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High and stable HIV prevalence among transwomen with low income recruited with respondent driven sampling, San Francisco, 2010 – 2016.

H. Fisher Raymond[1], **Erin C. Wilson**[2,3], **Tracey Packer**[2], **Jess Lin**[2], and **Willi McFarland**[2,3]

[1]School of Public Health, Rutgers University.

[2]San Francisco Department of Public Health.

[3]University of California, San Francisco.

Abstract

Background: Studies have documented high HIV prevalence among transwomen in the United States, however to our knowledge, no studies have documented trends in HIV prevalence in this population.

Methods: We used respondent-driven sampling (RDS) to sample transwomen in San Francisco for three HIV prevalence and behavioral surveys in 2010, 2013 and 2016. Our analysis of point estimates and trends were weighted for the sampling method.

Results: HIV prevalence by serological testing in the survey was 38.8% (95% CI 32.4, 45.2), 33.7% (95% CI 25.9, 41.5) and 31.6% (95% CI 12.2, 38.1) in 2010, 2013 and 2016, respectively. Disparities in higher HIV prevalence by Black, Latino, and Asian race/ethnicity and lower education level persisted through 2016.

Conclusion: Based on a statistical test for trend HIV prevalence among transwomen has remained high and stable from 2010 to 2016. HIV infection is still highest at 31.6% compared to any other group in San Francisco. We also observed that older transwomen had significantly higher odds of living with HIV than younger women over the last two waves of data collection. Taken together, these trends suggest that there is declining incidence of new HIV infections among low-income transwomen in San Francisco. Moreover, among transwomen, HIV disproportionately affects transwomen of color.

Summary

HIV prevalence among transwomen has remained high and stable from 2010 to 2016. Older transwomen had higher odds of HIV infection. These trends suggest declining incidence of new HIV infections among transwomen in San Francisco.

Correspondence to: H. Fisher Raymond, DrPH, 683 Hoes Lane West, Piscataway, NJ, 08854., Hfisher.raymond@rutgers.edu.

Compliance with ethical standards

Conflict of Interest: All authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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Keywords

transwomen; HIV trends

Introduction

Transwomen have historically been a population highly impacted by HIV infection internationally, nationally and in San Francisco with estimated HIV prevalence well above 25% in numerous one-off studies.(1–4) Potential reasons for the disparity include a confluence of stigma, discrimination, high risk sexual and drug use behaviors and societal barriers that inhibit access to services.(5–7) HIV behavioral surveillance relies upon being able to produce prevalence and risk behavior indicators that can be compared across person, place, and time to monitor the state of the epidemic in a given population / geography.(8, 9) Individual studies, planned by independent researchers, often use a wide range of sampling methods [convenience (10, 11), snowball, respondent driven sampling (3), HIV testing records(4)], eligibility criteria [cross dressers, sex workers(11), self-identified transgender persons (10)] and measures of HIV prevalence [self report (12), testing (4)]. To ensure that HIV prevalence and risk behavior indicators are comparable across time consistent methods to recruit community samples of the population and consistent measures to estimate these indicators should be used.(8, 9)This is the rationale for the National HIV Behavioral Surveillance (NHBS) system of surveys conducted periodically in multiple US cities for men who have sex with men (MSM), people who inject drugs (PWID).(8) However, not until 2017 were transwomen added as an NHBS population in seven US cities although implementation of NHBS among this population has not yet started as of August 2018. Numerous one-off studies have documented high HIV prevalence in this population, however no studies have implemented consistent methods and measures over time to document trends in HIV prevalence and demographic characteristics among transwomen in the US. In San Francisco no study has attempted to measure community level HIV prevalence or trends in HIV prevalence among this population since the late 1990's. To fill this gap and better estimate trends in and correlates of HIV infection among transwomen, we conducted standardized serial cross-sectional studies in San Francisco to have robust data to guide appropriate epidemic response in this vulnerable population.

Methods

We used respondent-driven sampling (RDS) to sample adult transwomen in San Francisco for a series of cross-sectional HIV prevalence and behavioral surveys in 2010, 2013 and 2016. Conceptually our studies mimic the design of NHBS where periodic cross-sectional community surveys measuring demographics and risk behaviors with HIV testing are conducted to monitor the HIV epidemic in key populations.(8, 13) RDS was chosen to sample this hard to reach population in order to maximize the diversity of the study sample and to enable us to make population parameter estimates of key indicators.(14) RDS uses peer referrals starting with "seed" subjects to recruit across the social networks of a study population. Demographically diverse (race / ethnicity, income, education) seeds were recruited from community based organizations and outreach. At our centrally located office

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in San Francisco each participant was screened for eligibility. Eligibility criteria were 1) aged 18 and over, 2) resident of San Francisco by self-reporting living in San Francisco, 3) assigned male at birth and currently identified as something other than male (e.g. female, trans woman, woman, non-binary, gender queer) and 4) spoke English or Spanish. Of note, income was not an eligibility criterion at any time. After providing informed consent, participants completed an interviewer-administered computerized survey that addressed demographics, gender identity and self-reported HIV status. Each participant was also asked to provide a specimen for rapid HIV testing performed by study staff. At the end of the study visit participants were invited to recruit up to 3 of their transwomen peers. Participants were asked to refer peers who identified as transgender, we did not specify what that meant intentionally to allow any assigned male at birth (AMAB) persons who identified as something other than male to participate. Of note, for simplicity we refer to all participants as transwomen in this paper regardless of their gender identity. Participants received a monetary incentive for both study participation ($50) and recruitment of peers ($10 each). All three rounds of the cross-sectional surveys had IRB approval from the University of California, San Francisco's Human Research Protection Program.

Measures

Our analysis focused on key demographic characteristics which included race / ethnicity, age, educational attainment, yearly income, living situation, nativity in the United States and gender identity. For race / ethnicity participants could report multiple race / ethnicities. If they reported any Hispanic they were categorized as Hispanic. If they reported only one race they were categorized as that race. If they reported multiple races other than Hispanic they were categorized as "other". In addition we collected data on any pre-exposure prophylaxis (PrEP) use in the past 12 months and self-reported HIV status. We also tested participants for HIV antibodies at the time of the study visit. In Teach 1 OraQuick (Orasure Technologies, Bethlehem PA) rapid finger stick was used as the first test. For those reactive on the first test the ClearView Stat-Pak (Chembio, Medford, NY) rapid test was used for confirmation of HIV-positive status. In TEACH2 we initially performed a finger stick rapid HIV test using Insti (biolytical, Vancouver, Canada). For those reactive on the first test we used Clearview Stat-Pak. In TEACH3 we used Insti and then Alere Determine (Abbott, Abbott Park, IL) for confirmation. If there were any discrepancies between self-reported status or between any of the rapid tests a specimen was taken for laboratory confirmation using EIA/Western Blot per standard laboratory procedures. In all three waves all participants regardless of self-reported HIV status were tested for HIV antibodies on the day of their study visit. For the purposes of RDS analysis we elicited each participant's social network size by asking a series of nested questions that assessed this domain: "How many other transwomen to do you know? How many of these transwomen have your seen in person in the past six months? How many of these transwomen have you seen in the past one month? Of these transwomen how many would you be willing to give a recruitment coupon to?" The response to the final question was used for RDS adjustment. Finally, links between recruiter and recruits were tracked in an Excel database.

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Analysis

We tabulated crude (unadjusted for the sampling method) frequencies and proportions in SAS. We computed weights to account for the RDS sampling method using Giles Successive Sampling (SS) estimator in RDS Analyst.(15) We chose to use Gile's SS as this estimator is recommended when the sampling fraction of the population is high.(15) The population size of low-income transwomen in San Francisco is estimated to be about 3,000 persons.(16) Gile's SS estimator adjusts for differences in each individual's social network size or in other words their different probabilities of inclusion. We appended the weights to the dataset and calculated weighted proportions and 95% confidence intervals (CI) using survey procedures in SAS. We conducted Cochran-Armitage tests for trend among univariate indicators across the three surveys using an Excel tool that produces statistical measures of heterogeneity over multiple RDS surveys. (17) We conducted weighted bivariate analysis of demographic and risk correlates of HIV infection in SAS (v 9.3). The independent variables were chosen because they are considered crucial to understanding which sub segments of the population bear the most HIV burden. Weighted multivariable logistic regression for each study year and across all study years were also conducted in SAS (v 9.3) using the same weights.

Results

Sampling

In 2010, 11 seeds started the RDS recruitment and resulted in a total sample size of 314 transwomen. In 2013, 12 seeds started RDS recruitment resulting in a total sample size of 234 transwomen. In 2016, 16 seeds started RDS recruitment resulting in a total sample size of 318 transwomen. All three studies' recruitment period lasted five months. No additional seeds were added after the start of the studies.

Descriptive analysis

Crude and weighted descriptive results are shown in Table 1, suggesting stability in the demographic make-up of the population over time. Across the three cross-sectional surveys there were no statistically significant trends with the exception of a decrease in the proportion of transwomen 36–45 years old (32.3%, 95% CI 26.2, 38.3 in 2010 to 21.9%, 95% CI 15.9, 27.8 in 2016, $p = 0.05$), and changes in housing. We observed a decrease in the proportion whose living situation was "renting" from 56.1% (95% CI 49.5, 62.6) in 2010 to 51.4% (95% CI 42.8, 59.9) in 2013 to 32.0% (95% CI 24.9, 39.0) in 2016 ($p < 0.001$) and an increase in the proportion of transwomen whose living situation was "homeless / shelter" from 8.9% (95% CI 4.9, 12.8) in 2010 to 16.1% (95% CI 9.9, 22.4) in 2013 to 23.5% (95% CI 16.9, 29.9) in 2016 ($p = 0.0007$). The racial / ethnic identities of transwomen were consistent across the three surveys: Asian (2.9% - 3.3%), Black (18.9% - 29.3%), Latina (26.9% - 32.9%), white (17.6% - 26.1%) and "other" race / ethnicity (15.9 % - 18.9%). We also consistently estimate a high proportion of transwomen (above 90% in all surveys) with incomes less than $30,000 per year. About two-thirds of transwomen in our studies were born in the United States. Just less than half (43.8% - 47.8%) of participants identified as female and just over half (45.7% - 52.8%) identified as transwomen in each survey.

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Pre-exposure prophylaxis (PrEP) use was not measured in 2010 and zero participants reported PrEP use in 2013. We estimate PrEP use to be at 10.9% of HIV negative transwomen (95% CI 4.6, 16.8) in 2016.

Trends in HIV prevalence

HIV prevalence by serological testing in the survey was 38.8% (95% CI 32.4, 45.2), 33.7% (95% CI 25.9, 41.5) and 31.6% (95% CI 12.2, 38.1) in 2010, 2013 and 2016, respectively (differences across years not significant by our test for trend). The proportion of previously diagnosed HIV infection among HIV infected transwomen was 91.1% (95% CI 86.4, 96.8), 83.5% (95% CI 72.2, 94.9) and 92.1% (95% CI 87.2, 97.0) in 2010, 2013 and 2016, respectively (differences across years not significant by our test for trend).

Bivariate analysis of HIV infection

In weighted bivariate analysis of HIV prevalence, white transwomen consistently had lower prevalence of HIV infection (10.4% - 14.8%) compared to all other race / ethnicity groups (26.3% - 82.9%) ($p < 0.001$ in all years). Transwomen 26 years of age and older all had HIV prevalence at higher than 25% across the three waves. Notably, over time HIV prevalence among those aged 18 to 25 years of age appears to have declined but not significantly so from 23.8% in 2010 to 17.8% in 2016. HIV prevalence declined as educational attainment increased in all three waves of the study ($p < 0.001$). Income was only significantly associated with HIV prevalence in the second wave with prevalence 3-fold higher at 35.6% among those with incomes less than $30,000 per year compared to those who made $30,000 or more per year ($p < 0.001$). HIV prevalence related to living situation was complex. In wave one (2010) HIV prevalence was significantly lower among individuals living with family or friends and not paying rent (2.2%) and being homeless / living in a shelter (22.5%) compared to those owning their homes (53.6%), renting (44.1%), living in hotel or rooming house (37.9%) and in other housing types (45.3%) ($p < 0.001$). In wave two (2013), those who reported being homeless / living in a shelter had the lowest HIV prevalence (23.5%) compared to renters (41.1%), those living in a hotel or rooming house (33.3%) and those reporting other living situations (30.0%) ($p < 0.001$). In wave one (2010) HIV prevalence was 46.0% among individuals reporting other living situations compared to 21.5% among those renting, 29.0% living with family or friends and not paying rent, 24.1% among those reporting living in a hotel or rooming house and 33.2% among those reporting being homeless/ living in a shelter ($p < 0.001$). Individuals who were born outside of the United States had lower HIV prevalence compared to those born in the United States in the first wave (32.6% vs. 42.4%, $p < 0.001$). There was no difference in HIV prevalence by nativity in the second wave. However, in the third wave (2016), those born outside the United States had a higher HIV prevalence (43.6%) compared to those born in the United States (37.6%) ($p = 0.03$). Across all waves, individuals who identified as transwomen had higher HIV prevalence than those who identified as female ($p < 0.05$ in all waves).

Multivariate analysis of HIV infection

Multivariate analysis of HIV infection within each of the three cross-sectional surveys, adjusting for all variables in the model, suggests some consistent and inconsistent patterns. Across all three waves, racial/minority transwomen had significantly higher odds of being

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HIV infected compared to white transwomen (p <0.001). Asian transwomen had AORs for HIV infection of 11.3 (95% CI 4.7, 26.2), 49.3 (95% CI 13.7, 176.1) and 5.8 (95% CI 2.3, 14.3) in 2010, 2013 and 2016, respectively. Black transwomen had AORs for HIV infection of 21.3 (95% CI 11.8, 38.6), 5.8 (95% CI3.6, 9.2) and 9.7 (95% CI 5.5, 17.1) in 2010, 2013 and 2016, respectively. Among Latina transwomen, the AORs for HIV infection were 6.7 (95% CI 3.7, 12.2), 4.9 (95% CI 3.0, 7.9) and 2.9 (95% CI 1.7, 4.9) in 2010, 2013, and 2016, respectively.

The age of those with HIV infection varied across the cross-sectional surveys. In 2010 transwomen aged 26–35 years old (AOR 2.0, 95% CI 1.3, 3.1, p 0.002) and 36–45 years old (AOR 2.2, 95% CI 1.5, 3.2, p <0.001) had at least twice the odds of being HIV infected compared to transwomen 46 years old and older. In 2013 transwomen 18–25 years old (AOR 0.1, 95% CI 0.05, 0.4, p <0.001) and 36–45 years old (AOR 0.6, 95% CI 0.4, 0.9, p 0.03) had lower odds of being HIV infected compared to transwomen 46 years old and older. In 2016 only 18–25 year olds (AOR 0.3, 95% CI 0.2, 0.6, p < 0.001) had lower odds of being HIV infected compared to transwomen ages 46 years old and older.

Across the cross-sectional surveys, transwomen who had some college or college education generally had lower odds of HIV infection compared to those who were high school graduates. In 2010, college graduates had an AOR of 0.2 (95% CI0.06, 0.4, p < 0.001) compared to high school graduates. In 2013 those with some college had an AOR of 0.6 (95% CI 0.4, 0.8, p < 0.001) compared to high school graduates. In 2016, both those with some college (AOR 0.5, 95% CI 0.3, 0.7, p <0.001) and college graduates (AOR 0.09, 95% CI 0.03, 0.3, p <0.001) had lower odds of HIV infection compared to high school graduates.

Income was not associated with HIV infection in the multivariate analysis in any of the cross-sectional surveys. However, there were patterns in term of housing status and HIV infection. In 2010 those living with family, friends or partner (AOR 0.05, 95% CI 0.006, 0.4, p 0.003) and those reporting being homeless or living in a shelter (AOR 0.3, 95% CI 0.2, 0.5, p <0.001) had lower odds of HIV infection compared to those that reported renting. In 2013 those reporting living in a hotel or rooming house (AOR 0.7, 95% CI 0.4, 1.0, p 0.03) and being homeless or living in a shelter (AOR 0.6, 95% CI 0.4, 1.0, p 0.05) had lower odds of HIV infection compared to those reporting renting. In 2016, the only significant finding was that those reporting living in a hotel or rooming house (AOR 0.5, 95% CI 0.3, 0.7, p <0.001) had lower odds of HIV infection compared to renters.

Finally our multivariate model with study year as a covariate found similar patterns in terms of demographic variables as in the individual models and importantly study year was not a significant covariate of HIV infection when adjusting for the included demographics (2013 vs 2010, AOR 1.0, 95% CI 0.8, 1.2, p 0.7; 2016 vs. 2010 AOR 0.9, 85% CI 0.7, 1.1, p 0.2).

Discussion

HIV prevalence among transwomen in San Francisco has remained high and stable at or above one-third living with infection from 2010 to 2016. The proportion of infection that has been diagnosed has remained at or above 90% across this period as well. In comparison,

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men who have sex with men in San Francisco have slightly lower HIV prevalence (24%) and slightly higher proportions diagnosed (97%).(18) Unfortunately there are no contemporaneous community level estimates of HIV infection among transwomen in San Francisco for comparison however data from HIV case reporting in San Francisco suggest stable trends in death among transwomen infected with HIV and slightly declining numbers of new diagnoses.(19) We also observed that older transwomen had significantly higher odds of living with HIV than younger women over the last two waves of data collection. Taken together, these trends suggest that there is declining incidence of new HIV infections among low-income transwomen in San Francisco.

The stability of these trends is notable in that previous research has suggested high HIV incidence in this population.(4) A putative cause of decreasing incidence is unclear. The suppressive effect of treatment in the potential partners of transwomen is a possible explanation, given the overall high level of HIV treatment access in our city. However, data on the partners of transwomen are currently not available. San Francisco was an early adopter of PrEP rollout, another possible cause for reduced HIV acquisition. In our study, over 10% of HIV negative low-income transwomen were estimated to be taking PrEP in 2016. However, our data is insufficient to speculate on the contribution of PrEP to lowering HIV incidence in the population. In an analysis of PrEP uptake Grant et al. (2015) speculated that uptake much higher than 10% of the population would be required to produce notable reductions in new HIV infections.(20)

One particular trend from our studies bears highlighting. The decrease in “renting” and increase in “homeless / shelter” as living situations is disturbing in light of the economic boom that San Francisco is experiencing. Gentrification may be reducing the stock of affordable housing for some of the poorest and most vulnerable San Franciscans. However, being homeless or in a shelter was not associated with HIV infection suggesting that the most vulnerable segment of an already vulnerable population is managing, most likely through assistance programs associated with HIV care, to retain rental housing.

As with any study our study has limitations. Our first limitation is not directly related to the main objective of this study however this point bears considerably on the interpretation of our results. Our studies consistently sampled and estimated that the transwoman population in San Francisco is low-income despite not having any income criteria for seeds or eligibility. Our finding that over 90% of our sample and weighted estimates of income slightly higher suggests that our RDS was only sampling from, and thus we can only generalize to, lower income transwomen in San Francisco. As such we do not have sufficient data on HIV infection and risk among higher income transwomen. Further, efforts are needed to determine if HIV infection also impacts higher income transwomen. Second, we sampled few Asian transwomen despite San Francisco being over 30% Asian in the general population. Migration of transwomen to and from San Francisco to the rest of the country may account for differences from the general population of the city. Additionally, some strata of our variables of interest contained few participants which hampered weighted analysis. Finally, it is possible that some women participated in more than one survey wave and we are unable to distinguish which individuals this may pertain to. Nonetheless, the

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serial cross-sectional survey methods were designed to be independent of each other, and persons were neither excluded or included explicitly based on prior participation.

Despite stability in HIV prevalence among low income transwomen, HIV infection is still the highest in this population compared to any other group in our city – a pattern that is evident in much of the world.(21) Moreover, among low-income transwomen, HIV disproportionately affects transwomen of color. Programs must continue to work to provide appropriate care and treatment to this segment of the population and address the challenging needs for stable housing.

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Table 1.

Crude and RDS-weighted demographic characteristics and HIV infection among transwomen with low income, San Francisco, 2010–2106

	2010				2013				2016				
	Crude (n= 314)		Weighted		Crude (n = 233)		Weighted		Crude (n = 318)		Weighted		P for trend
	n	%	%	95% CI	N	%	%	95% CI	n	%	%	95% CI	
Race / Ethnicity													
Asian	21	6.7	6.0	2.9, 9.1	5	2.2	2.9	0, 6.1	9	2.8	3.3	0.9, 5.8	0.3
Black	88	28.0	27.2	21.3, 33.1	65	29.7	29.3	21.4, 37.3	68	21.4	18.9	13.3, 24.4	0.4
Latina	96	30.6	31.2	25.1, 37.4	77	33.1	26.9	20.1, 33.8	116	36.5	32.9	25.9, 39.8	0.3
White	52	16.6	17.6	12.5, 22.6	43	18.5	24.9	16.8, 33.2	59	18.6	26.1	18.5, 33.7	0.1
Other	57	18.2	17.9	12.9, 22.9	43	18.5	15.9	9.9, 21.8	66	20.8	18.9	13.6, 24.1	0.8
Age													
18–25	31	9.9	9.2	5.5, 12.9	17	7.3	7.1	2.7, 11.4	31	9.8	12.3	6.7, 17.9	0.4
26–35	56	17.8	18.3	12.9, 23.6	26	11.2	14.3	7.9, 20.7	65	20.4	20.6	14.8, 26.5	0.4
36–45	105	33.4	32.3	26.2, 38.3	59	25.3	25.1	17.5, 32.8	75	23.6	21.9	15.9, 27.8	0.05
46+	122	38.9	41.2	33.7, 46.7	131	56.2	53.5	44.9, 62.1	147	46.2	45.1	37.6, 52.7	0.1
Education													
Less than HS	84	26.8	30.0	23.1, 36.3	67	28.8	28.7	21.1, 36.4	90	28.3	21.9	16.6, 27.3	0.1
HS	82	26.1	27.6	21.5, 33.7	71	30.5	32.9	24.7, 41.0	102	32.1	32.9	25.9, 40.0	0.4
Some college	116	36.9	34.4	28.3, 40.5	72	30.9	29.0	21.3, 36.7	99	31.1	34.2	26.7, 41.6	0.5
College grad.	23	7.3	5.5	3.0, 7.9	16	6.9	6.9	2.2, 11.7	18	5.7	5.4	2.5, 8.4	0.9
Post-grad.	9	2.9	2.5	0.6, 4.3	2	3.0	2.4	0.1, 4.8	9	2.8	5.4	1.0, 10.3	0.5
Income (yearly)													
<$30,000	295	93.5	95.2	92.5, 97.9	213	91.4	92.3	87.4, 97.2	289	90.9	91.0	86.4, 95.6	0.2
$30,000+	19	6.1	4.8	2.0, 7.5	19	8.2	7.7	2.8, 12.6	29	9.1	9.0	4.4, 13.6	0.3
Living situation													
Own	3	1.0	1.1	0, 2.4	4	1.7	1.0	0, 2.1	1	0.3	0.1	0, 0.4	0.05
Rent	175	55.7	56.1	49.5, 62.6	116	49.8	51.4	42.8, 59.9	100	31.5	32.0	24.9, 39.0	<0.001
Live with family, friends or partner without paying rent	8	2.6	4.7	1.0, 8.5	9	3.9	4.3	0.6, 7.9	13	4.1	3.0	1.0, 5.2	0.7

Sex Transm Dis. Author manuscript; available in PMC 2020 February 01.

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	2010				2013				2016				
	Crude (n= 314)		Weighted		Crude (n = 233)		Weighted		Crude (n = 318)		Weighted		P for trend
	n	%	%	95% CI	N	%	%	95% CI	n	%	%	95% CI	
Hotel or rooming house	82	26.1	25.4	19.9, 30.8	60	25.8	23.7	16.7, 30.6	95	29.9	31.5	24.4, 38.7	0.3
Homeless / shelter	29	9.2	8.9	4.9, 12.8	34	14.6	16.1	9.9, 22.4	75	23.6	23.5	16.9, 29.9	<0.001
Other	17	5.4	3.9	1.9, 6.0	10	4.3	3.6	1.1, 6.1	34	10.7	9.8	5.9, 13.8	0.02
Born in US													
Yes	222	70.7	71.3	65.4, 77.2	182	78.1	78.8	72.0, 85.6	238	74.8	77.4	71.5, 83.4	0.2
No	92	29.3	28.7	22.9, 34.6	51	21.9	21.2	14.4, 27.9	80	25.2	22.6	16.6, 28.5	0.2
Current Gender identity													
Male	0	0	0	-	0	0	0	-	0	0	0	-	-
Female	150	47.8	48.1	41.5, 54.8	102	43.8	48.2	39.6, 56.6	143	44.9	47.8	40.2, 55.3	1.0
Transwoman	164	52.2	51.9	45.2, 58.5	123	52.8	47.2	38.7, 55.7	159	50.0	45.7	38.2, 53.1	0.4
Other	0	0	0	-	8	3.4	4.6	0.7, 8.4	16	5.0	6.6	1.7, 11.4	0.5
PrEP use past 12 m	-	-	-	-	0	-	-	-	23	11.9	10.7	4.6, 16.8	na
HIV-Positive, tested	123	39.2	38.8	32.4, 45.2	84	36.1	33.7	25.9, 41.5	123	38.6	31.6	12.2, 38.1	0.5
Previously diagnosed	112	91.1	91.7	86.4, 96.8	73	86.9	83.5	72.2, 94.9	110	89.4	92.1	87.2, 97.0	0.4

HS = high school; PrEP = pre-exposure prophylaxis

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Table 2.

RDS weighted associations with HIV infection among transwomen with low income, San Francisco, 2010–2106

	2010 Weighted			2013 Weighted			2016 Weighted		
	%	95% CI	χ^2, p	%	95% CI	χ^2, p	%	95% CI	χ^2, p
Race / Ethnicity			162.0, <0.001			104.3, <0.001			130.8, <0.001
Asian	34.4	9.7, 59.1		82.9	37.2, 100		54.6	8.9, 100	
Black	65.8	53.8, 77.8		43.1	27.2, 59.1		57.1	40.2, 74.0	
Latina	39.2	27.4, 51.1		38.8	25.2, 52.4		34.5	23.1, 45.9	
White	10.4	1.2, 19.5		14.8	0.6, 29.0		8.3	1.8, 14.9	
Other	26.3	13.2, 29.4		28.6	12.1, 45.0		28.9	15.3, 42.7	
Age			35.0, <0.001			32.7, <0.001			16.1, 0.001
18–25	23.8	6.5, 41.1		4.2	0, 13.4		17.8	0.1, 34.5	
26–35	46.4	29.4, 63.3		25.8	5.2, 46.4		29.6	15.0, 44.1	
36–45	46.7	35.7, 57.8		35.0	18.3, 51.7		36.9	22.9, 50.9	
46+	32.4	22.5, 42.4		38.7	27.9, 49.5		34.0	24.3, 43.8	
Education			20.8, <0.001			25.9, <0.001			73.7, <0.001
Less than HS	44.5	31.6, 57.3		40.2	24.9, 55.5		44.4	31.7, 57.2	
HS	38.7	26.2, 51.2		38.7	23.9, 53.3		39.4	27.2, 51.6	
Some college	38.9	28.3, 49.7		27.9	14.3, 41.4		24.8	14.4, 35.2	
College grad.	16.4	0, 33.4		19.5	0, 45.6		6.8	0, 17.3	
Post-grad.	17.9	0, 44.4		-	-		-	-	
Income (yearly)			0.15, 0.7			18.2, <0.001			0.008, 0.9
<$30,000	39.1	32.5, 45.7		35.6	27.4, 43.8		31.7	24.9, 38.4	
$30,000+	32.8	0, 69.3		11.7	0, 32.9		31.2	7.8, 54.7	
Living situation			43.6, <0.001			21.3, <0.001			19.6, <0.001
Own	53.6	0, 100		-	-		-	-	
Rent	44.1	35.2, 52.9		41.1	28.9, 53.1		33.2	21.5, 44.8	
Live with family, friends or partner without paying rent	2.2	0, 8.2		-	-		29.0	0, 60.9	
Hotel or rooming house	37.9	26.1, 49.7		32.5	17.6, 47.4		24.1	14.0, 34.1	

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	2010			2013			2016		
		Weighted			Weighted			Weighted	
	%	95% CI	χ^2, p	%	95% CI	χ^2, p	%	95% CI	χ^2, p
Homeless / shelter	22.5	0, 745.8		26.2	7.6, 44.7		33.2	19.2, 47.2	
Other	45.3	16.2, 74.5		19.1	0, 46.6		46.9	25.1, 68.8	
Born in US			15.1, <0.001			0.13, 0.7			4.5, 0.03
Yes	42.4	34.5, 50.3		30.3	21.8, 38.8		29.9	22.7, 37.2	
No	29.8	19.4, 40.2		46.4	28.2, 64.6		37.6	23.7, 51.5	
Current gender identity			37.5, <0.001			6.3, 0.04			52.1, <0.001
Female	28.3	20.0, 36.7		22.0	12.9, 31.2		23.1	14.8, 31.3	
Transwoman	48.5	39.4, 57.6		41.2	29.7, 52.7		43.1	33.1, 53.3	
Other	-	-		79.0	38.1, 100		14.9	0, 32.2	

HS = high school

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Sex Transm Dis. Author manuscript; available in PMC 2020 February 01.

Table 3.

Correlates of HIV infection among transwomen with low income within each round of TEACH, San Francisco, 2010–2016 (weighted for RDS design, adjusted for other variables in the models).

	2010			2013			2016		
	AOR	**95% CI**	**p**	**AOR**	**95% CI**	**p**	**AOR**	**95% CI**	**p**
Race / Ethnicity									
	11.3	4.7, 26.2	<0.001	49.3	13.7,	<0.001	5.8	2.3, 14.3	<0.001
Asian					176.1				
Black	21.3	11.8, 38.6	<0.001	5.8	3.6, 9.2	<0.001	9.7	5.5, 17.1	<0.001
Latina	6.7	3.7, 12.2	<0.001	4.9	3.0, 7.9	<0.001	2.9	1.7, 4.9	<0.001
White	Ref	-	-	-	-		-	-	-
Other	4.5	2.4, 8.4	<0.001	3.3	1.9, 5.7	<0.001	2.7	1.5, 4.8	0.001
Age									
18–25	0.8	0.4, 1.5	0.5	0.1	0.05, 0.4	<0.001	0.3	0.2, 0.6	<0.001
26–35	2.0	1.3, 3.1	0.002	0.6	0.3, 1.0	0.3	0.7	0.5, 1.1	0.1
36–45	2.2	1.5, 3.2	<0.001	0.6	0.4, 0.9	0.03	1.2	0.8, 1.7	0.4
46+	Ref	-	-	-	-	-	-	-	-
Education									
Less than HS	0.8	0.6, 1.2	0.3	0.9	0.6, 1.3	0.6	1.0	0.7, 1.5	0.8
HS	Ref	-	-	-	-	-	-	-	-
Some college	0.8	0.5, 1.2	0.3	0.6	0.4, 0.8	0.004	0.5	0.3, 0.7	<0.001
College grad.	0.2	0.06, 0.4	<0.001	0.9	0.3, 2.6	1.0	0.09	0.03, 0.3	<0.001
Post-grad.	0.4	0.1, 1.5	0.2	-	-	-	-	-	-
Income (yearly)									
<$30,000	0.9	0.4, 2.1	0.9	0.2	0.07, 0.7	0.009	1.6	0.9, 2.9	0.2
$30,000+	Ref	-	-	-	-	-	-	-	-
Living situation									
Own	1.7	0.2, 15.0	0.6	-	-	1.0	-	-	-
Rent	Ref	-	-	-	-	-	-	-	-
Live with family, friends or partner without paying rent	0.05	0.006, 0.4	0.003	-	-	1.0	0.6	0.2, 1.3	0.2

	2010			2013			2016		
	AOR	**95% CI**	**p**	**AOR**	**95% CI**	**p**	**AOR**	**95% CI**	**p**
Hotel or rooming house	0.7	0.5, 1.0	0.4	0.7	0.4, 1.0	0.03	0.5	0.3, 0.7	<0.001
Homeless / shelter	0.3	0.2, 0.5	<0.001	0.6	0.4, 1.0	0.05	0.7	0.5, 1.1	0.2
Other	1.6	0.8, 3.5	0.2	0.3	0.1, 0.9	0.02	1.5	0.9, 2.5	0.1

HS = high school; PrEP = pre-exposure prophylaxis

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Table 4.

Correlates of HIV infection among transwomen with low income across three rounds of TEACH, San Francisco, 2010–2016 (weighted for RDS design, adjusted for other variables in the models).

	AOR	95% CI	p
Race / Ethnicity			
Asian	10.5	6.5, 16.9	<0.001
Black	10.7	7.9, 14.4	<0.001
Latina	4.6	3.4, 6.2	<0.001
White	Ref	-	-
Other	3.6	2.6, 4.9	<0.001
Age			
18–25	0.4	0.3, 0.5	<0.001
26–35	0.9	0.7, 1.2	0.6
36–45	1.2	1.0, 1.5	0.1
46+	Ref	-	-
Education			
Less than HS	1.0	0.7, 1.1	0.4
HS	Ref	-	-
Some college	0.6	0.5, 0.8	<0.001
College grad.	0.2	0.1, 0.4	<0.001
Post-grad.	0.1	0.04, 0.3	<0.001
Income (yearly)			
<$30,000	1.1	0.7, 1.6	0.7
$30,000+	Ref	-	-
Living situation			
Own	1.1	0.3, 3.7	0.9
Rent	Ref	-	-
Live with family, friends or partner without paying rent	0.1	0.1, 0.2	<0.001
Hotel or rooming house	0.6	0.5, 0.8	<0.001
Homeless / shelter	0.5	0.4, 0.7	<0.001
Other	1.0	0.7, 1.4	0.9
Round of study			
2010	Ref	-	-
2013	0.96	0.8, 1.2	0.7
2016	0.88	0.7, 1.1	0.2

*HS= High School