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Unveiling HIV dynamics among transgender women: a respondent driven sampling study in Rio de Janeiro, Brazil

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Abstract

Background—The burden of HIV in transgender women (transwomen) in Brazil remains unknown. We aimed to estimate HIV prevalence among transwomen, and identify the factors associated with newly diagnosed HIV infections.

Methods—"*Transcender*" was a respondent driven sampling study of transwomen in Rio de Janeiro, Brazil, conducted from August 2015 to January 2016. Twelve seeds were recruited from social movements and formative phase. Eligibility criteria were: self-identification as transwomen, being 18 years of age or older, living in Rio de Janeiro or metropolitan area, and having a valid peer recruitment coupon. Participants were categorized as HIV-negative, known HIV infected, or

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COMPETING INTERESTS

We declare that we have no conflicts of interest.

AUTHORS' CONTRIBUTIONS

BG, EMJ, WMcF, ECW, SB, and VGV conceived the study and interpreted the findings. BG, EMJ, ECW, and VGV drafted the manuscript. LV performed the statistical analyses with aid from RIM, EMJ, and PML. LM, LV, RIM, ACFG, CVC, AK, and PML helped with data acquisition, interpretation of the results, and drafting the manuscript. WMcF, AYL and SB were involved in revising the manuscript for important intellectual content. All authors read and approved the final manuscript.

newly diagnosed as HIV infected. Predictors of newly diagnosed HIV infections were assessed by comparing the newly diagnosed with the HIV-negative. Population estimates were adjusted using the RDSII estimator.

Findings—In total, 345 eligible transwomen were enrolled. The study sample was young and diverse on gender identity. Population estimates of no prior HIV testing, HIV-infection and newly diagnosed as HIV-infected were 29·1%, 32·1% and 7·0%, respectively (based on n=60 with no prior testing, n=141 HIV-infected, n=40 newly diagnosed). Syphilis, rectal chlamydia and gonorrhea infection were diagnosed in 28·9%, 14·6%, and 13·5%, respectively. Newly diagnosed HIV infections were associated with black race (22·8; 95%CI 2·9–178·9), *travesti* (34·1; 95%CI 5·8–200·2) or transsexual woman (41·3; 95%CI 6·3–271·2) gender identity, history of sex work (30·7; 95%CI 3·5–267·3), and history of sniffing cocaine (4·4; 95%CI 1·4–14·1).

Interpretation—Our results suggest that transwomen bear the largest burden of HIV among any population at risk in Brazil. The high proportion of HIV diagnosis among young participants points to the need for tailored long-term health care and prevention services in order to curb the HIV epidemic and improve the quality-of-life of transwomen in Brazil.

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Keywords

transgender person; HIV; STD; prevalence; respondent-driven sampling

INTRODUCTION

Of all populations affected by HIV, evidence suggests that transgender women (transwomen) may carry the heaviest HIV burden worldwide.[1] To date, several studies have found rates of HIV infection among transwomen that are substantially higher than among other groups at risk.[2] A meta-analysis of pooled data among transwomen from 10 low-income countries found an HIV prevalence of 18% and a 50-fold increased odds of HIV infection compared to other adults of reproductive age.[1]

Population-based studies of transwomen in South America have documented HIV prevalence rates as high as 30%.[3] A cross-sectional study of 284 transwomen seeking sex reassignment surgery in southern Brazil (1997–2014) found 25% living with HIV.[4] One Brazilian study of *travestis* conducted in 2008 found that 12% self-reported having HIV.[5]

Rigorous population-based HIV prevalence and incidence studies of transwomen are needed to support the development of public health policies tailored to this highly vulnerable population. In an attempt to address this gap, we conducted *Transcender,* a respondent driven sampling (RDS) study of transwomen in Rio de Janeiro, Brazil. This is the second largest city in Brazil and the state capital with the second largest number of HIV/AIDS cases reported in the country. We aimed to determine point estimates for the prevalence of HIV and other sexually transmitted diseases (STDs) among transwomen, and to identify factors associated with newly diagnosed HIV infections.

METHODS

Study Design and population

For this manuscript, we will use transwomen as an umbrella term that includes *travestis*, transsexual women, and other people with a gender identity different than that typically associated with their male sex assigned at birth (see Supplementary Material, page 1). The study was conducted from August 1, 2015 to January 29, 2016 at Oswaldo Cruz Foundation (FIOCRUZ), in Rio de Janeiro, Brazil.

RDS, an established method to obtain robust and diverse samples of populations with high vulnerability to HIV,[6–8] was employed because there is no sampling frame for transwomen. A purported benefit of RDS is that estimates of the true population can be derived using statistical weights for creating unbiased prevalence estimates.

The transwomen community was engaged throughout the development, implementation, and dissemination of this project. Four focus groups discussions with 34 transwomen were convened to vet the naming of the project, determine appropriate language related to gender identity to be used in the survey instrument, and ensure that all study procedures were sensitive to the needs of participants. Three members of the community were part of the study team in charge of study implementation. Once study data were analysed, a community town hall was convened to discuss study results with the trans community members. Strategies and challenges related to the dissemination of study results to the broader trans community were also addressed. Analyses were refined and written with trans community input.

Based on formative focus group findings, twelve seeds were selected to ensure that the sample was not over-represented by key variables, e.g. age, race/ethnicity, trans identities, education, geography, HIV status, history of sex work, and risk behaviors. Participants received up to five coupons that were used to refer peers to the study until the sample size was reached, and equilibrium was achieved on key variables. Equilibrium was reached when the sample composition from one wave to the next differed by less than 2%.[9] We specifically monitored education, geography, race/ethnicity, sex work status and HIV status between waves to ensure equilibrium was reached. Participants were included or excluded according to the inclusion/exclusion criteria only, and those criteria were not modified based on equilibrium assessments.

Recruitment was completed in 26 weeks with a mean of 3·6 recruitment waves for active seeds (standard deviation [SD] 1·6). The three recruitment RDS assumptions were met for this study;[10] i.e., (1) population members knew each other as members of the trans population, (2) participants were well networked as evidenced by long recruitment chains achieving cross-recruitment and equilibrium, and (3) this sample of 345 is likely small relative to the overall trans population. The coupon return rate was 37%. Incentives for study participation included snacks, sexual health materials, make up, and a medical visit. This medical visit was scheduled after study enrollment. All participants who tested positive for HIV were immediately offered linkage to care, specialized HIV care and combination antiretroviral therapy (cART). Results that were not available at the time of study enrollment

were provided during the medical visit. Treatment for any diagnosed STD was provided as well as Hepatitis B vaccination for those who needed it. Participants with hepatitis B or C were referred to specialized care at FIOCRUZ (see Supplementary Material, figure S1). Each study participant was screened for study eligibility before enrollment. Individuals were eligible for the study if they (1) self-identified as transwomen, (2) were 18 years of age or older, (3) reported living in Rio de Janeiro or *Baixada* (part of the Rio de Janeiro metropolitan area), and (4) possessed a valid peer recruitment coupon.

The Evandro Chagas - FIOCRUZ National Institute of Infectious Diseases Institutional Review Board provided human subjects approval for this project.

All participants signed an informed consent form prior to study procedures. All the procedures were approved by the local ethics committee, and linkage is part of the Evandro Chagas National Institute of Infectious Diseases (INI)-Fiocruz HIV Clinical Cohort's regular data-checking procedures. All the data that can identify participants are kept in password-protected files encrypted with a strong algorithm (AES-256). The files have highly restricted access to the personnel involved in the data analyses procedures.

Procedures

All surveys were performed face-to-face by trained interviewers using computers. The survey instrument captured sociodemographic information, sexual behavior, gender transition procedures and hormone use, discrimination and violence, alcohol and drug use, physical and mental health, history of STDs, HIV testing history, HIV care information, and HIV prevention knowledge.

HIV testing was performed following the Brazilian Ministry of Health algorithm. Briefly, a different rapid test was performed if the first test (HIV Strip Test Bioeasy, Brazil) was positive. If the second test (Abon HIV Test, USA) was positive, individuals were considered HIV-positive; if the second test was negative, individuals were considered indeterminate, and serology was performed (Elisa HIV test and Western-blot). Individuals with a first negative test were considered HIV negative. In addition, participants with a negative HIV rapid test who reported condomless anal intercourse in the last 30 days were offered pooled HIV RNA testing to diagnose acute HIV infection. All participants with a positive HIV test had their HIV viral load (VL) (Real Time PCR) and CD4+ cell count assessed.

VDRL was performed for syphilis screening; positive results were confirmed using a microhemagglutination assay for *Treponema pallidum* (MHA-TP). Active/recent syphilis was defined as titers ≥ 1/8 plus a positive MHA-TP. Rapid tests were used to screen for hepatitis B and C. If positive, serology (anti-HBs, HBsAg and anti-HBc for hepatitis B and anti-HCV for hepatitis C) was performed for confirmation. Active hepatitis B was considered if HBsAg was positive. Rectal *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (NG) infection were screened using the Abbott Real Time platform and the NG/CT Amplification Reagent Kit (Abbott Molecular, Des Plains, IL). All indeterminate results for rectal CT/NG were repeated using the same tests on the same sample, and the results were reported accordingly. All laboratory testing were processed at the FIOCRUZ Laboratory.

Statistical analysis

The minimum sample size for this study was 300 participants, enabling us to detect an estimated HIV prevalence of 5% with a 95% confidence interval (CI), 80% power, 5% precision and a design effect of 2.

HIV and STD prevalences were calculated based on test results. For this analysis, participants were categorized as HIV negative, known HIV infected, or newly diagnosed as HIV infected. Those who self-reported being HIV negative in the survey but tested HIV positive were categorized as newly diagnosed. To rule out any possible misreporting of HIV infection (that is, a denial of knowledge of HIV infection), we linked our data with information from the Brazilian Information Registry Databases. Six participants were found in these databases meaning that they were already aware of their HIV infection and were thus reclassified as known HIV infected. We used chi-square tests to compare the known HIV infected group with the newly diagnosed and found these groups to be significantly different from each other (shown in Supplementary Material, pages 2 and 3). Accordingly, to study the predictors of HIV acquisition, we used a subset of the original dataset that excluded the known HIV infected group and compared the newly HIV diagnosed to the HIV negative group. The modeling process included stepwise backward logistic regression including all variables with p-values <0·20 in univariate modeling, removing terms of greatest non-significance until a final model was reached where all variables had a p-value 0·05. We used RDSAT (version 6·0 - D. Heckathorn, Ithaca, NY; http://www.respondentdrivensampling.org) to examine homophily, mean network size, waves of recruitment, crude sample stability by week of recruitment, and equilibrium by wave of recruitment. The RDSII estimator was used to weigh and adjust population estimates according to recruitment patterns. We conducted weighted, bivariate and multivariate analysis using RDS Analyst Software version 0·57 (URL http://hpmrg.org.).[11] We used RDS-II estimates, with 1000 iterations, 95% CI for the estimates, and 500 bootstraps. As results are RDS-weighted, we provide only estimates and not the absolute numbers. Given the very small proportion of missing data (0.9% for the main outcome), imputation techniques were not employed, and missing data was simply excluded from the modeling process.

Role of the funding source

This study was sponsored by the Brazilian Research Council (CNPq) and the National Institute of Allergy and Infectious Diseases (NIAID-NIH). These sponsors had no role on study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

RESULTS

A total of 374 individuals returned with a recruitment coupon, 370 consented with their participation and were screened (98·9%), and 345 (93·2%) eligible transwomen participated in the study. Pattern of recruitment according to HIV status is shown in Supplementary Material (page 4). Reasons for ineligibility were: invalid coupon (17), non-transgender

identity (7), and residence outside Rio de Janeiro or *Baixada* (1). Table 1 describes seeds characteristics. HIV status (0·27) and race/color (0·20) had a moderate positive homophily suggesting a moderate tendency to recruit others of the same HIV status and race. A strong positive homophily was found for engagement in sex work (0·55) suggesting that those with a history of sex work had the greatest tendency to recruit others like themselves. The recruitment chain from one seed generated 23·5% of our sample.

Table 2 presents crude and RDS-weighted characteristics of transwomen in Rio de Janeiro, Brazil. The median age was 28 years (interquartile interval [IQI] 22–37). Most transwomen were living full time as a woman (86·0%; 95%CI 82·0–88·0). Soft tissue fillers were ever used by 32·3% of participants and 93·3% (95%CI 86·5–100·0) accessed these substances outside health facilities by unlicensed individuals. The majority reported ever using hormones (81·0% 95%CI 79·0–82·0), and most hormones were used without a medical prescription (87·0% 95%CI 85·0–90·0). The median number of sexual partners in the prior 6 months was 8 (IQI 2–50) and the mean was 113·0 (SD 244·0).

Overall, 29·1% (95%CI 23·2–35·4) of transwomen reported no prior HIV testing. Almost all participants agreed to be tested for HIV (N=342, 99·0%). Among all participants, almost one third of transwomen were estimated to be living with HIV, more than 20% previously knew their HIV status, and 7·0% (95%CI 0·0–15·9) did not know they were HIV-infected before participating in *Transcender*. Among HIV-infected participants, 22·2% (95%CI 0·0–50·8) were not aware of their HIV-status.

Among those newly diagnosed as HIV infected, nearly half (48·7%, 95%CI 0·0–100·0) reported no prior HIV testing and 43·7% (95%CI 8·4–79·0) reported a negative HIV test within the last year. One participant was diagnosed with acute HIV infection. Respectively, 44·1% (95%CI 15·2–73·6), 21·2% (95%CI 0·0–51·0) and 10·6% (95%CI 0·0–47·3) of transwomen newly diagnosed as HIV infected presented active/recent syphilis, rectal CT and NG.

Table 3 presents univariate and RDS-weighted multivariate analysis adjusted for all variables in the logistic regression model that compared newly HIV diagnosed with the HIV negative transwomen. The final model shows that newly diagnosed HIV infections were associated with black race, *travesti* or transsexual woman gender identity, sex work, and sniffed cocaine use.

DISCUSSION

We observed high HIV and STD prevalences among transwomen in Rio de Janeiro. Almost one third of transwomen in our study were estimated to be living with HIV, which is higher than the HIV prevalence in any other key population in the Brazilian HIV epidemic (4·9%, 14·2%, 5·9%, and 5·0% for female sex workers, men who have sex with men, people who use drugs and crack users, respectively).[12–14] The HIV prevalence observed in this study is also considerably higher than the pooled estimate for HIV among transwomen globally,[1] but on par with other RDS studies of transwomen.[3,15] Our multivariate analysis showed that

self-reported gender identity other than woman, black race, engagement in sex work, and sniffed cocaine use were independently associated with being newly diagnosed with HIV.

To our knowledge, this is the largest population-based study of transwomen in Brazil and one of the largest studies in Latin America. A strength of our findings is that we obtained population-based estimates. Other studies of transwomen in Brazil and elsewhere may have provided less accurate estimates of HIV due to convenience sampling approaches and self-reported data for HIV endpoints.[4,5] Moreover, our study also provided a unique opportunity to understand factors associated with new HIV infections.

High STD prevalences were identified among study participants. A high syphilis prevalence among Brazilian transwomen who were sex workers has been previously described.[16] To the best of our knowledge, these data are the first to describe the prevalence of anorectal CT and NG among transwomen in Brazil. High rates of these infections were also found among transwomen in Peru.[17] Since most chlamydial infections are asymptomatic and potentially facilitate HIV acquisition and transmission,[18] the high prevalence of anorectal CT infection may be a contributing factor to the ongoing HIV epidemic in transwomen in our setting. Unfortunately, STD molecular screening is not standard of care in Brazil with diagnosis relying mostly on the syndromic approach. In the absence of symptoms, the infected individual is not prompted to seek health services or adjust risk practices. This population could highly benefit from molecular STD screening, though the current high cost to implement such testing suggests that these strategies may not be affordable in low and middle income settings. Cost-effectiveness analysis could help address the economic value of molecular STD testing for transwomen in these settings.

Individual-level risks are necessary for the spread of HIV, but they are insufficient to explain the extraordinarily high HIV prevalence observed among transwomen in this study. It is more likely that the interplay of several HIV risk factors may explain the high population-specific HIV epidemic among transwomen. Many transwomen engaged in condomless anal sex, which could be in the context of economic survival and identity affirmation, as other studies of transwomen have described.[19] Additionally, transgender people faced with multiple stigmas may use substances to cope with discrimination and stigma, which may result in increased risk for HIV.[20] Substance use before or during sex was previously shown to be an independent predictor of condomless receptive anal sex in transwomen.[21,22]

The discrepancy between self-reported HIV prevalence (24·2%) and laboratory-confirmed HIV (31·2%) suggests that many transwomen remain unaware of their HIV status. Despite higher HIV testing rates than those found among other key populations in Brazil,[23] 21·9% had never been tested for HIV before, in agreement with findings from another Brazilian study among transwomen.[5] Reasons for low levels of HIV testing have been described for others key-populations in Brazil.[24] Fear of HIV infection, stigma as well as uncertain access to medical care and low perception of personal risk are among the cited barriers to HIV testing.[25] Without knowledge of their HIV status, transwomen cannot benefit from early treatment, which is universally available at no cost for all HIV-infected individuals in Brazil through our Public Health System. Moreover, we found that more than 40% of transwomen newly diagnosed as HIV infected had a negative HIV test in the prior year. These results

suggest that, had pre-exposure prophylaxis (PrEP) been available during the year prior to the study, then these HIV infections could have been averted, as well as future infections derived from them. Studies are needed to better understand transwomen's motivations to get tested for HIV, their perception about the meaning of a negative HIV test result and its implications for HIV prevention. Efforts to enable this vulnerable population to access HIV prevention interventions are of utmost importance.

Socio-structural factors play a major role in risk for HIV among transwomen. Our findings on gender are interesting and comparable to findings from other studies. We found that transwomen who self-identified as *travesti* or transsexual as opposed to those who self-identified as women were more likely to be newly diagnosed with HIV. Transgender gender identity was also a significant factor associated with HIV infection in San Francisco.[15] Transwomen suffer inordinate discrimination and violence because they are seen as transgressing gender norms.[26] Discrimination and violence related to gender identity are key factors explaining why transwomen experience higher rates of mental health disorders, substance use, and HIV.[27] Identification as women may be a marker of greater external and/or internal gender identity acceptance due to a variety of factors, like the ability to utilize medical services to transition,[28] thus reducing the risk of violence. In our setting, the ability to identify as women may confer a protective effect for HIV acquisition. The independent association of black race with new HIV diagnosis suggests that transwomen of color may face unique social and economic vulnerabilities created by the intersection of gender identity stigma, racism and transphobia. Racial, socioeconomic and gender inequalities can act synergistically and place people at the center of multiple stigmas resulting in higher risk for a number of poor social and health outcomes, including HIV.[2,29,30]

Our population was also very young, especially compared to other studies of transwomen in the US. [15] The young age of this sample has implications for the provision of long-term HIV care, the present needs for prevention among youth, and highlights that there is a new generation of transwomen bearing the burden of this preventable disease. Additionally, roughly 40% were internal migrants. Transwomen from other regions in the country migrate to the southeast, where Rio de Janeiro is located, probably aiming for less stigma and more life opportunities. The educational level of participants was lower than among participants in a study of transwomen described in Lima, Peru.[3] Unfortunately, in the present study we were not able to assess whether the feminization process and transgender-related discrimination could have hampered their access to education; future studies are needed to fill this gap in knowledge.

Income was also lower among transwomen compared to average Brazilian income[31] likely reflecting the lack of job opportunities for transwomen, leading to major challenges to maintain an adequate livelihood. Therefore in many settings transwomen have been forced to rely on sex work in order to survive, further exacerbating their risk for HIV and explaining the high rates of engagement in sex work in the population, similar to other studies in the region,[3,5] and in the US.[32] Although condomless anal sex is more common with primary than commercial partners,[2] economic pressures may result in transwomen compromising safer sex practices for monetary incentives.

Our study is not without limitations. Some authors have argued that it is not yet established if RDS can provide unbiased estimates,[33] and that the size of the network may be imprecise thus leading to biased RDS estimates.[34] Also, although our estimates show high variability as evidenced by the wide confidence intervals, which is common using RDS-methodology and may also be due to the sample size, the detected associations were of high magnitude and statistically significant. Given its cross-sectional design, this study does not allow inference on causality. Also, RDS hinge on networks for referral. Some transwomen (e.g. higher income, who underwent medical or social transition) may be underrepresented since they might have limited or inexistent networks within transwomen population, and our results may not be generalizable to them. In addition, our data refers only to Rio de Janeiro and its metropolitan area, so generalizing our results to other Brazilian cities is beyond the scope of the study. Lastly, the present analysis did not evaluate variables, such as stigma and racism, that might significantly contribute to HIV epidemic in transwomen.

Our results contribute to minimize the dearth of knowledge on transwomen's health and provide representative data on transwomen in Rio de Janeiro, Brazil. Our results reinforce the structural context of social exclusion and marginalization surrounding trans population, leading to a high vulnerability to HIV infection. The high proportion of transwomen infected with HIV, some of whom were newly diagnosed and likely recently infected given that almost half of those newly diagnosed had a negative HIV test within the prior year, corroborates the urgent need for effective prevention strategies for this population, including PrEP. Furthermore, these prevention strategies need to take into account the specificities of low and middle income countries, such as barriers to health access, high engagement in sex work, high levels of violence and transphobia. HIV prevention strategies should be urgently tailored to these most at-risk transwomen. If the 90-90-90 targets are to be achieved, access to HIV prevention and care to all key populations, including transwomen, is needed.[35] Notwithstanding, in order to succeed, these efforts must be built on interventions aiming to reduce discrimination that create vulnerabilities within transwomen communities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Seeds characteristics - *Transcender* Study, Rio de Janeiro, Brazil, 2015–2016

Seed ID	Age (years)	Known HIV status	Engagement in sex work	Schooling (years)	Race/color	Waves (N)	Recruits (N)
A	30	Positive	No	9–12	Black	6	42
B	31	Negative	Current	9–12	White	2	6
C	33	Negative	Current	9–12	White	4	51
D	37	Negative	Ever (not current)	4–8	Mixed	4	11
E	27	Negative	Ever (not current)	9–12	Mixed	4	27
F	36	Negative	No	12+	Black	3	12
G	29	Negative	No	9–12	Mixed	7	81
H	33	Negative	Current	9–12	White	4	30
I	42	Positive	Ever (not current)	9–12	Mixed	7	28
J	42	Positive	Ever (not current)	4–8	Mixed	2	8
K	29	Negative	No	12+	Black	6	43
L	24	Negative	Current	12+	White	2	6

Table 2

Crude and weighted characteristics of transwomen in a RDS-sampling study in Rio de Janeiro, Brazil, 2015–2016[1]

Characteristic	Crude (n= 345), N (%)	RDS Weighted, % (95% CI)
Age[2]		
18–24	95 (27·6)	30·0 (20·1–39·9)
25–35	145 (42·0)	39·9 (29·0–50·8)
36–45	66 (19·1)	17·9 (7·3–28·5)
>45	39 (11·3)	12·2 (4·4–19·9)
Self-declared race/color		
White	79 (22·9)	28·4 (25·9–30·9)
Mixed	175 (50·7)	43·7 (31·8–55·7)
Black	84 (24·3)	27·3 (15·0–39·6)
Other	7 (2·0)	0·5 (0·0–3·3)
Born in Rio de Janeiro	250 (72·0)	58.5 (50·6–66·3)
Housing instability[3]	149 (43·2)	40·4 (28·0–52·9)
Monthly income (in US$)[2,4]		
<=130·00	140 (43·5)	54·7 (44·4–65·0)
131·00 – 260·00	109 (33·9)	22·3 (8·9–35·8)
>260·00	73 (22·7)	23·0 (10·7–35·2)
Years of education[2]		
<4	27 (7·8)	10·1 (2·5–17·7)
4–8	108 (31·3)	29·6 (23·1–36·1)
9–12	188 (54·5)	56·3 (46·5–66·1)
>12	22 (6·4)	4·0 (0·0–8·4)
Current gender identity		
Travesti	131 (38·0)	25·6 (16·0–35·3)
Woman	96 (27·8)	39·2 (24·2–54·2)
Transsexual woman	107 (31·0)	29·1 (18·2–40·0)
Other definitions	11 (3·2)	6·1 (0·6–11·6)
Changed name in identity documents	9 (2·6)	1·4 (0·2–2·5)
Sexual orientation		
Heterosexual	212 (61·5)	54·4 (40·7–68·2)
Homosexual	105 (30·4)	37·7 (23·8–51·5)
Other definitions	28 (8·1)	7·9 (0·0–15·8)
What is the gender of people they are attracted to		
Only men	326 (94·5)	93·2 (88·6–97·9)
Only woman	3 (0·9)	0·6 (0·0–3·1)
Other	16 (4·6)	6·2 (2·3–10·1)
Currently taking hormones	170 (52·3)	56·8 (45·3–68·4)
Ever used soft tissue fillers	166 (48·1)	32·3 (22·1–42·6)

Characteristic	Crude (n= 345), N (%)	RDS Weighted, % (95% CI)
Ever had gender-related surgery (vagina, penis, oorchiectomy)	20 (5·8)	6·2 (0·9–11·4)
Access to health care in the last 6 months	199 (57·7)	49·4 (38·2–60·6)
Access to trans-related health care	51 (14·8)	15·9 (7·7–24·2)
Age at sexual debut[2]		
<12	121 (35·2)	31·0 (19·6–42·3)
12–18	195 (56·7)	62·2 (51·1–73·3)
>19	28 (8·1)	6·9 (0·0–14·1)
Engagement in sex work		
Current	167 (48·4)	34·1 (22·8–45·4)
Ever (not currently)	104 (30·1)	24·5 (14·7–34·2)
Never	74 (21·4)	41·5 (28·3–54·7)
Ever suffered discrimination	333 (96·5)	96·7 (91·6–100·0)
Ever suffered physical violence	187 (54·2)	48·6 (36·6–60·6)
Ever raped	164 (47·5)	41·5 (29·0–53·9)
Ever drug use	266 (77·1)	75·7 (64·8–86·6)
Sniffed cocaine	149 (43·2)	41·5 (29·3–53·7)
Glue	86 (24·9)	23·3 (13·4–33·3)
Downers	125 (36·2)	41·4 (28·9–53·9)
Marijuana	203 (58·8)	56·1 (43·6–68·6)
Others	82 (23·8)	23·8 (12·6–34·9)
Binge drinking[5]	227 (65·8)	68·1 (56·7–79·6)
Number of sex partners last 6 mos[2]		
0	1 (0·3)	0·0 (0·0–0·0)
1–4	93 (28·6)	40·0 (40·0–50·0)
>4	231 (71·1)	60·0 (50·0–60·0)
Condomless anal intercourse with last 3 partners	219 (63·5)	68·2 (57·4–79·0)
Active STD		
Syphilis	112 (32·7)	28·9 (18·0–39·8)
Rectal chlamydia	46 (14·1)	14·6 (5·4–23·8)
Rectal gonorrhea	25 (7·6)	13·5 (3·2–23·8)
Hepatitis B	10 (2·9)	0·7 (0·1–1·3)
Hepatitis C	6 (1·7)	0·8 (0–1·8)
HIV-positive self-reported status	101 (29·3)	24·2 (11·5–37·0)
HIV-positive status via testing	141 (41·2)	31·2 (18·8–43·6)
Undetectable viral load[6]	60 (43·5)	35·4 (19·6–51·3)
CD4+ cells count[2]		
<=200	17 (12·6)	8·4 (0·0–23·6)
201–350	14 (10·4)	4·5 (0·0–12·3)
351–500	23 (17·0)	13·7 (1·6–25·8)
>500	81 (60·0)	73·3 (60·9–85·7)

[1]Proportions calculated for valid data; missing excluded;

[2] Continuous variables were reclassified as categorical;

[3] Housing instability was considered if the participant referred to living in a shelter, on the streets, being allowed to live in some place as a favor, or at work;

[4] US$1·00=BRL3·85;

[5] Defined as six or more alcohol drinks on any occasion;

[6] Only transwomen on cART; viral load<40 copies per mL;

[7] cells per μL.

Table 3

Predictors of newly diagnosed HIV infection compared to HIV-negative among transwomen in Rio de Janeiro, Brazil, 2015–2016*

Characteristic	Univariate (RDS weighted)		Multivariate (RDS weighted)	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Age				
18–24	1			
25–35	1·97 (0·44–8·84)	0·3700		
36+	0·65 (0·06–6·47)	0·7190		
Self-declared race/color				
White	1		1	
Mixed/other	5·23 (0·71–38·56)	0·1039	6·2 (0·9–40·5)	0·0570
Black	6·34 (0·76–52·4)	0·0859	22·8 (2·9–178·9)	0·0031
Born in Rio de Janeiro	1·7 (0·5–6·2)	0·4130		
Monthly income (in US$)[2]				
<=130·00	1·70 (0·34–8·35)	0·5074		
131·00 – 260·00	6·15 (1·05–36·0)	0·0436		
>260·00	1			
Years of education				
<4	1·33 (0·14–12·45)	0·8020		
4–8	0·49 (0·15–1.7)	0·2610		
9+	1			
Current gender identity				
Woman	1		1	
Travesti	21·2 (3·8–117·6)	0·0005	34·1 (5·8–200·2)	0·0001
Transsexual women	15·3 (2·3–100·3)	0·0046	41·3 (6·3–271·2)	0·0001
Other definitions	0·4 (0·0–6·0)	0·4826	0·2 (0·0–4·1)	0·2782
Sexual orientation				
Heterosexual	1			
Homosexual	0·81 (0·20–3·33)	0·7780		
Other definitions	1·49 (0·19–11·4)	0·6990		
Currently taking hormones	0·4 (0·1–1·7)	0·2323		
Ever used soft tissue fillers	2·9 (0·7–11·6)	0·1330		
Ever had gender-related surgery (vagina, penis, oorchiectomy)	0·07 (0·0–0·73)	0·0258		
Access to trans-related health care	1·29 (0·16–10·4)	0·8090		
Age at sexual debut				
<12	3·9 (0·40–39·4)	0·2340		
12–18	5·26 (0·67–41)	0·1130		
>19	1			
Ever engaged in sex work	51·8 (6·0–450)	0·0004	30·7 (3·5–267·3)	0·0020
Ever suffered discrimination	0·6 (0·2–1·7)	0·3410		
Ever suffered physical violence	7·8 (1·8–33·4)	0·005		

Characteristic	Univariate (RDS weighted)		Multivariate (RDS weighted)	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Ever raped	2·3 (0·6–9·2)	0·2460		
Ever drug use	1·5 (0·3–7·0)	0·6402		
Ever sniffed cocaine use	3·8 (1·0–14·7)	0·0560	4·4 (1·4–14·1)	0·0141
Binge drinking[1]	3·3 (0·9–12·0)	0·0651		
5+ sex partners in the last 6 mos	13·00 (2·7–61·5)	0·0013		
Condomless anal intercourse with last 3 partners	0·3 (0·1–1·2)	0·0782		
Current syphilis, rectal Chlamydia or gonorrhea	2·5 (0·7–9·9)	0·1790		

*Analysis considering a subset of the original dataset with only the newly HIV diagnosed and the HIV negative groups;

[1]Defined as six or more alcohol drinks on any occasion;

[2]US$1·00=BRL3·85.