The HIV Care Cascade Among Female Sex Workers in Zimbabwe: Results of a Population-Based Survey From the Sisters Antiretroviral Therapy Programme for Prevention of HIV, an Integrated Response (SAPPH-IRe) Trial

Frances M. Cowan, MD,† Calum B. Davey, MSc,‡ Elizabeth Fearon, PhD,‡ Phillis Mushati, MSc,† Jeffrey Dirawo,† Valentina Cambiano, PhD,* Sue Napierala Mavedzenge, DPhil,§ Dagmar Hanisch, MPH,‖ Ramona Wong-Gruenwald, MPH,¶ Milton Chemhuru, MD, MPH,# Nyasha Masuka, MBChB, MPH,** Karin Hatzold, MD,†† Owen Mugurungi, MD,‡‡ Joanna Busza, MSc,§§ Andrew N. Philips, PhD,* and James R. Hargreaves, PhD‡*

Introduction: Female sex workers (FSW) in sub-Saharan Africa have a higher prevalence of HIV than other women of reproductive age. Social, legal, and structural barriers influence their access to care. Little is known about the HIV diagnosis and care cascade in most countries in Southern Africa. We aimed to describe the HIV diagnosis and care cascade among FSW in Zimbabwe.

Methods: We conducted cross-sectional respondent driven sampling (RDS) surveys of FSW in 14 sites across Zimbabwe as the baseline for a cluster-randomised controlled trial investigating a combination HIV prevention and care package. We administered a questionnaire, tested women for HIV and measured viral load. We report the mean, minimum, and maximum respondent-driven sampling-2 weighted site values.

Results: The survey included 2722 women, approximately 200 per site. The mean HIV prevalence was 57.5% (42.8–79.2 site minimum and maximum). Of HIV-positive women, 64.0% (51.6–73.7) were aware of their status, 67.7% (53.4–84.1) of these reported taking antiretroviral therapy, and 77.8% (64.4–90.8) of these had a suppressed HIV viral load (<1000 copies/mL). Among all HIV-positive women, 49.5% had a viral load < 1000 copies/mL.

Conclusions: Although most HIV-positive women aware of their status are accessing antiretroviral therapy, 36.0% of HIV-positive women are unaware of their status and 29.3% of all FSW have an unsuppressed HIV viral load. Investigation and investment into models of testing, treatment, and care are necessary to reach UNAIDS targets for HIV elimination.

Key Words: antiretroviral therapy, HIV seroprevalence, HIV viral load, sex workers, Africa, Pragmatic Clinical Trial

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From the *Department of International Public Health, Liverpool School of Tropical Medicine, Liverpool, United Kingdom; †Centre for Sexual Health & HIV/AIDS Research (CeSHHAR) Zimbabwe, Harare, Zimbabwe; ‡Department of Social and Environmental Health Research, Centre for Evaluation, Public Health and Policy, London School of Hygiene and Tropical Medicine, London, United Kingdom; §Women's Global Health Imperative, RTI International, San Francisco, CA; ‖United Nations Population Fund, Harare, Zimbabwe; ¶Gesellschaft für Internationale Zusammenarbeit, Harare, Zimbabwe; #Midlands Province, Ministry of Health and Child Welfare, Harare, Zimbabwe; **Matebeleland North Province, Ministry of Health and Child Welfare, Harare, Zimbabwe; ††Population Services International Global, Harare, Zimbabwe; ‡‡HIV AIDS TB Unit, Ministry of Health and Child Welfare, Harare, Zimbabwe; and §§Department of Population Studies, Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, United Kingdom.

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The trial is registered with the Pan African Clinical Trials Registry (PACTR201312000722390).

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Correspondence to: Frances M. Cowan, MD, Centre for Sexual Health & HIV/AIDS Research (CeSHHAR) Zimbabwe, 9 Monmouth Road, Avondale West, Harare, Zimbabwe (e-mail: frances.cowan@lstmed.ac.uk).

INTRODUCTION

In sub-Saharan Africa, female sex workers (FSW) have high HIV incidence and prevalence and therefore are in particular need of good access to effective HIV testing, prevention, and treatment services.[1] In sub-Saharan Africa, FSW are estimated to have 13.5 times higher odds of HIV infection than in the general population of adult women.[1] However, FSW are a marginalized group, sex work is illegal in many countries including Zimbabwe,[2] and FSW are often stigmatized by communities and health workers.[3,4] Typically, FSW are also highly mobile.[5] Designing service-delivery approaches that meet the needs of this population is therefore complex but urgently needed.

There is currently little information about the continuum of care from diagnosis to virological suppression (the HIV care cascade) among FSW with which to guide programing. Previous studies of FSW in sub-Saharan Africa indicate that antiretroviral therapy (ART) can be provided to FSW[6] at costs comparable with that of provision in the general population.[7] A recent systematic review and meta-analysis of antiretroviral uptake, adherence, and outcomes among FSW found that current ART use among HIV-positive FSW was 39% (95% confidence interval: 29%–48%), but noted a concerning lack of published data available.[8] Another review of the provision of sexual and reproductive health services for FSW in Africa found little emphasis among programs on access to antiretroviral treatment and support for adherence.[9] Although there is some evidence to guide the design of HIV prevention programs for FSW in Africa, little is known about the best means to improve testing, access, and adherence to ART and effective use of preexposure prophylaxis.[10,11]

In 2009, in response to a situational analysis conducted among FSW by Zimbabwe's National AIDS Council and partners,[12] the "Sisters with a Voice" program was established in 5 sites, and has since expanded to 36 sites covering all the provinces of Zimbabwe. Services provided are based on guidance from the World Health Organization[13] and include HIV testing and counseling, sexual and reproductive health services, condom provision, and health education supported by trained peer educators and a program of community mobilization. Results of a respondent-driven sampling (RDS) survey conducted in 3 towns in 2011,[14] along with qualitative work,[15] suggested that FSW in Zimbabwe were poorly engaged with HIV prevention and care services.

In response to this finding, we launched the Sisters Antiretroviral Programme for Prevention of HIV—an Integrated Response (SAPPH-IRe) trial, a cluster-randomized controlled trial conducted in 14 sites around Zimbabwe (7 matched-pairs). The aim is to determine the effectiveness and cost effectiveness of an enhanced community–based intervention to increase uptake, retention, and adherence to antiretroviral-based prevention and therapy among FSW. Outcomes were assessed at a population level in all 14 communities among FSW recruited to RDS surveys at baseline (December 2013), and will also be assessed at endline (April 2016–May 2016).

Aiming to contribute to our scant knowledge of the HIV diagnosis and care cascade among FSW in sub-Saharan Africa, this article describes the HIV diagnosis and care cascade at 14 sites around Zimbabwe at the baseline of the SAPPH-IRe trial. Data are presented on sociodemographic characteristics, HIV prevalence, ART coverage, viral suppression, and the proportion of all FSW with unsuppressed HIV viral load: the primary endpoint for the SAPPH-IRe trial.

METHODS

Study Population and Setting

Fourteen of the 36 sites where the "Sisters" services are provided are included in the SAPPH-IRe trial. These sites were purposively selected to reflect different sex work location types (eg, town, growth point, colliery/army base), were locations of adequate size (85–300 FSW attending clinics annually), and were geographically disparate to minimize contamination during the trial. Women were eligible if they were aged 18 or elder, had exchanged in sex for money or gifts in the preceding 30 days, and had lived at the site for at least the previous 6 months.

Data Collection

We conducted RDS[16] surveys of FSW using identical procedures in each of the 14 sites. We used RDS because it was unfeasible to assemble a sampling frame of the intended target population; it has been recommended for research among hard-to-reach populations[17]; we successfully conducted similar RDS surveys of FSW in 3 locations in 2011,[14] and sex work in these settings is not conducted primarily within brothels or set venues making time-location sampling methods less appropriate. In each site, we first conducted 2–3 days of geographic and social mapping, including informal discussions with trained peer educators, health care staff, and community informants. This formative work informed specific criteria for purposely selected "seed" women to ensure that all subpopulations within the site's sex worker population were represented and helped determine how many of these seeds should be selected.[18]

In line with RDS methodology, seed participants in each site were interviewed and given 2 recruitment coupons to pass on to their sex worker peers. Women were uniformly advised to recruit other sex workers whose names they knew and who knew theirs, who had not already enrolled in the study, and who met the study eligibility criteria. Interviewers used screening questions to confirm as far as possible that women given coupons met these criteria when they presented for interview. Six seeds were recruited in the smaller sites, whereas in 4 larger sites 8 seeds were recruited. When women receiving the coupons attended for the interview ("recruits"), they were also given 2 coupons to give out to women they knew who worked as FSW in that location. Coupons were coded such that recruiter/recruitee relationships could be tracked and unique IDs recorded. In all 14 sites, a maximum of 5 iterations, or "waves," of this process were performed (6 waves, including the initial seeds). We aimed to recruit 200 FSW per site to give adequate power to detect the intervention effect at follow-up.[19] In line with other RDS surveys,

women were reimbursed for participating in the survey ($5) and for recruiting eligible participants ($2 for each recruited). All participants gave informed consent to participate after receiving information about the study from trained interviewers and being given the opportunity to ask questions.

Five teams of trained researchers undertook data collection between November 13, 2013 and December 20, 2013. Interviewer-administered questionnaire data were collected onto tablet computers and directly loaded into a master database using a wireless internet connection in the field. Questionnaires included information on demographics, sex work, sexual behavior and condom use, HIV testing history, ART use, stigma, experience of violence, relationships with other sex workers, and use of sexual, and reproductive health services. We also collected data to determine personal network size, or "degree," for RDS estimation. In our survey, the degree was the number of FSW a participant reported knowing personally, whose names they knew and who knew theirs, who were at least 18 years old, lived at the site, and whom the participant would consider recruiting to the study.

All women had a finger prick blood sample collected in the form of a dried blood spot (DBS) for detection of HIV antibody [AniLabsytems EIA kit (AniLabsystems Ltd, OyToilette 3, FIN-01720, Finland)]. Blood samples were air-dried on filter papers and stored at room temperature, then transported biweekly to the Flow cytometry Laboratory in Harare. If HIV antibodies were detected then the DBS sample was tested for HIV viral load using NucliSENS EasyQ HIV-1 v2.0, both to confirm HIV-positive status and to quantify the viral load. For samples with a positive HIV antibody test, but an undetectable viral load, a second confirmatory enzyme-linked immunosorbent assay was performed [Enzygnost Anti-HIV 1/2 Plus ELISA (Germany)]. At 2 trial sites, plasma samples were collected in addition to DBS and tested in parallel using NucliSENS EasyQ HIV-1 v2.0, to permit validation of the use of DBS for viral load quantification.[20]

The Medical Research Council Zimbabwe, University College London, and the London School of Hygiene and Tropical Medicine gave ethical approval for the SAPPH-IRe trial, including the baseline data collection and analysis. The trial was also registered with the Research Council of Zimbabwe, the Pan African Clinical Trials Registry (PACTR201312000722390), and was approved by the Medicines Control Authority of Zimbabwe.

Data Analysis

We follow the recommendations of the STROBE-RDS guidelines in reporting our study.[21] First, we described the sample recruited. A limitation of RDS is that it is difficult to describe nonparticipation rates because no sample frame is present, and we did not conduct "exit interviews" of women who had distributed coupons to ascertain how many of their peers refused to take part. We calculated cluster-summaries for key sociodemographic characteristics of the sample. We calculated and report the mean of the 14 cluster-level RDS-2 weighted summaries and the range of estimates across clusters (minimum and maximum). Both as a total and summarized across clusters, we described the proportion of participants with suppressed HIV viral load, ($<$1000 copies/mL, as per World Health Organization guidelines[22,23]), and steps of the HIV care cascade underlying this: the proportion who were found to be HIV positive; the proportion who reported through questionnaire previously testing positive (ie, knew their status); the proportion who reported being on ART; and the proportion who had a viral load of $<$1000 copies/mL. We described these estimates both as proportions of the previous step on the cascade and as proportions of the total of women testing HIV positive.

We used "RDS-2" to conduct all analyses, which uses the "Volz-Heckathorn" estimator[24] and has been found to be less biased than previous estimators.[25] RDS-2 is based on estimating the inclusion probabilities of each survey participant, assuming the recruitment process can be modeled as a "random walk" over the social network of FSW. Within this model, the probability that each participant will be included is approximated as the inverse of the reported degree. Estimates were calculated in Stata 12 using the "rds" analysis package,[26] which removes seeds from the proportion estimates.

RDS-2 estimation assumes that recruitment chains progress such that final estimates are no longer dependent on the characteristics of the seeds, that recruitment does not become confined within subgroups of the FSW population ("bottlenecks"), and assumes with-replacement sampling even when women cannot participate more than once in practice.[25] We assessed these assumptions and their potential for bias on estimates of HIV prevalence and suppressed viral load for each site, using plots of the convergence of HIV and viral suppression estimates over sample waves ("convergence plots") and plots of estimate convergence by seed ("bottleneck plots"). We also examined the difference between RDS-2 estimates and estimates produced using the RDS "successive sampling" estimator[27] for a range of possible population sizes to assess the bias resulting from assuming with-replacement sampling. These analyses were guided by published advice about RDS diagnostics[28] and used the "rds" package for the R statistical language.[29] Details of the diagnostic methods and results are given in Appendix 1 (http://links.lww.com/QAI/A952).

RESULTS

RDS Recruitment and Estimation

In total, 2722 participants were recruited over 6 waves in 14 sites. Of these participants, 90 were seeds, of whom 62 (68.9%) were HIV positive and 29 (32.2%) had HIV viral load $\geq$ 1000 copies/mL. The number of nonseed "recruits" varied from 147 to 212 per site. There were an additional 15 participants from 8 sites who were missing recruiter information and who were treated as seeds and therefore dropped from the estimation.

Estimates for the proportion of FSW with suppressed viral load and for HIV prevalence seemed to converge well by the final sample wave for all sites except one for HIV prevalence and 2 for viral load, and there was little evidence of recruitment becoming confined within subgroups from any site (see Appendix 1).

Characteristics of FSW

Participants were aged between 18 and 65, with a mean age of 31 years (minimum site mean of 29 and maximum of 34). Approximately, one-third of women had no or only primary education, another third had completed forms 1–3, and the final third had completed at least form 4 (Table 1). Very few of the women were married (0.8% overall unweighted, the proportion was too small to calculate RDS weights) and 61.9% (range 46.4%–70.6% across sites) were separated or divorced. Most women (53.5%) reported initiating sex work by 24 years old, with 17.4% (8.5–25.9) reporting having started sex work before they were 18 years old. In total, 8.2% reported having no clients in the past week, 49.9% of women reported having between 1 and 5 clients per week; and 13.2% reported having 16 or more. Just under half of the women in each cluster (45.0%) were food insecure (food insecurity was indicated by any of the following: being unable to eat 2 meals a day; sometimes going to bed hungry; going an entire day without eating in the last week). More than a quarter of women (26.7%) had worked at another geographic location in the previous 12 months, whereas 52.2% had lived in their current location for 6 or more years. Just under two thirds (61.4%) of women reported good or very good relations with other FSW.

Violence from intimate partners was the most common form of interpersonal violence ever experienced (40.3%), followed by violence from clients (27.7%). Violence from police in the previous year was 9.7% overall, although in one location it was 19.5%.

Most participants reported having previously tested for HIV (91.1%), and of those who were HIV negative 70.5% (52.7–88.8) reported having tested for HIV in the previous 6 months.

HIV and the Diagnosis and Care Cascade

The HIV care cascade for HIV-positive FSW is described in Figure 1. HIV prevalence among FSW was estimated to be 57.5%, ranging from 42.8% to 79.2% across sites.

Among those who tested HIV positive, an average of 64.0% (51.6–73.7) in each site were aware of their status, ie, they reported a previous positive HIV test. Of those aware of their positive status, 67.7% (53.4–84.1) reported taking ART, which was 43.3% (32.3–54.0) of all those who tested HIV positive in the study. Across sites, an average of 77.8% (64.4–90.8) of women who were on ART had a viral load <1000 copies/mL. Women on ART with viral loads <1000 copies/mL were 33.7% (range 36.5–62.2) of all those testing HIV positive. An additional 15.8% (range 12.6–16.6) of those testing positive had a viral load <1000 copies/mL, despite not reporting being on ART. Of all HIV-positive FSW, 43.3% (32.3–54.0) were on ART and 49.5% (36.5–62.2) had viral loads of <1000 copies/mL.

When considering all FSW as the denominator, there were an estimated 29.3% (18.9–42.3) of women who had an unsuppressed HIV viral load of ≥ 1000 copies/mL.

DISCUSSION

We analyzed data from 2722 FSW recruited in 14 sites in Zimbabwe. HIV prevalence was very high (mean 57.5% across sites, ranging 42.8%–79.2%). Although recent HIV testing and access to ART were relatively common, still some 36.0% of HIV-positive FSW did not report that they were positive in the research interview (26.3–48.4). Most women who tested HIV positive and reported being aware of their status reported accessing ART (67.7%) and of those, 77.8% had a viral load <1000 copies/mL. However, overall only 49.5% of all HIV-positive women had a viral load <1000 copies/mL, in part because many were unaware of their status. Significant and rapid progress is needed to reduce HIV infection rates, increase HIV status awareness, and improve overall levels of viral suppression.

We undertook an ambitious field study to collect baseline data and test the feasibility of our proposed approach to the trial end-line data collection. We have shown that it was feasible to rapidly recruit approximately 200 FSW per site in 14 sites across Zimbabwe using RDS methodology. Our findings make an important contribution to the sparse literature on the HIV diagnosis and care cascade among FSW in sub-Saharan Africa.[8] We have been able to measure women having unsuppressed viral load as a proportion of all HIV-positive sex workers, not only among those accessing ART, which is important given that approximately one-third of HIV-positive FSW were unaware of their status. Sampling approaches such as ours provide a key means for assessing how close we are to the 90:90:90 targets[30] in a given population or setting.

All sampling methods for hard-to-reach populations have limitations, and RDS is no exception. The estimation makes many assumptions about the recruitment process and the social networks of sex workers. Previous mapping of sex workers in Zimbabwe suggests they are well networked.[14,31] Critical is that appropriate statistical techniques are used although there remains debate about methods of analysis. We have undertaken a series of in-depth diagnostic tests to determine the validity of RDS among FSW in these surveys, and find little evidence that there were major issues with recruitment. We present diagnostics in Appendix 1. However, as in all applications of RDS in hidden populations, it was not possible for us to empirically verify the extent to which the sample we recruited reflects the characteristics of FSWs working in the 14 sites. A major strength of our study was that we adopted identical field procedures in each of the sites, strengthening our capacity to compare findings across them.

Our estimate of viral load for HIV-positive FSW was based on analysis of DBS samples. Although plasma analysis is normally considered the gold-standard approach, DBS seemed to be an acceptable method for viral load monitoring using the NucliSENS assay, and we estimated high DBS sensitivity compared with plasma "gold-standard" (sensitivity = 87.4% and specificity = 96.8%).[20]

Coverage of ART among HIV-positive FSW was similar at 43.4% (range 32.3–54.0) to the 40% we had hypothesized before the trial.[19] This was slightly higher but in the range of the pooled estimate of 39.3% (27.2%–52.9%) among sex workers from low and middle income in studies found in a recent meta-analysis and systematic review.[8] Some 67.7% of those FSW who were aware of their status and reported they were positive also reported taking ART (range

TABLE 1. Baseline Range and Means of Cluster-Level Summaries of Sociodemographic Characteristics of 2722 FSW From 14 Clusters

Characteristics of FSW	Frequency, N	Unweighted, %	RDS Weighted, Mean % Across Sites, (Min–Max)
Age at interview, yrs			
18–24	656	24.1	26.5 (9.9–38.4)
25–29	668	24.5	23.6 (17.8–33.1)
30–39	956	35.1	34.4 (22.7–45.1)
>40	442	16.2	15.5 (6.5–22.3)
Total	2722		
Highest level of education that you have completed			
None/primary	857	31.7	36.2 (17.5–54.9)
Form 1–3	966	35.7	35.3 (18.1–46.4)
Form 4+	882	32.6	28.5 (18.4–40.8)
Total	2705		
Marital status			
Married	22	0.8	*
Divorced/separated	1710	62.8	61.9 (46.4–70.6)
Widowed	493	18.1	19.4 (9.5–39.2)
Never married	497	18.3	18.7 (6.8–39.3)
Total	2722		
Age when first exchanged sex for gifts or money (ie, when first started sex work), yrs			
<18	492	18.1	17.4 (8.5–25.9)
18–19	173	6.4	6.2 (1.7–19.4)
20–24	839	30.8	29.9 (19.0–40.2)
25/29	650	23.9	25.6 (15.1–32.4)
>30	568	20.9	20.8 (8.9–26.5)
Total	2722		
No. clients had sex with in the previous week			
None	200	7.4	8.2 (3.1–13.6)
1–5	1352	49.7	49.9 (33.4–70.3)
6–10	578	21.2	21.8 (9.8–36.7)
11–15	218	8.0	6.9 (3.2–9.7)
>16	374	13.7	13.2 (3.5–31.3)
Total	2722		
Insecure food quantity†			
No	1513	55.6	—
Yes	1209	44.4	45.0 (27.0–74.5)
Total	2722		
Worked as a sex worker at anywhere other than current location in the last 12 mo			
No	1987	73.0	—
Yes	734	27.0	26.7 (17.6–38.4)
Total	2721		
How long lived at the site, yrs			
0–1	274	10.1	13.4 (0.1–30.4)
2–5	855	31.5	34.4 (15.7–52.7)
>6	1582	58.4	52.2 (33.7–80.1)
Total	2711		
Answered "very good" or "good" in response to "In general how would you describe your relationship with other sex workers in [SITE]?"			
No	1050	38.6	—
Yes	1672	61.4	61.4 (50.0–77.0)
Total	2722		

(*continued on next page*)

TABLE 1. (*Continued*) Baseline Range and Means of Cluster-Level Summaries of Sociodemographic Characteristics of 2722 FSW From 14 Clusters

Characteristics of FSW	Frequency, N	Unweighted, %	RDS Weighted, Mean % Across Sites, (Min–Max)
Ever had a sexual partner (including a current or former husband, boyfriend but NOT a client) that has hit, slapped, kicked, pushed, shoved, or otherwise physically hurt			
No	1542	56.8	—
Yes	1172	43.2	40.3 (14.9–65.5)
Total	2714		
Ever had a client that has hit, slapped, kicked, pushed, shoved, or otherwise physically hurt			
No	1897	69.7	—
Yes	825	30.3	27.7 (11.0–53.4)
Total	2722		
In the past year has any member of the police been sexually violent against you?			
No	2569	94.4	—
Yes	152	5.6	4.6 (0–9.0)
Total	2721		
In the past year has any member of the police been physically violent against you?			
No	2430	89.3	—
Yes	290	10.7	9.7 (1.8–19.5)
Total	2720		
Consistent condom use with clients*			
No	589	21.6	—
Yes	2133	78.4	76.7 (61.6–88.5)
Total	2722		
Ever tested for HIV			
No	213	7.8	—
Yes	2509	92.2	91.1 (82.5–96.9)
Total	2722		
Tested for HIV within the last 6 months and not HIV positive			
No	331	29.5	—
Yes	792	70.5	70.5 (52.7–88.8)
Total	1123		
HIV status			
Negative	1109	41.0	—
Positive	1599	59.0	57.5 (42.8–79.2)
Total	2708		
HIV viral load <1000 copies/mL among all FSW			
No	825	30.5	—
Yes	1883	69.5	70.7 (57.7–81.6)
Total	2708		

*Reports using condom at last sex and answering "no" to "Think again about all your clients in the last month, have there been any times when you did not use condoms?"
†Answering "no" to "We can eat at least 2 meals a day," or "yes" to "Sometimes we go to bed hungry," or "yes" to "In the last week, have you had to go an entire day without eating because there was no food in your household?"

53.4%–84.1%). This was similar to our findings in 3 sites in 2011, when we found 51%–74% HIV-positive FSWs who were aware of their HIV status were also engaged with care.[14] However, coverage is well below the target set by UNAIDS (90% of people with HIV are aware of their infection, 90% of people diagnosed with HIV are on ART, and 90% of those on ART adhere and have undetectable levels of HIV in their blood).[30] Coverage among the general population of adult women in Zimbabwe is not known.

Overall, 77.8% of those reporting taking ART had a viral load <1000 copies/mL, as did 15.8% of HIV-positive women who did not report being on ART. That such a large proportion of women not on ART had a suppressed viral load was not anticipated; one explanation is that women under-

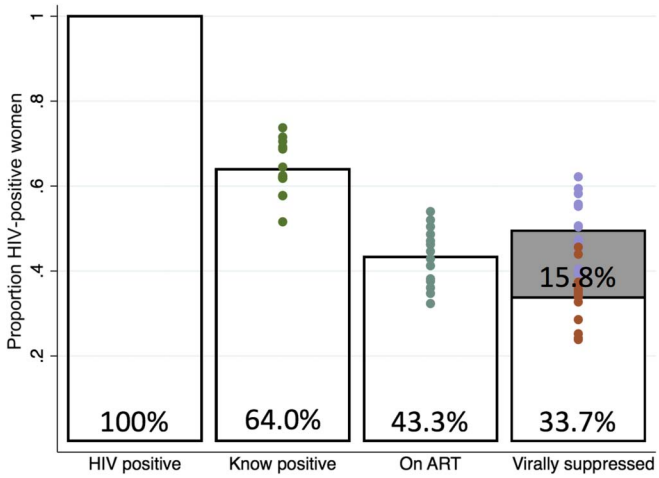

FIGURE 1. The y-axis indicates the proportion of women at each step of the cascade of all women testing HIV positive, whereas the figures on each bar indicate the proportion of women from each preceding step. Bars indicate the mean RDS-weighted values across sites, whereas the colored points are individual site values. The shaded portion of the virally suppressed bar represents those women who had a suppressed viral load, but who did not report taking ART.

reported their knowledge of HIV status and ART usage. However, there have been other surveys with similar findings: the 2012 Kenya AIDS Indicator Survey found that 30% of individuals who reported not being on ART were virally suppressed[32] and among men who have sex with men in the United States reporting to be unaware of their status and therefore not on ART in 2004–2011, 2/11 to 3/7 were found to be virally suppressed.[33] We plan to investigate this further.

These data point to an urgent need to improve HIV prevention and care for FSW in Africa using comprehensive community–based sex worker–led interventions.[10] There is good evidence of their cost effectiveness[34,35] but in few countries has comprehensive care as recommended by WHO[11] been taken to scale. Interventions that work across the cascade are likely to be more scalable and cost effective than those that work on only one aspect of the cascade.[36]

CONCLUSIONS

In conclusion, our findings have contributed to knowledge of the HIV care cascade among sex workers in Southern Africa. They confirm the urgent need for HIV prevention and care services in this population that address each step of the care cascade. We hope that the SAPPH-IRe trial will contribute to our understanding of how best to serve the needs of FSW in the region.

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