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HIV care cascade and associated factors among men who have sex with men, transgender women, and genderqueer individuals in Zimbabwe: findings from a biobehavioural survey using respondent-driven sampling

Tiffany G Harris,

Yingfeng Wu,

Lauren E Parmley,

Godfrey Musuka,

Munyaradzi P Mapingure,

Innocent Chingombe,

Owen Mugurungi,

Avi Hakim,

Perpetua Gozhora,

Sophia S Miller,

Matthew R Lamb,

Chesterfield Samba,

John H Rogers

(TG Harris PhD, Y Wu PhD, LE Parmley MSPH, SS Miller MPH, MR Lamb PhD)**; Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA** (TG Harris, MR Lamb)**; ICAP at Columbia University, Harare, Zimbabwe** (G Musuka PhD, MP Mapingure MSc, I Chingombe MSc, P Gozhora MBA)**; AIDS and TB Programme, Zimbabwe Ministry of Health and Child Care, Harare, Zimbabwe** (O Mugurungi MD)**; Division of Global HIV and TB, Center for Global Health, US Centers for Disease Control and Prevention, Atlanta, GA, USA** (A Hakim MPH)**; GALZ, Harare, Zimbabwe** (C Samba MBA)**; Division of Global HIV and TB, Center for Global Health, US Centers for Disease Control and Prevention, Harare, Zimbabwe** (JH Rogers PhD)

Summary

Correspondence to: Tiffany G Harris, ICAP at Columbia University, MSPH Box 18, New York, NY, 10032 USA tiffanygharris@outlook.com.

Contributors

TGH, YW, LEP, GM, MPM, IC, AH, PG, SSM, OM, CS, and JHR contributed to designing the survey, developing the data collection instruments, and the implementation of survey procedures. TGH wrote the initial manuscript draft. YW led the analysis and contributed to the drafting of the manuscript. YW and MRL verified the underlying data. All authors critically reviewed the manuscript, approved the final manuscript, had full access to all the data in the study, and had final responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Background—Globally, men who have sex with men (MSM), transgender women, and genderqueer individuals are at greater risk for HIV than the general population although little data are available from these groups in Zimbabwe, a country with a national adult HIV prevalence of 12·9%. We aimed to examine progress towards the UNAIDS 90–90–90 treatment targets and factors associated with meeting the targets among a sample of MSM, transgender women, and genderqueer individuals in Zimbabwe.

Methods—In this cross-sectional survey in 2019, we used respondent-driven sampling to identify MSM, transgender women, and genderqueer individuals aged at least 18 years to participate in a biobehavioural survey in Harare and Bulawayo, Zimbabwe. Participants were eligible to participate if they were assigned male at birth; had engaged in anal or oral sex with a man in the past 12 months; resided in Harare or Bulawayo for at least 1 month; spoke English, Shona, or Ndebele; provided written informed consent; and were in possession of a valid recruitment coupon if applicable. Enrolled participants completed a questionnaire and underwent HIV testing, and off-site viral load testing was done on all HIV-positive samples. Unweighted bivariate analyses and multivariable logistic regression models were used to evaluate the association of sociodemographic, behavioural, and other factors with HIV-positive status awareness among MSM, transgender women, and genderqueer individuals, and with viral load suppression among MSM. Analyses were done firstly using self-reported information and then by classifying those with a viral load of less than 200 copies per mL as being aware of their status and on treatment (viral load recategorisation).

Findings—Among MSM, 248 (21%; 95% CI 19–24) of 1176 tested positive for HIV. Of those who tested positive, based on self-report, 119 (48%; 95% CI 42–54) reported knowing their HIV status, of whom 112 (94%; 88–98) reported using antiretroviral therapy (ART), of whom 89 (79%; 71–87) had viral load suppression. Based on viral load recategorisation, 180 (73%; 67–78) of 248 MSM testing HIV positive reported knowing their HIV status, of whom 174 (97%; 93–99) reported using ART, of whom 151 (87%; 81–91) had viral load suppression. 92 (28%; 23–33) of 335 transgender women and genderqueer individuals tested positive for HIV. Based on self-reports from these individuals 34 (37%; 27–48) of 92 participants reported knowing their HIV status, of whom 31 (91%; 76–98) reported using ART, of whom 27 (87%; 70–96%) had viral load suppression. Based on viral load recategorisation of data from transgender women and genderqueer participants, 53 (58%; 47–58) of 92 reported awareness of their HIV status, of whom 50 (94%; 84–99) reported using ART, of whom 46 (92%; 81–98) had viral load suppression. HIV-positive MSM aged 18–24 years had lower odds of being aware of their status than those aged at least 35 years (adjusted odds ratio [aOR] 0·34; 95% CI 0·13–0·92), as did HIV-positive MSM aged 25–34 years (aOR 0·26; 0·12–0·56). HIV-positive MSM aged 18–24 years also had a lower odds of having viral load suppression than those aged 35 years and older (aOR 0·35; 0·16–0·78), as did those aged 25–34 years (aOR 0·36; 0·19–0·67). No factors were significantly associated with awareness among transgender women and genderqueer individuals in multivariable models.

Interpretation—Our survey showed that HIV prevalence was high and the largest difference between our results and the 90–90–90 treatment targets was in HIV status awareness, indicating the need for improvements in engaging MSM (especially young MSM), transgender women, and genderqueer individuals in HIV testing services.

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Introduction

Key populations including men who have sex with men (MSM) and transgender women are at greater risk of acquiring HIV than the general population and face stigma and other barriers to receiving HIV services.[1] A 2019 meta-analysis found that in sub-Saharan Africa, MSM had an average HIV prevalence almost 3 times higher than men in the general population, although there were differences by region.[2] In 2020, Zimbabwe, a country with a generalised HIV epidemic, had a current HIV prevalence among adults aged 15 years and older of 12·9% with approximately 1·225 million adults living with HIV.[3] The UNAIDS fast-track 2020 targets (UNAIDS 90–90–90) were for 90% of HIV-positive people to know their status; for 90% of people who know their status to be on antiretroviral therapy (ART); and for 90% of people on ART to have viral load suppression. Zimbabwe made substantial progress towards reaching these targets and was at 86·8%–97·0%–90·3% as of 2020.[3] However, little data exist for MSM, transgender women, and genderqueer individuals in Zimbabwe, where same sex sexual relationships between men is illegal, same sex marriage is prohibited by the constitution, it is illegal for a person assigned male at birth to dress as a female, transgender individuals have scarce access to gender affirming services and are unable to have their gender identity legally recognised, and high levels of stigma and discrimination among these groups are reported.[4,5] To identify risk factors and estimate the HIV prevalence among MSM, transgender women, and genderqueer individuals, and progress towards the UNAIDS 90–90–90 targets and ultimately the UNAIDS 2025 95–95–95 targets, we did a biobehavioural survey with these groups in Harare and Bulawayo, the two largest cities in Zimbabwe.

Methods

Survey population and recruitment

We adapted the methods from the biobehavioural survey guidelines for populations at risk for HIV for this cross-sectional survey of MSM and transgender women in non-health-care facility spaces used for the purpose of the survey in Harare and Bulawayo, Zimbabwe.[6] Information about the survey is provided in this Article and additional details can be found in the final report.[7]

We calculated a sample size of 1538 participants (718 from Harare and 820 from Bulawayo) was needed to estimate HIV prevalence and viral load suppression with acceptable precision (at 95% confidence level) and to detect a change in HIV prevalence between the current survey and any future surveys. MSM, transgender women, and genderqueer individuals were eligible to participate if they were assigned male at birth; had engaged in anal or oral sex with a man in the past 12 months; were aged 18 years or older; resided in Harare or Bulawayo for at least 1 month; spoke English, Shona, or Ndebele; provided written informed consent; and were in possession of a valid recruitment coupon if applicable (described later).

The survey used respondent-driven sampling, a chain referral approach used to recruit hard-to-reach populations.[8] Initial survey participants (seeds) were specifically recruited to reflect diversity in sociodemographic characteristics (eg, age, sexual orientation and gender identity, education) and on the basis of whether they were well regarded by their peers and well connected within their social networks, and were selected with the support of local key population organisations. For peer-recruited participants, candidate participants received a coupon from a peer who had already participated in the survey. The coupon included survey site contact information but nothing that identified it with MSM or transgender women. Initially, everyone who had participated in the survey was given three coupons, and the number of coupons was reduced as recruitment needs slowed and then stopped when the sample size was reached. Ethical approvals were received from the Columbia University Institutional Review Board and the Medical Research Council of Zimbabwe. The protocol was also reviewed in accordance with the US Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be research, but CDC investigators did not interact with human participants or have access to identifiable data or specimens for research purposes.

Survey procedures

Potential participants were invited to attend an initial visit at the survey offices, during which survey staff verified coupons and screened potential participants for eligibility. If eligible and interested, survey staff obtained written informed consent from each participant in either English, Shona, or Ndebele based on participant preference. Participants could consent to completing the questionnaire and not biomarker testing. Using a tablet, survey staff administered a structured questionnaire adapted from the biobehavioural survey guidelines that included questions on sociodemographics; sexual history; behaviours and attitude related to, and knowledge about, HIV and sexually transmitted infections (STIs); condom and lubricant use; alcohol and drug consumption; history of engagement with health and support programmes; and experiences of stigma and discrimination (appendix pp 64–69).[6] On-site rapid HIV, syphilis, and HBsAg testing were done for all consenting individuals regardless of self-reported status following Zimbabwe's national guidelines.[9] On-site CD4 and HIV recency testing and off-site viral load testing were done on all HIV-positive samples. After being tested for HIV, participants were also screened for tuberculosis symptoms as per Zimbabwean Ministry of Health and Child Care guidelines. Participants who tested positive for HIV and did not report being in care, and those who tested positive for active syphilis or HBsAg, or screened positive for tuberculosis symptoms, were actively linked to appropriate services. Participants who were HIV negative were referred for pre-exposure prophylaxis. During a second visit 2 weeks later, participants were asked if they had completed any such referrals and remaining coupons were collected. For those who tested HIV-positive, viral load results were provided along with HIV recency results according to the recent infection testing algorithm. Participants were compensated US$5 for each visit and $5 for each successfully recruited peer (maximum of three peers) to cover communication and related recruitment costs.

Measures

The first question on the survey asked participants to report their sex or current gender, followed by a question asking participants what their sex at birth was (appendix p 11). Participants who answered male for both questions were classified as MSM. Those who answered transfemale or transwoman on the first question or those who answered female on the first and male on the second question were categorised as transgender women. Those who answered genderqueer, a non-binary gender term used in Zimbabwe, on the first question were combined with transgender women on the basis of feedback from stakeholders from Zimbabwe key population organisations. All analyses were stratified by key population groups (MSM, transgender women, and genderqueer people).

Factors of interest included sociodemographics, behaviour, access and utilisation of services, and experiences of stigma and discrimination related to being part of a key population. Network size was based on the number of MSM, transgender women, or genderqueer people living in Harare or Bulawayo aged 18 years or older that participants had seen in the past 14 days. Alcohol dependence was defined using an alcohol use disorders identification test score of at least 15.[10] Likely presence of a major depressive disorder was defined as a score of at least 3 on the patient health questionnaire-2.[11] Consistent condom use was defined as the participant answering that they had always used condoms in the last 6 months with all the types of partners they reported (main male; other non-paying male; main transgender woman; other non-paying transgender woman; men the participant gave money, goods, or services in exchange for sex; transgender women the participant gave money, goods, or services in exchange for sex; men who gave the participant money, goods, or services in exchange for sex; main female; other non-paying female). We defined comprehensive HIV knowledge as being able to correctly define all in a series of five HIV transmission questions using the UNAIDS definition.[12]

Statistical analysis

Some key variables did not reach convergence, including HIV status in diagnostic plots. Because of this non-convergence and inability to meet respondent-driven sampling estimator conditions or assumptions, analyses were unweighted and did not account for sampling design. For estimates of precision around prevalence estimates, Clopper-Pearson exact CIs were estimated. The STROBE-RDS guidelines were used in reporting the results.[13] Achievements towards UNAIDS 90–90–90 targets were examined. Bivariate and multivariable logistic regression analyses were done to separately identify factors associated with awareness of HIV-positive status and viral load suppression (defined as <1000 copies per mL in accordance with WHO guidelines[14]) both among all participants and among those who reported being on ART. Factors associated with ART were not examined because of the high ART coverage among participants who reported knowing they were HIV positive. Multivariable regression models for viral load suppression among transgender women and genderqueer people were not done due to small sample size. First, Pearson χ^2 or Fisher's exact test was used to evaluate bivariate associations between variables of interest and the outcomes. Fisher's exact test was used when the validity of χ^2 test was in doubt because of small frequencies (≥25% of the crosstabulation cells had expected sizes of <5). Variables with $p \leq 0{\cdot}10$ in bivariate analysis were included in multivariable exact logistic regression

models, and variables with exact test p ≤ 0·05 were retained in the final model. Missing data were minimal and complete case analysis was used. Age and city were included in all final multivariable models to produce parameter estimates controlling for effects of uncaptured factors potentially associated with them. The goodness of fit of all final models was tested using the Hosmer and Lemeshow test. Analyses were done using two approaches. The first used self-reported HIV and ART status. The second approach assumed those who reported they were HIV negative or had an unknown status but then tested HIV positive and had a viral load of less than 200 copies per mL or said they were HIV positive and not on ART but had a viral load of less than 200 copies per mL were aware of their HIV status and on ART (referred to as the viral load recategorisation in the results). A threshold of 200 copies per mL was used to account for biological variation around the cut point of 1000 copies per mL and because the clinical implications of detectable viral load of more than 200 copies per mL is uncertain.[15] Analyses were done using SAS version 9.4 and recruitment diagnostics (eg, recruitment tree, recruits by seed and wave, homophily, convergence and bottleneck plots) were examined using RDS-Analyst version 1.8.

Role of the funding source

The funder of the study had a role in the survey design and implementation, data analysis, data interpretation, and writing of the report. The funder of the study did not have a direct role in data collection, but they did review summary data during data collection.

Results

Survey data were collected from March 25 to July 12, 2019. Initially eight seed participants were recruited in Harare (six MSM and two transgender women or genderqueer people) and six seed participants were recruited in Bulawayo (two MSM and four transgender women or genderqueer people). To recruit under-represented subpopulations, including older individuals and those residing in other areas of each city, an additional five seed participants were added during the survey (three from Harare and two from Bulawayo). The mean number of recruits per seed was 64 (SD 123) in Harare and 102 (SD 162) in Bulawayo. In Harare, 1927 coupons were distributed and 825 (42·8%) were returned. In Bulawayo, 1913 coupons were distributed and 1002 (52%) returned. The number of recruits and number of waves per seed is provided in the appendix (p 114). Among the candidate participants screened for eligibility, 718 (86%) of 836 in Harare and 820 (81%) of 1009 in Bulawayo were eligible and, of those, 100% in both cities enrolled, resulting in 718 participants from Harare (431 MSM and 287 transgender women or genderqueer people) and 820 from Bulawayo (763 MSM and 57 transgender women or genderqueer people). Almost all participants consented to biomarker testing (695 [97%] of 718 in Harare and 816 [>99%] of 820 in Bulawayo). Characteristics of the survey population stratified by city and key population groups have been previously published.[7] In summary, in both cities and key population groups, most participants were young, single or never married, had secondary school education, and approximately one third were unemployed. Reclassification of participants that reported they were not aware of their HIV-positive status or were aware but not on treatment but had suppressed viral load results was higher among those from

Harare than those from Bulawayo and lower among those who were unemployed than those who were employed, students, or retired (data not shown).

Among MSM who consented to biomarker testing, 248 of 1176 participants were HIV positive and HIV prevalence was 21% overall (95% CI 19–24) with 71 (17%) of 416 (95% CI 14–21) MSM testing positive in Harare and 177 (23%) of 760 (95% CI 20–27) MSM testing positive in Bulawayo. Overall, 119 (48%) of 248 (95% CI 42–54) MSM testing HIV positive reported knowing their HIV status (figure 1A). Among MSM who reported knowing their HIV-positive status, 112 (94%) of 119 (95% CI 88–98) reported using ART, and of these, 89 (79%) of 112 (95% CI 71–87) had viral load suppression (figure 1A). Among all MSM testing HIV positive, 158 (64%) of 248 (95% CI 57–70) had viral load suppression. When those who reported they were HIV negative or unknown and then tested HIV positive (n=61), or said they were HIV positive and not on ART (n=1) but had a viral load of more than 200 copies per mL, were reclassified as being aware of their status and being on ART (viral load recategorisation analysis), 180 (73%; 95% CI 67–78) of 248 MSM testing HIV positive reported knowing their HIV status, 174 (97%; 95% CI 93–99) of 180 HIV-positive MSM reported using ART, and 151 (87%; 95% CI 81–91) of 174 MSM on ART had viral load suppression (figure 1B).

The following variables were significantly associated ($p \leq 0{\cdot}10$) with self-reported status awareness among HIV-positive MSM in bivariate analyses and were eligible for inclusion in the multivariable model: city, age, race, network size, consistent condom use with all partner types in the last 6 months, time since last engagement with a peer worker, receipt of free condoms in the past 12 months, and HBsAg status (table 1). Network size and consistent condom use were retained in the final multivariable model along with city and age ($p = 0{\cdot}64$). In multivariable analysis, HIV-positive MSM reporting consistent condom use in the previous 6 months with all partner types (adjusted odds ratio [aOR] 2·81; 95% CI 1·54–5·18) had a higher odds of knowing their status (table 1). Having a network size of five or more versus less than five was of marginal significance (aOR 1·77; 95% CI 0·99–3·20). In viral load recategorisation analysis, the following were significantly associated with awareness in bivariate analyses and were included in the multivariable model: age, marital status, network size, ever arrested for being part of a key populations group, age at first sexual intercourse with a male, lifetime number of male sexual partners, comprehensive HIV knowledge, received free condoms in last 12 months, and HBsAg status (table 1). In the final model ($p=0{\cdot}92$), engagement with a peer worker and comprehensive HIV knowledge were included along with city and age. In multivariable analysis, MSM who were aged 18–24 years had a lower odds of being aware of their status than those aged at least 35 years (aOR 0·34; 95% CI 0·13–0·92) and those aged 25–34 years had a lower odds of being aware of their status than those aged at least 35 years (aOR 0·26; 95% CI 0·12–0·56). Those who had comprehensive HIV knowledge had a higher odds of being aware of their HIV status than those without comprehensive knowledge (aOR 2·41; 95% CI 1·18–4·96) and those reporting engagement with a peer worker in the last 6 months had a higher odds of being aware than those with engagement more than 6 months ago (aOR 2·66, 95% CI 1·12–6·39; table 1).

The following variables were significantly associated ($p \leq 0{\cdot}10$) with viral load suppression in bivariate analyses among HIV-positive MSM who reported being on ART: education,

network size, lifetime number of male partners, time since last engagement with a peer worker, having reported any STI symptoms in the past 12 months, and HBsAg status (table 2). In the final adjusted model (p=0·69), those who had had 11 or more male partners in their lifetime had a higher odds of having viral load suppression than those who had had between one and ten male partners in their lifetime (aOR 5·14; 95% CI 1·22–33·0) and those who tested HBsAg positive had a lower odds of having viral load suppression than those who were negative for HBsAg (aOR 0·17; 95% CI 0·04–0·65; table 2). In viral load recategorisation analysis, the following variables were significant in bivariate analyses: education, lifetime number of male partners, time since last engagement with a peer worker, having reported any STI symptoms in the last 12 months, and HBsAg status (table 2). In the final multivariable model (p=0·45), MSM whose highest level of education was primary had a lower odds of viral load suppression than MSM whose highest level of education was tertiary or vocational (aOR 0·04; 95% CI <0·001–0·57); MSM who reported any STI symptoms in the last 12 months had a lower odds of viral load suppression than those who did not report any STI symptoms in the last 12 months (aOR 0·26; 95% CI 0·08–0·87); and those who tested HBsAg positive had a lower odds of viral load suppression than those who tested negative for HBsAg (aOR 0·19; 95% CI 0·05–0·67; table 2).

Viral load suppression was also examined in all HIV-positive MSM regardless of self-reported HIV status. In bivariate analyses the following variables were associated with viral load suppression: age, network size, and ever having been arrested for being part of a key populations group (table 3). In the final multivariable model (p=0·96), MSM who were aged 18–24 years had a lower odds of viral load suppression than those aged 35 years and older (aOR 0·35; 95% CI 0·16–0·78) and those aged 25–34 years had a lower odds of viral load suppression than those aged 35 years and older (aOR 0·36; 95% CI 0·19–0·67). Those with a network size of less than five people had a lower odds of viral load suppression than those with a network size of five people or more (aOR 0·56; 95% CI 0·32–0·97; table 3).

Among transgender women and genderqueer participants who consented to biomarker testing, 92 (28%) of 335 people (95% CI 23–33) tested positive for HIV overall, including 78 (28%) of 279 people (95% CI 23–34) in Harare and 14 (25%) of 56 people (95% CI 14–38) in Bulawayo. Of the transgender women and genderqueer participants, 34 (37%) of 92 people (95% CI 27–48) reported knowing their HIV status, of whom 31 (91%) of 34 (95% CI 76–98) reported using ART, and of whom 27 (87%; 95% CI 70–96) of 31 had viral load suppression (figure 2A). Among all transgender women and genderqueer participants testing positive for HIV, 51 (55%; 95% CI 45%–66%) of 92 had viral load suppression. When those who reported they were HIV negative or did not know their HIV status (n=19) and then tested HIV positive but had a viral load of less than 200 copies per mL were reclassified as being aware of their status and being on ART, the number of participants who reported knowing their HIV status increased to 53 (58%; 95% CI 47–68) of 92, of whom the number of people reported using ART increased to 50 (94%; 95% CI 84–99) of 53, and of whom the number of people who had viral load suppression increased to 46 (92%; 95% CI 81–98) of 50 (figure 2B). Based on self-reported HIV status, there was no significant difference in awareness between HIV-positive MSM and trans gender women or genderqueer participants (p=0·07) but in the viral load recategorisation analysis, awareness was higher among MSM than transgender women or genderqueer participants (p=0·01).

ART use and viral load suppression did not differ between MSM and transgender women or genderqueer participants in either analysis (all $p > 0{\cdot}05$).

The following factors were associated ($p \leq 0{\cdot}10$) with self-reported awareness in bivariate analyses among HIV-positive transgender women and genderqueer partici pants: age, sexual orientation, ever having been arrested for being part of a key populations group, vaginal sex with a female partner, age at first sexual intercourse with a male partner, first sexual encounter with a male partner having been transactional, lifetime number of male partners, consistent condom use with all types of partners in the last 6 months, and having received money, goods, or services for sex in the past 6 months (table 4). In the viral load recategorisation analysis the following variables were associated with awareness of HIV status in bivariate analyses: age at first sexual intercourse with a male partner, lifetime number of male partners, condomless receptive anal intercourse at last sexual encounter with a main male partner, consistent condom use with all types of partners in the last 6 months, diagnosis of an STI in the last 12 months, and circumcision status (table 4). No factors were significant for either definition of awareness of HIV status in multivariable models (data not shown).

Discussion

We found that HIV prevalence was higher in sampled MSM (17% in Harare and 23% in Bulawayo) and transgender women and genderqueer participants (28% and 25%) than in the general male population aged 15 years or older (10·5% and 10·8%[3]). Viral load recategorised HIV status awareness was lower among MSM (73%) and transgender women and genderqueer participants (63%) than the antiretroviral-adjusted awareness among the general adult male population in Zimbabwe (84·3%).[3] However, HIV-positive participants who knew their status had high ART coverage and viral load suppression, indicating strong linkage to and retention on treatment in this subgroup.

Like other published key populations data,[16] the largest gap between the UNAIDS 90-90-90 targets and current progress reflected by our survey of MSM and transgender women or genderqueer participants in Zimbabwe was the HIV status awareness target, indicating the need for improvements in testing among these populations, especially transgender women and genderqueer people. However, our findings of self-reported progress towards the UNAIDS 90–90–90 targets among MSM (48%–94%–79%) and transgender women and genderqueer participants (37%−91%−87%) were higher than those found in a 2019 meta-analysis of data after 2011 among African MSM that had pooled estimates of 18·5% −60·1%−75·6%.[17] However, findings from published biobehavioural surveys done in the last decade among MSM and transgender women in Africa using respondent-driven sampling vary widely with only a small number examining all three points of the cascade.[18–23] To our knowledge, a 2017 biobehavioural survey from Kenya is the only one that has reported separate estimates for MSM and transgender women, reporting progress towards the UNAIDS 90-90-90 targets of 78%−86%−80% among MSM and 72%−85%−71% among transfeminine individuals.[23] Among both MSM and transgender women and genderqueer participants in our survey, viral load recategorised HIV status awareness was higher than those based on self-report, although status awareness still exhibited the largest gap between

results and the target. We found that younger HIV-positive MSM had lower odds of being aware of their status and of having viral load suppression, and those who had recently seen a peer worker had higher odds of being aware. Data from both key populations and the general population have also found bigger gaps between results and targets in the treatment cascade for younger individuals.[24,25] Recent engagement with a peer worker and comprehensive HIV knowledge were also associated with status awareness in the viral load recategorised analysis, indicating the importance of engagement and education; however, because the survey is cross-sectional, it is unknown whether those factors increased the likelihood of being tested or were the result of being tested. Ways to better engage young key populations need to be identified and young MSM and transgender women and genderqueer people need to be an active part of designing, implementing, and evaluating interventions.[26] Such interventions could include traditional peer outreach approaches. However, younger key populations might be more likely to use technology to connect with members of their network than older populations and traditional place-based outreach approaches might be less useful for younger populations than older populations. Approaches such as social network testing or peer outreach through online platforms warrant evaluation.

It is unclear why a substantial number of individuals who seemingly were aware of their status and on ART (based on viral loads of less than 200 copies per mL) did not report a previous HIV diagnosis. Their choice not to disclose might be due to several reasons: social desirability bias, stigma, absence of complete belief in or understanding of their previous diagnosis (even though they might have initiated treatment on the basis of provider recommendation), or belief that being on treatment or viral load suppression will lead to a negative HIV test result and that will mean they are cured, or they want to tell partners they had a negative HIV test. Misreporting of HIV diagnosis and treatment status has been observed in other surveys including in Zimbabwe where a 2019–20 general population survey found that among adults living with HIV who reported no previous HIV diagnosis, 23·8% of adults overall (24·4% of men and 23·3% of women) had detectable antiretrovirals in blood specimens and among adults living with HIV who were unaware of their HIV status, 7·1% of adults overall (3·8% of men and 9·8% of women) had viral load suppression.[3] Other studies should explore this further as insights could inform engagement and education activities.

Our survey had several limitations. First, convergence was not reached on several variables, indicating that our sample might not be entirely representative of the broader target population. Because of this absence of convergence, respondent-driven sampling unadjusted estimates were used. Second, we only did our survey in two cities, limiting its generalisability to all MSM, transgender women, and genderqueer people in Zimbabwe. Additionally, we were underpowered for several analyses among transgender women and genderqueer individuals as their inclusion was identified during the formative work and funding did not allow for an increase in sample size. Our survey had several strengths. We used respondent-driven sampling to recruit participants, which is the recommended approach for enrolling hard-to-reach populations. We were also able to successfully recruit MSM and transgender women and genderqueer individuals in a complicated legal and social context. Additionally, we tested all participants not only for HIV but also for syphilis and hepatitis B virus, which are important co-infections among MSM, transgender women, and

genderqueer individuals. We also did HIV viral load testing, which has often been excluded from other biobehavioural surveys. Lastly, we included transgender women and genderqueer individuals and reported findings separately for them, which has been noted as crucial to conducting studies among these populations.[27]

As Zimbabwe approaches epidemic control in the general population, key populations will need to be prioritised in order to achieve the UNAIDS 2025 95–95–95 targets and reach HIV elimination. Improvements in testing are needed among MSM, transgender women, and genderqueer individuals, and programmes could consider innovative approaches such as self-testing to optimise case findings among these populations. HIV programmes targeting these populations should ensure that members of these populations are engaged in the design and implementation of programmes to ensure their success.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data sharing

Given the sensitivity of the data due to the social and legal context, deidentified participant data along with supporting documentation (survey protocol, data dictionary) are available upon request from the corresponding author (TGH) pending appropriate Institutional Review Board and institutional (ICAP at Columbia University, Zimbabwean Ministry of Health and Child Care, and CDC) leadership approval.

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Research in context

Evidence before this study

On March 1, 2021, we searched PubMed for articles examining progress towards the UNAIDS fast-track 2020 90–90–90 HIV targets among men who have sex with men (MSM), transgender women, and genderqueer individuals in Africa.

We used the terms ((“men who have sex with men”) OR (“transgender women”) OR ‘(transfeminine) OR (genderqueer)) AND (90–90–90) AND (Africa)’ and ‘((“men who have sex with men”) OR (“transgender women”) OR (transfeminine) OR (genderqueer) AND (UNAIDS targets) AND (Africa)’ and ‘((“men who have sex with men”) OR (“transgender women”) OR (transfeminine) OR (genderqueer)) AND (HIV awareness) AND (Africa)’ and ‘((“men who have sex with men”) OR (“transgender women”) OR ‘(transfeminine) OR (genderqueer)) AND (viral suppression) AND (Africa)’ and ‘((“men who have sex with men”) OR (“transgender women”) OR (transfeminine) OR (genderqueer)) AND (treatment cascade) AND (Africa)’) to identify papers published in English with data obtained from biobehavioural surveys or studies that employed respondent-driven sampling from Jan 1, 2010, or later. Additionally, studies included in a 2019 systematic review and meta-analysis of the HIV treatment cascade among MSM in Africa were also reviewed to identify any additional articles that met the same criteria. HIV status awareness, being on antiretroviral therapy (ART), and viral suppression varied widely among MSM, transgender women, and genderqueer individuals in Africa with most studies finding gaps for each with the largest gap in awareness of HIV status. However, most previously published biobehavioural surveys of these groups did not examine viral suppression and few surveys included specific data on transgender women and genderqueer individuals.

Added value of this study

We report on progress towards each of the UNAIDS HIV 90–90-90 treatment targets and factors associated with HIV awareness and viral suppression among MSM, transgender women, and genderqueer individuals in Harare and Bulawayo, Zimbabwe. To our knowledge, this is the first such data collected from MSM and transgender women, and genderqueer individuals in Zimbabwe. Among these groups, HIV prevalence was higher than that of the general population and awareness of HIV status was low. However, of those who were aware of their status, ART treatment coverage and viral suppression were closer to or exceeded the 90–90–90 targets.

Implications of all the available evidence

To achieve HIV elimination, key populations need to be reached with HIV services, which might be difficult in settings where related behaviours are criminalised or highly stigmatised. Members of these key populations should be engaged in the design of HIV services.

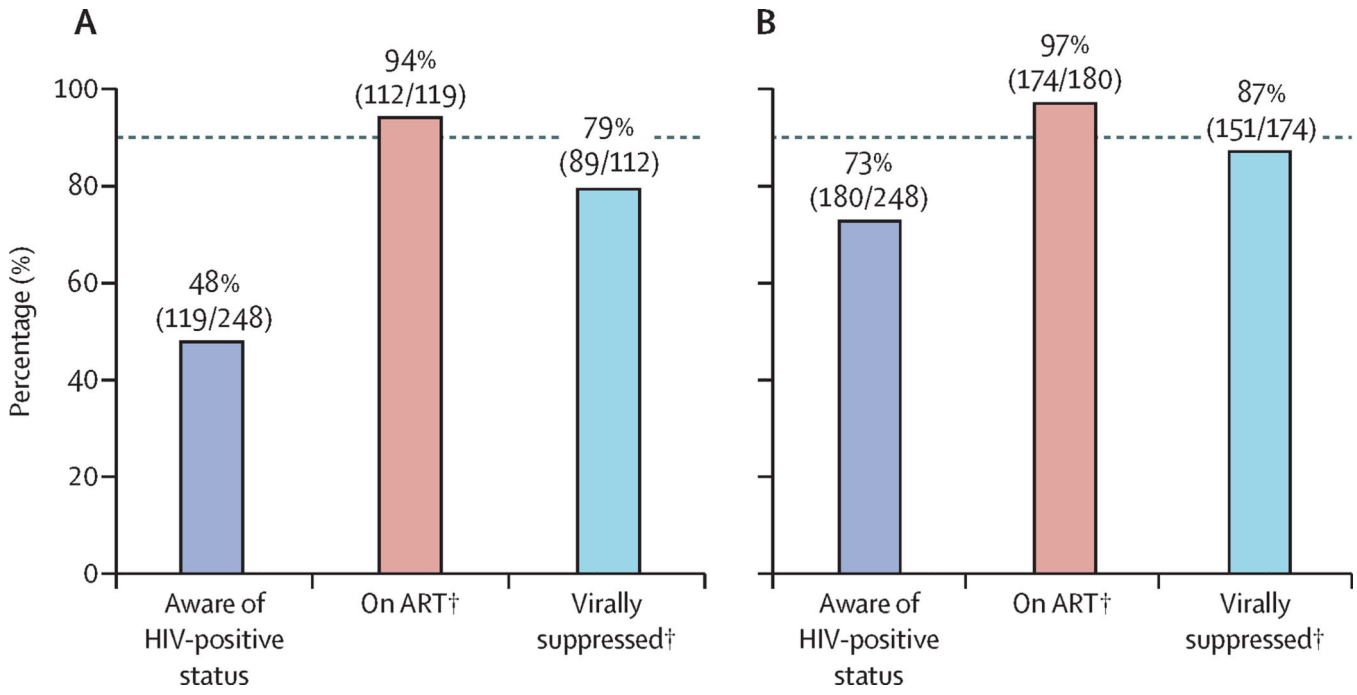

Figure 1: Progress towards the 90–90–90 targets among MSM based on self-reported HIV and ART status (A) and viral load recategorisation* (B), Harare and Bulawayo, Zimbabwe, 2019

ART=antiretroviral therapy. MSM=men who have sex with men. *Assumes those who had viral loads of less than 200 copies per mL were aware of their status and on ART regardless of self-reported status. †Percentages shown in the graph refer to the conditional 90–90–90 achievements.

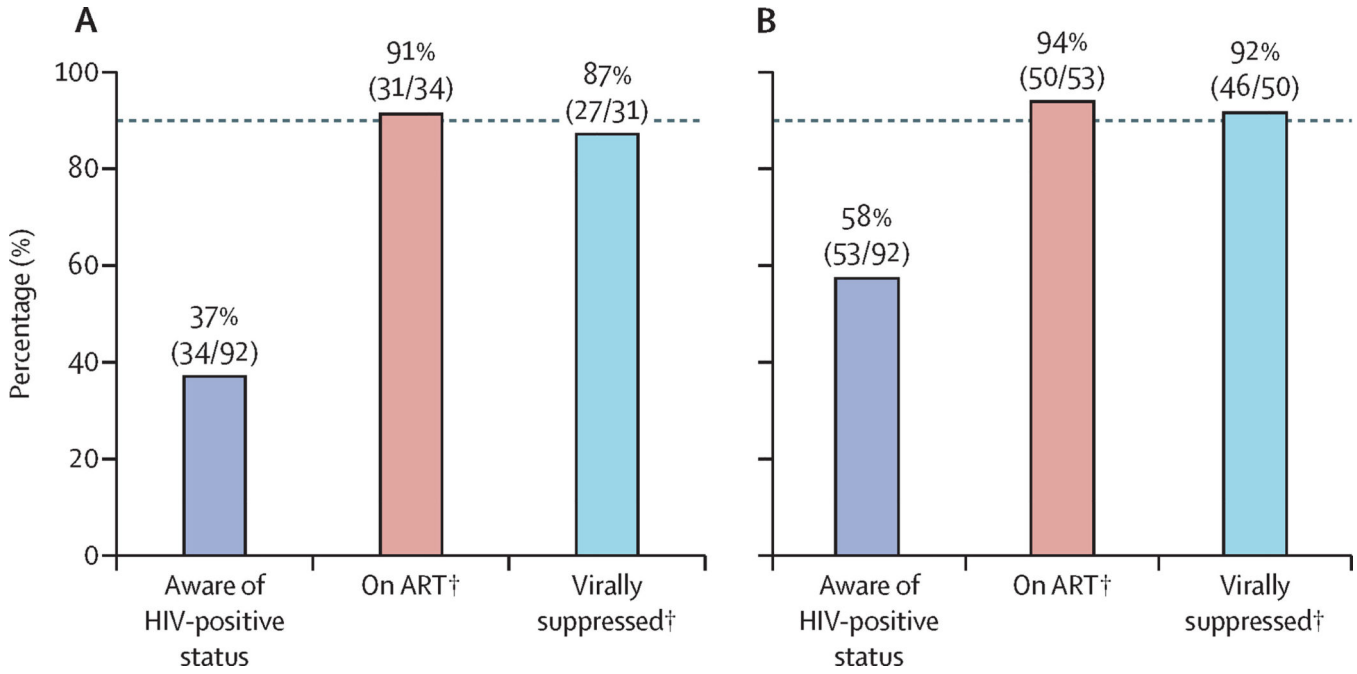

Figure 2: Progress towards the 90–90–90 targets among transgender women and genderqueer individuals based on self-reported HIV and ART status (A) and viral load recategorisation* (B), Harare and Bulawayo, Zimbabwe, 2019

ART=antiretroviral therapy. *Assumes those who had viral loads of less than 200 copies per mL were aware of their status and on ART regardless of self-reported status. †Percentages shown in the graph refer to the conditional 90–90–90 achievements.

Table 1:

Association between self-reported and viral load recategorised HIV status awareness and demographics, sexual behaviour, and other factors among HIV-positive MSM

	Self-reported HIV-positive status awareness (N=248) *				Viral load recategorised HIV-positive status awareness (N=248) †			
	Aware (n=119)	Not aware (n=129)	p value‡	aOR (95% CI) §	Aware (n=180)	Not aware (n=68)	p value‡	aOR (95% CI)¶
City of residence	..	..	<0·01	..	..	..	0·88	..
Bulawayo	95 (80%)	82 (64%)	..	1·76 (0·91-3·46)	128 (71%)	49 (72%)	..	0·91 (0·42-1·90)
Harare	24 (20%)	47 (36%)	..	1·00 (ref)	52 (29%)	19 (28%)	..	1·00 (ref)
Age, years	..	..	0·06	..	..	..	<0·01	..
18–24	23 (19%)	19 (15%)	..	1·07 (0·45-2·58)	29 (16%)	13 (19%)	..	0·34 (0·13-0·92)
25–34	42 (35%)	65 (50%)	..	0·65 (0·34-1·22)	68 (38%)	39 (57%)	..	0·26 (0·12-0·56)
≥35	54 (45%)	45 (35%)	..	1·00 (ref)	83 (46%)	16 (24%)	..	1·00 (ref)
Race	..	..	0·08	..	..	..	0·52	..
Black African	110 (92%)	126 (98%)	..	..	170 (94%)	66 (97%)	..	..
Other	9 (8%)	3 (2%)	..	..	10 (6%)	2 (3%)	..	..
Employment status	..	..	0·36	..	..	..	0·15	..
Self-employed	34 (29%)	43 (33%)	..	..	62 (34%)	15 (22%)	..	..
Employed full time	17 (14%)	23 (18%)	..	..	29 (16%)	11 (16%)	..	..
Employed part time	11 (9%)	13 (10%)	..	..	13 (7%)	11 (16%)	..	..
Full-time student	4 (3%)	8 (6%)	..	..	9 (5%)	3 (4%)	..	..
Unemployed	53 (45%)	42 (33%)	..	..	67 (37%)	28 (41%)	..	..
Education	..	..	0·75	..	..	..	0·55	..
None or primary	12 (10%)	10 (8%)	..	..	15 (8%)	7 (10%)	..	..
Secondary	86 (72%)	93 (72%)	..	..	128 (71%)	51 (75%)	..	..
Tertiary or vocational	21 (18%)	26 (20%)	..	..	37 (21%)	10 (15%)	..	..
Marital status	..	..	0·29	..	..	..	0·03	..
Single or never married	75 (63%)	90 (70%)	..	..	111 (62%)	54 (79%)	..	..
Married (to ≥1 woman or man) or cohabitating	6 (5%)	9 (7%)	..	..	12 (7%)	3 (4%)	..	..
Separated, divorced, or widowed	38 (32%)	30 (23%)	..	..	57 (32%)	11 (16%)	..	..

	Self-reported HIV-positive status awareness (N=248) *				Viral load recategorised HIV-positive status awareness (N=248) †			
	Aware (n=119)	Not aware (n=129)	p value‡	aOR (95% CI) §	Aware (n=180)	Not aware (n=68)	p value‡	aOR (95% CI)¶
Sexual orientation	..	..	0·76	..	..	..	0·50	..
Gay or homosexual	79 (66%)	88 (68%)	..	..	119 (66%)	48 (71%)	..	..
Bisexual, straight, or other	40 (34%)	41 (32%)	..	..	61 (34%)	20 (29%)	..	..
Network size‖	..	..	0·05	..	..	..	0·01	..
Below median	40 (34%)	59 (46%)	..	1·00 (ref)	63 (35%)	36 (53%)	..	..
Median or above	79 (66%)	70 (54%)	..	1·77 (0·99–3·20)	117 (65%)	32 (47%)	..	..
Alcohol dependence **	..	..	0·43	..	..	..	0·64	..
Dependent	28 (24%)	36 (28%)	..	..	45 (25%)	19 (28%)	..	..
Not dependent	91 (76%)	93 (72%)	..	..	135 (75%)	49 (72%)	..	..
Drug use in the past 6 months	..	..	0·20	..	..	..	0·24	..
Have used drugs in the past 6 months	44 (37%)	58 (45%)	..	..	70 (39%)	32 (47%)	..	..
Have not used drugs in the past 6 months	75 (63%)	71 (55%)	..	..	110 (61%)	36 (53%)	..	..
Screened positive for depression ††	..	..	0·13	..	..	..	0·49	..
Yes	8 (7%)	16 (12%)	..	..	16 (9%)	8 (12%)	..	..
No	111 (93%)	113 (88%)	..	..	164 (91%)	60 (88%)	..	..
Ever arrested for having had sex with men	..	..	0·94	..	..	..	0·05	..
Yes	8 (7%)	9 (7%)	..	..	16 (9%)	1 (1%)	..	..
No	111 (93%)	120 (93%)	..	..	164 (91%)	67 (99%)	..	..
Ever had vaginal sex with a female partner	..	..	0·97	..	..	..	0·43	..
Never	44/118 (37%)	50 (39%)	..	..	64/179 (36%)	30 (44%)	..	..
>6 months ago	71/118 (60%)	76 (59%)	..	..	111/179 (62%)	36 (53%)	..	..
Within the last 6 months	3/118 (3%)	3 (2%)	..	..	4/179 (2%)	2 (3%)	..	..
Age at first sexual intercourse with a male partner, years	..	..	0·59	..	..	..	0·01	..
<15	12/118 (10%)	7/128 (6%)	..	..	19/179 (11%)	0/67	..	..
15–19	44/118 (37%)	49/128 (38%)	..	..	63/179 (35%)	30/67 (45%)	..	..
20–24	27/118 (23%)	31/128 (24%)	..	..	43/179 (24%)	15/67 (22%)	..	..
≥25	35/118 (30%)	41/128 (32%)	..	..	54/179 (30%)	22/67 (33%)	..	..
First sexual encounter with a male partner was transactional	..	..	0·89	..	..	..	0·64	..

	Self-reported HIV-positive status awareness (N=248) *				Viral load recategorised HIV-positive status awareness (N=248) †			
	Aware (n=119)	Not aware (n=129)	p value‡	aOR (95% CI) §	Aware (n=180)	Not aware (n=68)	p value‡	aOR (95% CI)¶
Yes	22/118 (19%)	23/128 (18%)	..	..	34/179 (19%)	11/67 (16%)	..	..
No	96/118 (81%)	105/128 (82%)	..	..	145/179 (81%)	56/67 (84%)	..	..
Lifetime number of male sexual partners	..	..	0·71	..	..	..	0·06	..
1–5	50/118 (42%)	61/128 (48%)	..	..	73/179 (41%)	38/67 (57%)	..	..
6–10	28/118 (24%)	28/128 (22%)	..	..	46/179 (26%)	10/67 (15%)	..	..
> 10	40/118 (34%)	39/128 (30%)	..	..	60/179 (34%)	19/67 (28%)	..	..
Number of male sexual partners in the past 6 months	..	..	0·56	..	..	..	0·78	..
1–5	106/118 (90%)	112/128 (88%)	..	..	158/179 (88%)	60/67 (90%)	..	..
≥ 6	12/118 (10%)	16/128 (13%)	..	..	21/179 (12%)	7/67 (10%)	..	..
Had both male and female sexual partners past 6 months	..	..	0·43	..	..	..	0·18	..
Yes	4/118 (3%)	7/128 (5%)	..	..	6/179 (3%)	5/67 (7%)	..	..
No	114/118 (97%)	121/128 (95%)	..	..	173/179 (97%)	62/67 (93%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a main male partner (among those who had anal sex)	..	..	0·35	..	..	..	0·72	..
Yes	12/118 (10%)	18/128 (14%)	..	..	21/179 (12%)	9/67 (13%)	..	..
No	106/118 (90%)	110/128 (86%)	..	..	158/179 (88%)	58/67 (87%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a casual male partner (among those who had anal sex and a casual male partner)	..	..	0·34	..	..	..	1·0	..
Yes	3/54 (6%)	7/64 (11%)	..	..	8/92 (9%)	2/26 (8%)	..	..
No	51/54 (94%)	57/64 (89%)	..	..	84/92 (91%)	24/26 (92%)	..	..
Used condoms consistently with all types of partners in the past 6 month‡‡	..	..	<0·01	..	..	..	0·31	..
Yes	58/116 (50%)	31/128 (24%)	..	2·81 (1·54-5·18)	68/177 (38%)	21/67 (31%)	..	..
No	58/116 (50%)	97/128 (76%)	..	1·00 (ref)	109/177 (62%)	46/67 (69%)	..	..
Given somebody money, goods, or services for sex in the past 6 months	..	..	040	..	..	..	0·25	..
Yes	6/117 (5%)	10/128 (8%)	..	..	14/178 (8%)	2/67 (3%)	..	..
No	111/117 (95%)	118/128 (92%)	..	..	164/178 (92%)	65/67 (97%)	..	..
Received money, goods, or services for sex in the past 6 months	..	..	0·29	..	..	..	0·41	..

	Self-reported HIV-positive status awareness (N=248) *				Viral load recategorised HIV-positive status awareness (N=248) †			
	Aware (n=119)	Not aware (n=129)	p value‡	aOR (95% CI) §	Aware (n=180)	Not aware (n=68)	p value‡	aOR (95% CI)¶
Yes	6/117 (5%)	11/128 (9%)	..	..	11/178 (6%)	6/67 (9%)	..	..
No	111/117 (95%)	117/128 (91%)	..	..	167/178 (94%)	61/67 (91%)	..	..
Have comprehensive knowledge of HIV§§	..	..	043	..	..	..	0·04	..
Yes	91 (76%)	93 (72%)	..	..	140 (78%)	44 (65%)	..	2·41 (1·18-4·96)
No	28 (24%)	36 (28%)	..	..	40 (22%)	24 (35%)	..	1·00 (ref)
Time since last engagement with peer worker	..	..	0·08	..	..	..	0·12	..
Never engaged	35 (29%)	55 (43%)	..	..	62 (34%)	28 (41%)	..	1·68 (0·70–4·04)
0–6 months	56(47%)	46 (36%)	..	..	81 (45%)	21 (31%)	..	1·00 (ref)
>6 months	28 (24%)	28 (22%)	..	..	37 (21%)	19 (28%)	..	2·66 (1·12–6·39)
Received free condoms in the past 12 months	..	..	<0·01	..	..	..	0·02	..
Yes	99 (83%)	81 (63%)	..	..	138 (77%)	42 (62%)	..	..
No	20 (17%)	48 (37%)	..	..	42 (23%)	26 (38%)	..	..
Reported any STI symptoms in the past 12 month¶¶	..	..	0·20	..	..	..	0·80	..
Yes	28 (24%)	22 (17%)	..	..	37 (21%)	13 (19%)	..	..
No	91 (76%)	107 (83%)	..	..	143 (79%)	55 (81%)	..	..
Diagnosed with an STI in the past 12 months	..	..	0·30	..	..	..	0·76	..
Yes	16 (13%)	12 (9%)	..	..	21 (12%)	7 (10%)	..	..
No	103 (87%)	117 (91%)	..	..	159 (88%)	61 (90%)	..	..
Have been circumcised	..	..	0·27	..	..	..	046	..
Yes	34 (29%)	29 (22%)	..	..	48 (27%)	15 (22%)	..	..
No	85 (71%)	100 (78%)	..	..	132 (73%)	53 (78%)	..	..
Syphilis status	..	..	0·82	..	..	..	0·78	..
Active infection	11 (9%)	13 (10%)	..	..	18 (10%)	6 (9%)	..	..
No active infection	108 (91%)	116 (90%)	..	..	162 (90%)	62 (91%)	..	..
HBsAg status	..	..	0·03	..	..	..	0·02	..
Positive	17 (14%)	8 (6%)	..	..	23 (13%)	2 (3%)	..	..
Negative	102 (86%)	121 (94%)	..	..	157(87%)	66 (97%)	..	..

Some variables do not add up to the total number because of skip patterns (ie, based on the answer to a parent question, subsequent questions might or might not be asked), missing data, participants not knowing the answer to the question, or participants refusing to answer. Some percentages might not sum to 100% due to rounding differences. aOR=adjusted odds ratio. MSM=men who have sex with men. STI=sexually transmitted infection.

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[*] HIV-positive MSM who self-reported being HIV positive were considered aware of their HIV status; all others were considered not aware.

[†] HIV-positive MSM who either self-reported they were aware or had a viral load of less than 200 copies per mL; all others were considered not aware.

[‡] Pearson χ^2 or Fisher's exact test (used when 25% or more of the crosstabulation cells had expected sizes of <5).

[§] Odds ratios were estimated with Fisher's exact scoring method. All variables adjusted for all other variables in the model. Four participants (n=3 aware of HIV status, n=1 not aware) who were missing information on consistent condom use in the last 6 months with all types of partners were excluded.

[¶] Odds ratios were estimated with Fisher's exact scoring method. All variables adjusted for all other variables in the model.

[//] Number of MSM, transgender women, or genderqueer people living in Harare or Bulawayo aged 18 years or older that survey participants had seen in the past 14 days (below median is less than five people and median and above is five or more people).

[**] Dependence was defined as having an alcohol use disorders identification test score of at least 15.

[††] Depression was defined as having a patient health questionnaire-2 score of at least 3.

[‡‡] Consistent condom use was defined as the participant answering that they had always used condoms in the last 6 months with all the types of partners they reported (main male; other non-paying male; main transgender female; other non-paying transgender female; men the participant gave money, goods, or services in exchange for sex; transgender women the participant gave money, goods, or services in exchange for sex; men who gave the participant money, goods, or services in exchange for sex; main female; other non-paying female).

[§§] Defined as being able to correctly define all in a series of five HIV transmission questions using the UNAIDS definition.

[¶¶] Symptoms include presence of penile discharge, penile ulcer or sore, painful urination, anal discharge, or anal warts.

Table 2:

Association between viral load suppression and demographics, sexual behaviour, and other factors among HIV-positive MSM who self-reported being on antiretroviral therapy and among HIV-positive MSM assuming those who had viral loads less than 200 copies per mL were on ART regardless of self-reported status

	Viral load status among those who self-reported being on ART (N=112)				Viral load status among those who self-reported being on ART or had a viral load <200 copies per mL (N=174)			
	Suppressed (n=89)*	Not suppressed† (n=23)	p value‡	aOR (95% CI) §	Suppressed* (n=151)	Not suppressed† (n=23)	p value†	aOR (95% CI)¶
City of residence	..	..	1·0	..	..	..	0·18	..
Bulawayo	71 (80%)	19 (83%)	..	0·70 (0·14·2·91)	104 (69%)	19 (83%)	..	0·53 (0·11·2·16)
Harare	18 (20%)	4 (17%)	..	..	47 (31%)	4 (17%)	..	..
Age, years	..	..	0·36	..	..	..	0·47	..
18–24	16 (18%)	4 (17%)	..	0·84 (0·17·4·91)	22 (15%)	4 (17%)	..	0·32 (0·06·1·88)
25–34	29 (33%)	11 (48%)	..	..	56 (37%)	11 (48%)	..	..
≥35	44 (49%)	8 (35%)	..	..	73 (48%)	8 (35%)	..	..
Race	..	..	1·0	..	..	..	0·62	..
Black African	82 (92%)	21 (91%)	..	..	143 (95%)	21 (91%)	..	..
Other	7 (8%)	2 (9%)	..	..	8 (5%)	2 (9%)	..	..
Employment status	..	..	0·95	..	..	..	0·46	..
Self-employed	26 (29%)	6 (26%)	..	..	55 (36%)	6 (26%)	..	..
Employed full time	13 (15%)	3 (13%)	..	..	25 (17%)	3 (13%)	..	..
Employed part-time	8 (9%)	3 (13%)	..	..	10 (7%)	3 (13%)	..	..
Full-time student	3 (3%)	0	..	..	8 (5%)	0	..	..
Unemployed	39 (44%)	11 (48%)	..	..	53 (35%)	11 (48%)	..	..
Education	..	..	0·06	..	..	..	0·02	..
None or primary	7 (8%)	5 (22%)	..	..	10 (7%)	5 (22%)	..	0·04 (<0·001–0·57)
Secondary	64 (72%)	17 (74%)	..	..	107 (71%)	17 (74%)	..	0·19 (0·05–0·67)
Tertiary or vocational	18 (20%)	1 (4%)	..	..	34 (23%)	1 (4%)	..	1·00 (ref)
Marital status	..	..	0·49	..	..	..	0·32	..
Single or never married	56 (63%)	14 (61%)	..	..	93 (62%)	14 (61%)	..	..
Married (to ≥1 woman or man) or cohabitating	6 (7%)	0	..	..	12 (7%)	0	..	..

	Viral load status among those who self-reported being on ART (N=112)				Viral load status among those who self-reported being on ART or had a viral load <200 copies per mL (N=174)			
	Suppressed (n=89)*	Not suppressed† (n=23)	p value‡	aOR (95% CI) §	Suppressed* (n=151)	Not suppressed† (n=23)	p value†	aOR (95% CI)¶
Separated, divorced, or widowed	27 (30%)	9 (39%)	..	..	46 (31%)	9 (39%)	..	..
Sexual orientation	..	..	1·0	..	..	..	0·92	..
Gay or homosexual	60 (67%)	15 (65%)	..	..	100 (66%)	15 (65%)	..	..
Bisexual, straight, or other	29 (33%)	8 (35%)	..	..	51 (34%)	8 (35%)	..	..
Network size//	..	..	0·09	..	..	..	0·17	..
Below median	26 (29%)	11 (48%)	..	..	50 (33%)	11 (48%)	..	..
Median or above	63 (71%)	12 (52%)	..	..	101 (67%)	12 (52%)	..	..
Alcohol dependence **	..	..	0·46	..	..	..	0·38	..
Dependent	22 (25%)	4 (17%)	..	..	39 (26%)	4 (17%)	..	..
Not dependent	67 (75%)	19 (83%)	..	..	112 (74%)	19 (83%)	..	..
Drug use in the past 6 months	..	..	0·21	..	..	..	0·36	..
Have used drugs in the past 6 months	30 (34%)	11 (48%)	..	..	57 (38%)	11 (48%)	..	..
Have not used drugs in the past 6 months	59 (66%)	12 (52%)	..	..	94 (62%)	12 (52%)		..
Screened positive for depression ††	..	..	0·63	..	..	..	1·0	..
Yes	5 (6%)	2 (9%)	..	..	13 (9%)	2 (9%)	..	..
No	84 (94%)	21 (91%)	..	..	138 (91%)	21 (91%)	..	..
Ever arrested for having had sex with men	..	..	0·34	..	..	..	0·22	..
Yes	7 (8%)	0	..	..	15 (10%)	0	..	..
No	82 (92%)	23 (100%)	..	..	136 (90%)	23 (100%)	..	..
Ever had vaginal sex with a female partner	..	..	0·59	..	..	..	0·77	
Never	36/88 (41%)	7 (30%)	..	..	56/150 (37%)	7 (30%)	..	..
>6 months ago	50/88 (57%)	16 (70%)	..	..	91/150 (61%)	16 (70%)	..	..
Within the last 6 months	2/88 (2%)	0	..	..	3/150 (2%)	0	..	..
Age at first sexual intercourse with a male partner, years	..	..	0·99	..	..	..	0·99	

	Viral load status among those who self-reported being on ART (N=112)				Viral load status among those who self-reported being on ART or had a viral load <200 copies per mL (N=174)			
	Suppressed (n=89)*	Not suppressed† (n=23)	p value‡	aOR (95% CI) §	Suppressed* (n=151)	Not suppressed† (n=23)	p value†	aOR (95% CI)¶
<15	9/88 (10%)	3 (13%)	..	..	16/150 (11%)	3 (13%)	..	..
15–19	34/88 (39%)	8 (35%)	..	..	53/150 (35%)	8 (35%)	..	..
20–24	19/88 (22%)	5 (22%)	..	..	35/150 (23%)	5 (22%)	..	..
≥25	26/88 (30%)	7 (30%)	..	..	46/150 (31%)	7 (30%)	..	..
First sexual encounter with a male partner was transactional	..	..	0·37	..	..	..	0·40	..
Yes	15/88 (17%)	6 (26%)	..	..	28/150 (19%)	6 (26%)	..	..
No	73/88 (83%)	17 (74%)	..	..	122/150 (81%)	17 (74%)	..	..
Lifetime number of male sexual partners	..	..	0·03	..	..	..	0·03	..
1–10	55/88 (63%)	20 (87%)	..	1·00 (ref)	96/150 (64%)	20 (87%)	..	..
≥11	33/88 (38%)	3 (13%)	..	5·14 (1·22·33·0)	54/150 (36%)	3 (13%)	..	..
Number of male sexual partners in the past 6 months	..	..	0·45	..	..	..	0·32	
1–5	77/88 (88%)	22 (96%)	..	..	130/150 (87%)	22 (96%)	..	..
≥6	11/88 (13%)	1 (4%)	..	..	20/150 (13%)	1 (4%)	..	..
Concurrent male and female sexual partners in the past 6 months	..	..	1·0	..	..	..	1·0	..
Yes	3/88 (3%)	0	..	..	5/150 (3%)	0	..	..
No	85/88 (97%)	23 (100%)	..	..	145/150 (97%)	23 (100%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a main male partner (among those who had anal sex)	..	..	1·0	..	..	..	0·74	..
Yes	10/88 (11%)	2 (9%)	..	..	19/150 (13%)	2 (9%)	..	..
No	78/88 (89%)	21 (91%)	..	..	131/150 (87%)	21 (91%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a casual male partner (among those who had anal sex and a casual male partner)	..	..	1·0	..	..	..	1·0	..
Yes	2/43 (5%)	0/7	..	..	7/81 (9%)	0	..	..

	Viral load status among those who self-reported being on ART (N=112)				Viral load status among those who self-reported being on ART or had a viral load <200 copies per mL (N=174)			
	Suppressed (n=89)*	**Not suppressed† (n=23)**	**p value‡**	**aOR (95% CI) §**	**Suppressed* (n=151)**	**Not suppressed† (n=23)**	**p value†**	**aOR (95% CI)¶**
No	41/43 (95%)	7/7 (100%)	..	..	74/81 (91%)	7 (100%)	..	..
Used condoms consistently with all types of partners in the last 6 months‡‡	..	..	0·81	..	..	..	0·32	..
Yes	44/87 (51%)	11 (48%)	..	..	55/149 (37%)	11 (48%)	..	..
No	43/87 (49%)	12 (52%)	..	..	94/149 (63%)	12 (52%)	..	..
Given somebody money, goods, or services for sex in the past 6 months	..	..	1·0	..	..	..	0·70	..
Yes	5/87 (6%)	1 (4%)	..	..	13/149 (9%)	1 (4%)	..	..
No	82/87 (94%)	22 (96%)	..	..	136/149 (91%)	22 (96%)	..	..
Received money, goods, or services for sex in the past 6 months	..	..	1·0	..	..	..	1·0	..
Yes	5/87 (6%)	1 (4%)	..	..	10/149 (7%)	1 (4%)	..	..
No	82/87 (94%)	22 (96%)	..	..	139/149 (93%)	22 (96%)	..	..
Have comprehensive knowledge of HIV§§	..	..	0·69	..	..	..	0·88	..
Yes	66 (74%)	18 (78%)	..	..	116 (77%)	18 (78%)	..	..
No	23 (26%)	5 (22%)	..	..	35 (23%)	5 (22%)	..	..
Time since last engagement with peer worker	..	..	0·08	..	..	..	0·09	..
Never engaged	27 (30%)	6 (26%)	..	..	54 (36%)	6 (26%)	..	..
0–6 months	37 (42%)	15 (65%)	..	..	63 (42%)	15 (65%)	..	..
>6 months	25 (28%)	2 (9%)	..	..	34 (23%)	2 (9%)	..	..
Received free condoms in the past 12 months	..	..	0·36	..	..	..	0·11	..
Yes	73 (82%)	21 (91%)	..	..	113 (75%)	21 (91%)	..	..
No	16 (18%)	2 (9%)	..	..	38 (25%)	2 (9%)	..	..
Reported any STI symptoms in the past 12 months¶¶	..	..	0·04	..	..	..	0·02	..
Yes	17 (19%)	9 (39%)	..	..	26 (17%)	9 (39%)	..	0·26 (0·08–0·87)
No	72 (81%)	14 (61%)	..	..	125 (83%)	14 (61%)	..	1·00 (ref)

	Viral load status among those who self-reported being on ART (N=112)				Viral load status among those who self-reported being on ART or had a viral load <200 copies per mL (N=174)			
	Suppressed (n=89)*	Not suppressed† (n=23)	p value‡	aOR (95% CI) §	Suppressed* (n=151)	Not suppressed† (n=23)	p value†	aOR (95% CI)¶
Diagnosed with STI in the past 12 months	..	..	0·74	..	..	..	0·49	..
Yes	12 (14%)	4 (17%)	..	..	17 (11%)	4 (17%)	..	..
No	77 (87%)	19 (83%)	..	..	134 (89%)	19 (83%)	..	..
Have been circumcised	..	..	0·42	..	..	..	0·58	..
Yes	27 (30%)	5 (22%)	..	..	41 (27%)	5 (22%)	..	..
No	62 (70%)	18 (78%)	..	..	110 (73%)	18 (78%)	..	..
Syphilis status	..	..	0·43	..	..	..	0·47	..
Active infection	7 (8%)	3 (13%)	..	..	14 (9%)	3 (13%)	..	..
No active infection	2 (92%)	20 (87%)	..	..	137 (91%)	20 (87%)	..	..
HBsAg status	..	..	<0·01	..	..	..	<0·01	..
Positive	8 (9%)	8 (35%)	..	0·17 (0·04–0·65)	15 (10%)	8 (35%)	..	0·19 (0·05–0·67)
Negative	81 (91%)	15 (65%)	..	1·00 (ref)	136 (90%)	15 (65%)	..	1·00 (ref)

Some variables do not add up to the total number because of skip patterns (ie, based on the answer to a parent question, subsequent questions might or might not be asked), missing data, participants not knowing the answer to the question, or participants refusing to answer. Some percentages might not sum to 100% due to rounding differences. MSM=men who have sex with men. ART=antiretroviral therapy. aOR=adjusted odds ratio. STI=sexually transmitted infection.

*Suppressed was defined as less than 1000 copies per mL.

†Not suppressed was defined as a viral load of 1000 or more copies per mL.

‡Pearson χ^2 or Fisher's exact test (used when 25% or more of the crosstabulation cells had expected sizes of <5).

§Odds ratios were estimated with Fisher's Exact scoring method. All variables adjusted for all other variables in the model.

¶Odds ratios were estimated with Fisher's Exact scoring method. All variables adjusted for all other variables in the model. One person in the suppressed group was excluded due to missing information on the lifetime number of male partners.

//Number of MSM, transgender women, or genderqueer people living in Harare or Bulawayo aged 18 years or older that survey participants had seen in the past 14 days (below median is less than five people and median and above is five or more people).

**Dependence was defined as having an alcohol use disorders identification test score of at least 15.

††Depression was defined as having a patient health questionnaire-2 score of at least 3.

[##]Consistent condom use was defined as the participant answering that they had always used condoms in the last 6 months with all the types of partners they reported (main male; other non-paying male; main transgender female; other non-paying transgender female; men the participant gave money, goods, or services in exchange for sex; transgender women the participant gave money, goods, or services in exchange for sex; men who gave the participant money, goods, or services in exchange for sex; main female; other non-paying female).

[§§]Defined as being able to correctly define all in a series of five HIV transmission questions using the UNAIDS definition.

[¶¶]Symptoms include presence of penile discharge, penile ulcer or sore, painful urination, anal discharge, or anal warts.

Table 3:

Association between viral load suppression and demographics, sexual behaviour, and other factors among HIV-positive MSM regardless of being aware of self-reported HIV status or antiretroviral therapy use

	Suppressed (n=158)	Not suppressed (n=90)	p value*	aOR (95% CI)†
City of residence	..	..	0·27	..
Bulawayo	109 (69%)	68 (76%)	..	0·51 (0·27–0·95)
Harare	49 (31%)	22 (24%)	..	1·00 (ref)
Age, years	..	..	<0·01	..
18–24	23 (15%)	19 (21%)	..	0·35 (0·16–0·78)
25–34	60 (38%)	47 (52%)	..	0·36 (0·19–0·67)
≥ 35	75 (47%)	24 (27%)	..	1·00 (ref)
Race	..	..	1·0	..
Black African	150 (95%)	86 (96%)	..	..
Other	8 (5%)	4 (4%)	..	..
Employment status	..	..	0·11	..
Self-employed	57 (36%)	20 (22%)	..	..
Employed full time	25 (16%)	15 (17%)	..	..
Employed part time	11 (7%)	13 (14%)	..	..
Full-time student	8 (5%)	4 (4%)	..	..
Unemployed	57 (36%)	38 (42%)	..	..
Education	..	..	0·12	..
None or primary	11 (7%)	11 (12%)	..	..
Secondary	112 (71%)	67 (74%)	..	..
Tertiary or vocational	35 (22%)	12 (13%)	..	..
Marital status	..	..	0·24	..
Single or never married	100 (63%)	65 (72%)	..	..
Married (to ≥1 woman or man) or cohabitating	12 (8%)	3 (3%)	..	..
Separated, divorced, or widowed	46 (29%)	22 (24%)	..	..
Sexual orientation	..	..	0·34	..
Gay or homosexual	103 (65%)	64 (71%)	..	..
Bisexual, straight, or other	55 (35%)	26 (29%)	..	..

	Suppressed (n=158)	Not suppressed (n=90)	p value*	aOR (95% CI)†
Network size‡	..	..	0·03	..
Below median	55 (35%)	44 (49%)	..	0·56 (0·32–0·97)
Median or above	103 (65%)	46 (51%)	..	1·00 (ref)
Alcohol dependence§	..	..	0·95	..
Dependent	41 (26%)	23 (26%)	..	..
Not dependent	117 (74%)	67 (74%)	..	..
Drug use in the past 6 months	..	..	0·42	..
Have used drugs in the past 6 months	62 (39%)	40 (44%)	..	..
Have not used drugs in the past 6 months	96 (61%)	50 (56%)	..	..
Screened positive for depression¶	..	..	0·31	..
Yes	13 (8%)	11 (12%)	..	..
No	145 (92%)	79 (88%)	..	..
Ever arrested for having had sex with men	..	..	0·03	..
Yes	15 (10%)	2 (2%)	..	..
No	143 (91%)	88 (98%)	..	..
Ever had vaginal sex with a female partner	..	..	0·83	..
Never	60/157 (38%)	34 (38%)	..	..
> 6 months ago	94/157 (60%)	53 (59%)	..	..
Within the last 6 months	3/157 (2%)	3 (3%)	..	..
Age at first sexual intercourse with a male partner, years	..	..	0·29	..
< 15	16/157 (10%)	3/89 (3%)	..	..
15–19	57/157 (36%)	36/89 (40%)	..	..
20–24	36/157 (23%)	22/89 (25%)	..	..
≥ 25	48/157 (31%)	28/89 (32%)	..	..
First sexual encounter with a male partner was transactional	..	..	0·92	..
Yes	29/157 (19%)	16/89 (18%)	..	..
No	128/157 (82%)	73/89 (82%)	..	..
Lifetime number of male sexual partners	..	..	0·11	..
1–5	63/157 (40%)	48/89 (54%)	..	..
6–10	40/157 (26%)	16/89 (18%)	..	..
> 10	54/157 (34%)	25/89 (28%)	..	..

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	Suppressed (n=158)	Not suppressed (n=90)	p value*	aOR (95% CI)†
Number of male sexual partners in the past 6 months	..	..	0·37	..
1–5	137/157 (87%)	81/89 (91%)	..	..
≥ 6	20/157 (13%)	8/89 (9%)	..	..
Had both male and female sexual partners in the past 6 months	..	..	0·53	
Yes	6/157 (4%)	5/89 (6%)	..	..
No	151/157 (96%)	84/89 (94%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a main male partner (among those who had anal sex)	..	..	0·95	..
Yes	19/157 (12%)	11/89 (12%)	..	..
No	138/157 (88%)	78/89 (88%)	..	..
Had condomless receptive anal intercourse at last sexual encounter with a casual male partner (among those who had anal sex)	..	..	1·0	..
Yes	7/82 (9%)	3/36 (8%)	..	..
No	75/82 (92%)	33/36 (92%)	..	..
Used condoms consistently with all types of partners in the last 6 months//	..	..	0·60	..
Yes	55/156 (35%)	34/88 (39%)	..	..
No	101/156 (65%)	54/88 (61%)	..	..
Given somebody money, goods, or services for sex in the past 6 months	..	..	0·13	..
Yes	13/156 (8%)	3/89 (3%)	..	..
No	143/156 (92%)	86/89 (97%)	..	..
Received money, goods, or services for sex in the past 6 months	..	..	0·54	..
Yes	12/156 (8%)	5 (6%)	..	..
No	144/156 (92%)	84 (94%)	..	..
Have comprehensive knowledge of HIV **	..	..	0·40	..
Yes	120 (76%)	64 (71%)	..	..
No	38 (24%)	26 (29%)	..	..
Time since last engagement with peer worker	..	..	0·40	..
Never engaged	54 (34%)	36 (40%)	..	..
0–6 months	70 (44%)	32 (36%)	..	..
>6 months	34 (22%)	22 (24%)	..	..
Received free condoms in the past 12 months	..	..	0·49	..
Yes	117 (74%)	63 (70%)	..	..

	Suppressed (n=158)	Not suppressed (n=90)	p value*	aOR (95% CI)†
No	41 (26%)	27 (30%)	..	..
Reported any STI symptoms in the past 12 months††	..	..	0·20	..
Yes	28 (18%)	22 (24%)	..	..
No	130 (82%)	68 (76%)	..	..
Diagnosed with an STI in the past 12 months	..	..	0·73	..
Yes	17 (11%)	11 (12%)	..	..
No	141 (89%)	79 (88%)	..	..
Have been circumcised	..	..	0·39	..
Yes	43 (27%)	20 (22%)	..	..
No	115 (73%)	70 (78%)	..	..
Syphilis status	..	..	0·75	..
Active infection	16 (10%)	8 (9%)	..	..
No active infection	142 (90%)	82 (91%)	..	..
HBsAg status	..	..	0·97	..
Positive	16 (10%)	9 (10%)	..	..
Negative	142 (90%)	81 (90%)	..	..

Some variables do not add up to the total number because of skip patterns (ie, based on the answer to a parent question, subsequent questions might or might not be asked), missing data, participants not knowing the answer to the question, or participants refusing to answer. Some percentages might not sum to 100% due to rounding differences. Viral load suppression defined as <1000 copies per mL. aOR=adjusted odds ratio. MSM=men who have sex with men. STI=sexually transmitted infection.

*Pearson χ^2 or Fisher's exact test (used when 25% or more of the crosstabulation cells had expected sizes of <5).

†Odds ratios are estimated with Fisher's exact scoring method. All variables adjusted for all other variables in the model.

‡Number of MSM, transgender women, or genderqueer people living in Harare or Bulawayo aged 18 years or older that survey participants had seen in the past 14 days (below median is less than five people and median and above is five or more people).

§Dependence was defined as having an alcohol use disorders identification test (AUDIT) score of at least 15.

¶Depression was defined as having a patient health questionnaire-2 (PHQ2) score of at least 3.

//Consistent condom use was defined as the participant answering that they had always used condoms in the last 6 months with all the types of partners they reported (main male; other non-paying male; main transgender female; other non-paying transgender female; men the participant gave money, goods, or services in exchange for sex; transgender women the participant gave money, goods, or services in exchange for sex; men who gave the participant money, goods, or services in exchange for sex; main female; other non-paying female).

**Defined as being able to correctly define all in a series of five HIV transmission questions using the UNAIDS definition.

††Symptoms include presence of penile discharge, penile ulcer or sore, painful urination, anal discharge, or anal warts.

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Table 4:

Bivariate association of demographic, sexual behaviour, and other factors with self-reported and viral load recategorised HIV status awareness among HIV-positive transgender women and genderqueer participants in Bulawayo and Harare, Zimbabwe

	Self-reported HIV-positive status awareness (N=92)*			Virla load recategorised adjusted HIV-positive status awareness (N=92)†		
	Aware (n=34)	Not aware (n=58)	p value‡	Aware (n=53)	Not aware (n=39)	p value‡
City	..	..	0·62	..	..	0·53
Bulawayo	6 (18%)	8 (14%)	..	7 (13%)	7 (18%)	..
Harare	28 (82%)	50 (86%)	..	46 (87%)	32 (82%)	..
Age, years	..	..	0·01	..	..	0·51
18–24	8 (24%)	31 (53%)	..	19 (36%)	20 (51%)	..
25–34	21 (62%)	21 (36%)	..	27 (51%)	15 (39%)	..
35–44	5 (15%)	4 (7%)	..	6 (11%)	3 (8%)	..
≥45	0	2 (3%)	..	1 (2%)	1 (3%)	..
Race	..	..	0·37	..	..	1·0
Black African	33 (97%)	58 (100%)	..	52 (98%)	39 (100%)	..
All other groups	1 (3%)	0 (0%)	..	1 (2%)	0	..
Employment status	..	..	0·11	..	..	0·33
Self-employed	10 (29%)	16 (28%)	..	17 (32%)	9 (23%)	..
Employed full time	6 (18%)	13 (22%)	..	11 (21%)	8 (21%)	..
Employed part-time	6 (18%)	4 (7%)	..	7 (13%)	3 (8%)	..
Full-time student	0	8 (14%)	..	2 (4%)	6 (15%)	..
Unemployed	12 (35%)	17 (29%)	..	16 (30%)	13 (33%)	..
Education	..	..	0·27	..	..	0·84
None or primary	2 (6%)	1 (2%)	..	2 (4%)	1 (3%)	..
Secondary	26 (77%)	40 (69%)	..	39 (74%)	27 (69%)	..
Tertiary or vocational	6 (18%)	17 (29%)	..	12 (23%)	11 (28%)	..
Marital status	..	..	0·36	..	..	0·15
Single or never married	30 (88%)	44 (76%)	..	46 (87%)	28 (72%)	..
Married (to ≥1 woman or man) or cohabitating	0	2 (3%)	..	1 (2%)	1 (3%)	..
Separated, divorced, or widowed	4 (12%)	12 (21%)	..	6 (11%)	10 (26%)	..
Sexual orientation	..	..	0·01	..	..	0·47

	Self-reported HIV-positive status awareness (N=92)*			Virla load recategorised adjusted HIV-positive status awareness (N=92)†		
	Aware (n=34)	Not aware (n=58)	p value‡	Aware (n=53)	Not aware (n=39)	p value‡
Gay or homosexual	32 (94%)	42 (72%)	..	44 (83%)	30 (77%)	..
Bisexual, straight, or other	2 (6%)	16 (28%)	..	9 (17%)	9 (23%)	..
Network size§	..	..	0·51	..	..	0·61
Below median	10 (29%)	21 (36%)	..	19 (36%)	12 (31%)	..
Median or above	24 (71%)	37 (64%)	..	34 (64%)	27 (69%)	..
Alcohol dependence¶	..	..	0·76	..	..	0·39
Dependent	11 (32%)	17 (29%)	..	18 (34%)	10 (26%)	..
Not dependent	23 (68%)	41 (71%)	..	35 (66%)	29 (74%)	..
Drug use in the past 6 months	..	..	0·70	..	..	0·29
Have used drugs in the past 6 months	7 (21%)	14 (24%)	..	10 (19%)	11 (28%)	..
Have not used drugs in the past 6 months	27 (79%)	44 (76%)	..	43 (81%)	28 (72%)	..
Screened positive for depression//	..	..	1·0	..	..	0·37
Yes	5 (15%)	8 (14%)	..	6 (11%)	7 (18%)	..
No	29 (85%)	50 (86%)	..	47 (89%)	32 (82%)	..
Ever arrested for being part of a key population	..	..	0·09	..	..	0·58
Yes	8 (24%)	6 (10%)	..	9 (17%)	5 (13%)	..
No	26 (77%)	52 (90%)	..	44 (83%)	34 (87%)	..
Ever had vaginal sex with a female partner	..	..	0·03	..	..	0·18
Never	27 (79%)	33 (57%)	..	38 (72%)	22 (56%)	..
> 6 months ago	7 (21%)	25 (43%)	..	15 (28%)	17 (44%)	..
Within the last 6 months	0	0	..	0	0	..
Age at first sexual intercourse with a male partner, years	..	..	0·01	..	..	0·05
<15	8 (24%)	6 (10%)	..	9 (17%)	5 (13%)	..
15–19	22 (65%)	25 (43%)	..	32 (60%)	15 (39%)	..
20–24	3 (9%)	17 (29%)	..	9 (17%)	11 (28%)	..
≥25	1 (3%)	10 (17%)	..	3 (6%)	8 (21%)	..
First sexual encounter with a male partner was transactional	..	..	0·04	..	..	0·51
Yes	10 (29%)	7 (12%)	..	11 (21%)	6 (15%)	..
No	24 (71%)	51 (88%)	..	42 (79%)	33 (85%)	..

	Self-reported HIV-positive status awareness (N=92)*			Virla load recategorised adjusted HIV-positive status awareness (N=92)†		
	Aware (n=34)	Not aware (n=58)	p value‡	Aware (n=53)	Not aware (n=39)	p value‡
Lifetime number of male sexual partners	..	..	<0·01	..	..	0·01
1–5	5 (15%)	19 (33%)	..	8 (15%)	16 (41%)	..
6–10	2 (6%)	18 (31%)	..	11 (21%)	9 (23%)	..
> 10	27 (79%)	21 (36%)	..	34 (64%)	14 (36%)	..
Number of male sexual partners in the past 6 months	..	..	0·14	..	..	0·44
1–5	24 (71%)	49 (85%)	..	40 (76%)	33 (85%)	..
6–9	4 (12%)	6 (10%)	..	6 (11%)	4 (10%)	..
≥10	6 (18%)	3 (5%)	..	7 (13%)	2 (5%)	..
Had both male and female sexual partners in the past 6 months	..	..	1·0	..	..	0·42
Yes	0	1 (2%)	..	0	1 (3%)	..
No	34 (100%)	57 (98%)	..	53 (100%)	38 (97%)	..
Had condomless receptive anal intercourse at last sexual encounter with a main male partner (among those who had anal sex)	..	..	0·24	..	..	0·06
Yes	11 (32%)	26 (45%)	..	17 (32%)	20 (51%)	..
No	23 (68%)	32 (55%)	..	36 (68%)	19 (49%)	..
Had condomless receptive anal intercourse at last sexual encounter with a casual male partner (among those who had anal sex)	..	..	0·42	..	..	0·71
Yes	1/14 (7%)	7/38 (18%)	..	5/28 (18%)	3/24 (13%)	..
No	13/14 (93%)	31/38 (82%)	..	23/28 (82%)	21/24 (88%)	..
Used condoms consistently with all types of partners in the last 6 months**	..	..	0·07	..	..	0·03
Yes	15 (44%)	15 (26%)	..	22 (42%)	8 (21%)	..
No	19 (56%)	43 (74%)	..	31 (59%)	31 (80%)	..
Given somebody money, goods, or services for sex in the past 6 months	..	..	0·35	..	..	1·0
Yes	3 (9%)	2 (3%)	..	3 (6%)	2 (5%)	..
No	31 (91%)	56 (97%)	..	50 (94%)	37 (95%)	..
Received money, goods, or services for sex in the past 6 months	..	..	0·08	..	..	0·71
Yes	12 (35%)	11 (19%)	..	14 (26%)	9 (23%)	..

	Self-reported HIV-positive status awareness (N=92)*			Virla load recategorised adjusted HIV-positive status awareness (N=92)†		
	Aware (n=34)	Not aware (n=58)	p value‡	Aware (n=53)	Not aware (n=39)	p value‡
No	22 (65%)	47 (81%)	..	39 (74%)	30 (77%)	..
Have comprehensive knowledge of HIV ††	..	..	0·67	..	..	0·38
Yes	26 (77%)	42 (72%)	..	41 (77%)	27 (69%)	..
No	8 (24%)	16 (28%)	..	12 (23%)	12 (31%)	..
Time since last engagement with peer worker	..	..	0·70	..	..	0·34
Never engaged	14 (41%)	28 (48%)	..	21 (39·6%)	21 (54%)	..
0–6 months	18 (53%)	28 (48%)	..	30 (56·6%)	16 (41%)	..
>6 months	2 (6%)	2 (3%)	..	2 (3·8%)	2 (5%)	..
Received free condoms in the past 12 months	..	..	0·70	..	..	0·58
Yes	27 (79%)	44 (76%)	..	42 (79%)	29 (74%)	..
No	7 (21%)	14 (24%)	..	11 (21%)	10 (26%)	..
Reported any STI symptoms in the past 12 months ‡‡	..	..	0·35	..	..	0·84
Yes	8 (24%)	19 (33%)	..	16 (30%)	11 (28%)	..
No	26 (77%)	39 (67%)	..	37 (70%)	28 (72%)	..
Diagnosed with STI in the past 12 months	..	..	0·15	..	..	0·06
Yes	8 (24%)	7 (12%)	..	12 (23%)	3 (8%)	..
No	26 (77%)	51 (88%)	..	41 (77%)	36 (92%)	..
Have been circumcised	..	..	0·15	..	..	0·02
Yes	3 (9%)	13 (22%)	..	5 (9%)	11 (28%)	..
No	31 (91%)	45 (78%)	..	48 (91%)	28 (72%)	..
Syphilis status	..	..	1·0	..	..	0·57
Active infection	4 (12%)	8 (14%)	..	6 (11%)	6 (15%)	..
No active infection	30 (88%)	50 (86%)	..	47 (89%)	33 (85%)	..
HBsAg status	..	..	1·0	..	..	1·0
Positive	3 (9%)	5 (9%)	..	5 (9%)	3 (8%)	..
Negative	31 (91%)	53 (91%)	..	48 (91%)	36 (92%)	..

Some variables do not add up to the total number because of skip patterns (ie, based on the answer to a parent question, subsequent questions might or might not be asked), missing data, participants not knowing the answer to the question, or participants refusing to answer. Some percentages might not sum to 100% due to rounding differences. STI=sexually transmitted infection.

* HIV-positive transgender women or genderqueer participants who self-reported being HIV positive were considered aware; all others were considered not aware.

† HIV-positive transgender women or genderqueer participants who either self-reported they were aware or had a viral load of less than 200 copies per mL; all others were considered not aware.

‡ Pearson χ^2 or Fisher's exact test (used when 25% or more of the crosstabulation cells had expected sizes of <5).

§ Number of men who have sex with men or transgender women or genderqueer participants living in Harare or Bulawayo aged 18 years or older that survey participants had seen in the past 14 days.

¶ Dependence was defined as having an alcohol use disorders identification test score of at least 15.

‖ Depression was defined as having a patient health questionnaire-2 score of at least 3.

** Consistent condom use was defined as the participant answering that they had always used condoms in the last 6 months with all the types of partners they reported (main male; other non-paying male; main transgender female; other non-paying transgender female; men the participant gave money, goods, or services in exchange for sex; transgender women the participant gave money, goods, or services in exchange for sex; men who gave the participant money, goods, or services in exchange for sex; main female; other non-paying female).

†† Defined as being able to correctly define all in a series of five HIV transmission questions using the UNAIDS definition

‡‡ Symptoms include presence of penile discharge, penile ulcer or sore, painful urination, anal discharge, or anal warts.