Improved PrEP Awareness and Use among Trans Women in San Francisco, California

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Abstract
Transgender women face a serious risk of HIV infection. Despite this, there is limited knowledge and use of Pre-exposure prophylaxis (PrEP). We measured the continuity of prevention across services in the PrEP cascade and correlates of PrEP use among trans women in San Francisco enrolled in the 2019/20 National HIV Behavioral Surveillance Study. Knowledge and use of PrEP among trans women in San Francisco increased in recent years; almost all (94.0%) had heard about PrEP, 64.7% had discussed PrEP with a healthcare provider, and 44.8% had taken PrEP in the past 12 months. PrEP use was associated with participation in a PrEP demonstration project (aOR = 31.44, p = 0.001) and condomless receptive anal intercourse (aOR = 3.63, p = 0.024). Injection drug use was negatively associated (aOR = 0.19, p = 0.014). Efforts are needed to combat the gender-based stigma and discrimination faced by trans women, which can result in avoidance and mistrust of the medical system.

Keywords Transgender women · Pre-exposure prophylaxis · PrEP · HIV · PrEP cascade

Introduction
Transgender women (henceforth abbreviated as trans women) face a substantial and continued risk for HIV infection that has been well documented around the world [1–4]. This is particularly concerning during a period in the United States when national efforts to reduce incident HIV infections and “End the Epidemic” have been intensified and successful in many areas. For example, in San Francisco, a city that has embarked on an aggressive and increasingly successful HIV prevention campaign to ‘Get to Zero’ [5, 6], new HIV diagnoses have fallen dramatically in recent years.
methods such as PrEP [24, 25]. Prevalence as well as barriers to and trust in HIV prevention of discrimination and oppression results in both high HIVism, homophobia and transphobia [11] This intersectionality trans women of color is highly affected by the intersection in the United States are among Black trans women [23]. The risk of HIV infection for Black trans women and other trans women of color is highly affected by the intersection of discrimination and stigma they face due to sexism, racism, homophobia and transphobia [11] This intersectionality of discrimination and oppression results in both high HIV prevalence as well as barriers to and trust in HIV prevention methods such as PrEP [24, 25].

In 2019, for the first time, trans women were included in the Centers for Disease Control and Prevention National HIV Behavioral Surveillance Study (NHBS) in San Francisco. NHBS has cyclically surveyed MSM, people who inject drugs, and high risk heterosexuals since 2003. We conducted a secondary analysis of the first NHBS wave for trans women using data from the PrEP-eligible participants to ascertain engagement in the PrEP cascade and to examine if engagement has improved among trans women in recent years. Additionally, we examined risks for HIV and correlates of PrEP to identify barriers to optimal PrEP access and adherence and to identify potential intervention strategies.

Methods

This is a secondary analysis of data from the first cycle of the National HIV Behavioral Surveillance (NHBS) conducted for trans women in San Francisco from July 2019 to February 2020. For this analysis on PrEP engagement, participants known to have HIV were excluded as they are no longer PrEP-eligible.

Respondent-driven sampling (RDS) was used to obtain a diverse, community-based sample of trans women. Fifteen trans women, diverse with respect to demographic characteristics, were enlisted to recruit their peers. These initial 15 “seeds” were instructed to refer to other eligible trans women, namely 18 years of age or older, resident of San Francisco, and identifying as a trans woman (i.e., as a woman and gender other than male as assigned at birth). Eligible recruits completed an interviewer-administered questionnaire, provided blood specimens for HCV and HIV antibody and HIV viral load testing, and in turn, were asked to refer up to 10 other trans women to the study. Participants received $100 for completing the study activities and an additional $25 for each eligible peer referral enrolled into the study. Recruitment continued until the sample size (N = 201) was met and the composition of the sample stabilized with respect to demographic characteristics.

Measurements

In addition to being asked if they were previously diagnosed with HIV, participants were tested with the Oraquick® HIV Rapid Antibody Test (OraSure Technologies, Bethlehem, PA) to detect HIV antibodies.

An interviewer-administered survey included questions on demographic characteristics, substance use, risk behaviors, and indicators of PrEP engagement. An interviewer-administered survey included questions on demographic characteristics, substance use, risk behaviors, and indicators of PrEP engagement. Participants were asked to report use of any drugs that were not prescribed to them in the
past 12 months (dichotomized as using or not using mari-
juana, methamphetamine, crack cocaine, powder cocaine,
downers, painkillers, heroin, poppers, or something else
and injected or not injected). Survival or exchange sex was
assessed by asking participants if they had received money
or drugs in exchange for sex in the past 12 months. Sexual
behavior was ascertained by asking if participants had had
receptive anal, insertive anal, and vaginal sex in the past
12 months as well as asking participants about each of
these behaviors with their three last sexual partners. For
each of these partners, participants were asked “What was
your partner’s HIV status?” and whether or not a condom
was used for each sexual behavior.

Hormone use was categorized as “yes” for those who
reported currently being on any hormones, which could
have included non-prescribed hormones. Participants were
also asked if they had enrolled in a demonstration project
implemented during the study period in San Francisco
to improve PrEP uptake and adherence specifically with
trans populations. PrEP engagement (the PrEP cascade)
cluded awareness of PrEP, discussing PrEP use with a
medical provider, PrEP use, and adherence and persistence
in using PrEP. To measure awareness, participants were
asked “Before today, have you ever heard of PrEP?” Dis-
“ussion with a provider was ascertained by asking “In the
past 12 months, have you had a discussion with a health
care provider about taking PrEP?” PrEP use was deter-
“mined from the question “In the past 12 months, have
you taken PrEP to reduce the risk of getting HIV?” To
determine adherence, participants were asked “When you
took PrEP in the past 12 months, did you take it every
day, almost every day, or less often?” Participants who
answered every day or almost every day were classified as
highly adherent. Finally, to determine persistence, partici-
pants were asked “Did you take PrEP for at least 2 months
in a row?”.

**Statistical Analysis**

Descriptive statistics (i.e., frequencies and proportions)
were used to summarize demographic characteristics (e.g.,
age, race/ethnicity, education) and PrEP engagement indi-
cators. Bivariate logistic regression models were used to
find correlations between participant characteristics and
each step along the PrEP cascade, using p < 0.05 as the
level for significance. Condomless intercourse (insertive or
receptive vaginal or anal) was collapsed so that responses
of “No” and “Not applicable” were in the same category
as they both are risk-reduction practices. A multivariable
model was built with correlations that were associated
with PrEP use at the bivariate p < 0.05 level. Observations
that were co-linear were removed and the observation with
a lower p-value in the model were retained. In addition, we
controlled for age, race/ethnicity, and education.

**Ethical Considerations**

Participants who tested positive for HIV, HCV, or other STIs
were provided counseling and resources for linkage to appro-
priate care and treatment. The study protocol was reviewed
and approved by the Institutional Review Board (IRB) at
the University of California, San Francisco (UCSF) (#17-
24062). All participants provided written informed consent.

**Results**

**Participant Characteristics**

Overall, 201 trans women participated in the study. Partici-
pants who were living with HIV were excluded (n = 85) and
the remaining 116 participants without HIV infection, and
therefore PrEP-eligible, were included in this secondary
analysis. Of these, the mean age was 47.7 years (median
43, interquartile range [IQR] 32–52) (Table 1). Participants
were diverse with respect to race/ethnicity; 42.2% identi-
fied as Hispanic/Latinx, 23.3% identified as other, 22.4%
identified as White, and 12.1% identified as Black/African
American. For gender, the majority (68.3%) identified as a
trans woman, while 13.5% identified as woman, and 18.3%
had another identity. In terms of education, 49.1% had a high
school education/GED or less, 17.2% had some college or
a technical degree, and 33.6% completed a college degree
or more. Most participants (56.0%) were living at or below
the San Francisco poverty level, 73.3% were unemployed
at the time of this survey, 70.7% were unstably housed or
homeless.

**HIV-Related Risk Factors**

Only 3.4% of participants had a sexual partner living with
HIV (Table 1). Participants reported an average 18.8 sexual
partners (median 4, IQR 1–7). Additionally, 38.8% of partic-
ips engaged in exchange sex in the last year. Over half of
participants (52.6%) engaged in condomless receptive anal
sex in the past year, while 20.7% engaged in condomless
insertive anal sex, and 6.0% engaged in condomless recep-
tive vaginal sex. Ten participants (8.6%) reported injection
drug use in the last 12 months.

**PrEP Indicators**

Almost all (94.0%) participants had heard of PrEP (Fig. 1).
Seventy-five (64.7%) reported discussing PrEP with a
healthcare provider during a healthcare appointment.
Fifty-two (44.8%) participants reported taking PrEP in the last 12 months and 45 (38.8%) reported taking it for more than two months at a time. Fifty (43.1%) of those who had taken PrEP reported taking it every single day or nearly every single day, indicating a high adherence to PrEP.

Demographic and Behavioral Correlates of PrEP Indicators

Increased awareness of PrEP was associated with seeing PrEP advertisements (OR 4.64, 95% CI 1.26–17.16, p = 0.021) and hormone use (OR 7.98, 95% CI 1.46–43.59, p = 0.017) (Table 2). Lower odds were found for those seropositive for HCV antibodies (OR 0.19, 95% CI 0.039–0.97, p = 0.046). Discussing PrEP with a healthcare provider was significantly associated with receiving healthcare in a clinic that offers PrEP (OR 10.5, 95% CI 2.97–37.04, p = 0.001) and participation in the STAY study (OR = 10.5, 95% CI: 2.97–37.04, p = 0.001), a PrEP demonstration project implemented in San Francisco during the time of this study. Having taken PrEP in the last twelve months was significantly associated with having at least one sexual partner who was on PrEP (OR 6.00, 95% CI 1.15–31.2, p = 0.033), being currently insured (OR 3.86, 95% CI 1.50–9.90, p = 0.005), and engaged in condomless receptive anal sex in the last twelve months (OR 2.23, 95% CI 1.05–4.73, p = 0.036). PrEP use was also associated with having participated in the PrEP demonstration project (OR = 26.05, 95% CI: 8.17–83.01, p = 0.001). Lower odds of PrEP use in the last 12 months was associated with injection drug use (OR 0.25 95% CI 0.09–0.73, p = 0.011) and being HCV seropositive (OR 0.22 95% CI 0.059–0.81, p = 0.023). Correlates with adherence were not found due to the small number of observations.

Multivariable Model

OraQuick HCV antibody test was dropped from the analysis because of its collinearity with a history of injection drug use. Among characteristics that were collinear with one
another, we retained the characteristic that had the lower p-value at the bivariate level in the multivariable model. Participating in the PrEP demonstration project for trans people was also removed in order to improve the goodness of fit of the model. After controlling for age, race/ethnicity, and education, PrEP use in the last 12 months was positively associated with having participated in the PrEP demonstration project (aOR = 31.44, 95% CI = 7.86–125.78, p = 0.001) and having condomless receptive anal intercourse (aOR = 3.63, 95% CI = 1.18–11.13, p = 0.024) (Table 2). Having a history of injection drug use was negatively associated with PrEP use in the last 12 months (aOR = 0.15, 95% CI = 0.03–0.82, p = 0.029).

**Discussion**

Nearly all trans women participating in the 2019/20 NHBS study of trans women in San Francisco reported being aware of PrEP and nearly half had used PrEP in the last 12 months. These data show substantial increases along all indicators on the PrEP cascade compared to recent findings in previous surveys of trans women in San Francisco. For example, among trans women enrolled in another study in the San Francisco Bay Area from 2016 to 2018, 79% were aware of PrEP and only 14.7% reported using PrEP [20].

Our findings also point to sexual risk behavior as a strong facilitator of PrEP use. Trans women who engaged in condomless receptive anal sex were most likely to have been on PrEP in the last 12 months, speaking to the high self-efficacy trans women have for caring for their own sexual health. Further, being part of a PrEP demonstration project (the STAY study), which focused on making PrEP assessable to trans communities was positively associated with having taken PrEP in the last 12 months. Working to get trans women in culturally-relevant primary care services and meeting their PrEP-specific needs outside primary care, as was done in the demonstration project, can increase their use of PrEP.

Previous research has found that significant racial/ethnic disparities exist in PrEP knowledge and use [26–28] particularly among Black/African Americans and the Latinx community and that these disparities are pronounced among trans women [20]. Black trans women made up 15% of the STAY study population, and, in this study, 11% of the participants who reported they were also a STAY study participant were Black (data not shown). It is encouraging that these results and improvements along the PrEP cascade were observed across all racial groups in a diverse sample of trans women where over three-quarters were people of color.

Despite the encouraging findings regarding PrEP engagement, trans women in our analysis who injected drugs in the last year were significantly less likely to be engaged in PrEP. This finding is consistent with data from San Francisco showing very low engagement in PrEP among people who inject drugs [29]. Trans women in our
analysis also reported significant socio-economic barriers and high risk for HIV. High rates of condomless sex, sex work, and injection drug use were documented. Furthermore, over half of this population were at or below the San Francisco poverty level, had ever been incarcerated, nearly three quarters were unstably housed, and educational attainment and employment were low. Each of these social determinants of health have been previously shown to be associated with HIV infection, barriers to HIV treatment, and lower use of effective prevention strategies including PrEP [7, 30–32].

Our study is subject to a number of limitations. First, RDS may not produce representative samples of trans women. While RDS is a strategy purported to reach otherwise hard-to-reach participants, the majority of our participants reported an annual income below the poverty level.

### Table 2: Associations with PrEP indicators, trans women, National HIV Behavioral Surveillance (NHBS), San Francisco, CA, 2019 (N = 116)

| Predictor variables | Aware of PrEP OR (95% CI), p-value | Discussed PrEP with provider OR (95% CI), p-value | Took PrEP in last 12 months OR (95% CI), p-value | Took PrEP in last 12 months Adjusted OR (95% CI) |
|---------------------|-----------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Age                 | 0.93 (0.87–0.99), 0.038           | 0.96 (0.93–0.99), 0.020                       | 0.96 (0.94–0.99), 0.025                       | 0.97 (0.92–1.01), 0.167                      |
| Race/ethnicity      |                                   |                                               |                                               |                                               |
| White               | Reference                         | Reference                                     | Reference                                     | Reference                                     |
| Black/African American | 0.52 (0.03–9.00), 0.653           | 0.40 (0.09–1.62), 0.199                       | 0.65 (0.17–2.47), 0.525                       | 0.56 (0.07–4.42), 0.583                      |
| Hispanic/Latinx     | 0.45 (0.48–4.25), 0.486           | 0.44 (0.15–1.28), 0.129                       | 0.80 (0.31–2.10), 0.657                       | 0.76 (0.17–3.44), 0.721                      |
| Mixed/other         | 1.04 (0.06–17.55), 0.978          | 6.00 (0.18–2.02), 0.409                       | 1.46 (0.49–4.30), 0.494                       | 0.97 (0.18–5.11), 0.972                      |
| Education           |                                   |                                               |                                               |                                               |
| Up to high school   | Reference                         | Reference                                     | Reference                                     | Reference                                     |
| College level       | 0.66 (0.13–3.49), 0.631           | 1.00 (0.42–2.37), 0.99                        | 0.86 (0.38–1.95), 0.715                       | 0.36 (0.10–1.31), 0.121                      |
| Bachelors or higher | 1.05 (0.10–10.77), 0.964          | 0.61 (0.21–1.72), 0.353                       | 0.74 (2.63–2.08), 0.570                       | 0.47 (0.10–2.13), 0.325                      |
| Saw PrEP advertisements | 4.64 (1.26–17.16), 0.021        | 1.19 (0.85–1.67), 0.295                       | 1.38 (0.99–1.92), 0.051                       |                                               |
| Used post-exposure prophylaxis | 1.35 (0.15–11.83), 0.787 | 1.95 (0.65–5.78), 0.227                       | 1.83 (0.71–4.77), 0.214                       |                                               |
| At least one sexual partner who was on PrEP Omitted2 | 6.00 (1.15–31.2), 0.033 | ![Image](Image) |
| Currently on hormones | 7.98 (1.46–43.59), 0.017      | 3.73 (1.58–8.81), 0.003                       | 3.86 (1.50–9.91), 0.005                       | 1.89 (0.53–6.75), 0.329                      |
| Currently has health insurance | 1.34 (0.15–12.16), 0.791 | 2.37 (0.74–7.59), 0.147                       | 3.86 (1.50–9.90), 0.005                       | 0.83 (0.14–4.71), 0.829                      |
| Participated in PrEP demonstration project for trans people in SF Omitted2 | 10.5 (2.97–37.04), 0.001 | 26.05 (8.17–83.01), 0.001                      | 31.44 (7.86–125.78), 0.001                     |
| Received healthcare in last year at a clinic where PrEP is offered | 1.13 (0.21–6.15), 0.889 | 10.5 (2.97–37.04), 0.001                      | 1.34 (0.41–4.38), 0.625                       |                                               |
| Injection drug use, last 12 months | 0.31 (0.066–1.53), 0.153 | 0.88 (0.35–2.25), 0.804                       | 0.25 (0.09–0.73), 0.011                       | 0.15 (0.03–0.82), 0.029                      |
| HCV seropositive | 0.19 (0.039–0.97), 0.046          | 1.00 (0.34–2.94), 0.996                       | 0.22 (0.059–0.81), 0.0233                     |                                               |
| Arrested or held    | 0.1 (0.0098–1.05), 0.055          | 1.36 (0.63–2.94), 0.423                       | 0.7 (0.33–1.47), 0.347                       |                                               |
| Condomless receptive intercourse Omitted2 | 1.01 (0.31–3.22), 0.984 | 1.93 (0.67–5.56), 0.225                       |                                               |                                               |
| Condomless receptive anal sex | 0.82 (0.17–3.84), 0.804 | 2.00 (0.93–4.33), 0.078                       | 2.23 (1.05–4.73), 0.036                       | 3.63 (1.18–11.13), 0.024                      |
| Condomless receptive vaginal sex Omitted2 | 0.71 (0.15–3.36), 0.669 | 0.92 (0.19–4.3), 0.914                       |                                               |                                               |
| Condomless insertive anal sex | 0.632 (0.11–3.49), 0.598 | 0.71 (0.15–3.36), 0.669                       | 1.30 (0.52–3.19), 0.568                       |                                               |
| Condomless insertive vaginal sex | 0.54 (0.058–4.99), 0.587 | 1.30 (0.32–5.33), 0.712                       | 1.96 (0.52–7.34), 0.320                       |                                               |

1 Highlighted values were significant at the p ≤ 0.05 level
2 Omitted due to small sample size or perfect match between outcome and predictor variables
3 HCV seropositivity not included in final adjusted model due to collinearity with injection drug use
This has been the case with other local surveys of trans women that have used RDS [4, 33]. RDS that relies on peer referrals that are incentivized with cash stipends can lead to recruitment from social networks of lower SES [34, 35]. As such, results from our study may not be generalizable to trans women with higher incomes in San Francisco or elsewhere. Second, programs, policies, and resources available to trans women in San Francisco, including PrEP outreach, may also limit the generalizability of our findings to other locations. San Francisco has actively promoted PrEP as part of its “Getting to Zero HIV” campaign and therefore awareness may be higher in our city compared to elsewhere. Third, this was an interviewer-administered survey and may be subject to social desirability bias. However, this limitation may be mitigated by the use of well-trained, skilled and experienced interviewers who have an established rapport with the study population as utilized in this NHBS cycle. Finally, we were unable to stratify our sample to examine correlations within important sub-groups due to a limited sample size.

Conclusion

Knowledge of and uptake of PrEP among trans women in San Francisco has dramatically increased in the last few years. Trans women in San Francisco may have benefited from the overall citywide push to roll out PrEP in recent years. PrEP availability and access is one of the priority goals of the SF Getting to Zero effort, and trans women, a population recognized as being previously underserved, have been prioritized for media campaigns and outreach in recent years [5, 20] and specific efforts tailored to the trans community have been implemented. Sustainability of such efforts may help maintain high engagement in PrEP, especially those that build upon trans women’s resiliency to meet their own sexual health and gender affirming care needs. Despite some encouraging findings, efforts must continue to address the barriers to PrEP access and use, especially among trans women who also inject drugs. Furthermore, efforts to address significant specific gender-based stigma and discrimination faced by trans women, which results in health care avoidance and distrust are needed. An area of further research is the engagement in PrEP of the partners of trans women who are likely at high risk for HIV given the extremely prevalence among trans women in San Francisco and other cities [36]. To reach optimal PrEP uptake and ‘get to zero’ for everyone, steps are needed to ensure that particularly vulnerable populations such as trans women and their partners are reached and their specific barriers to PrEP awareness, trust and uptake are addressed.

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Declarations

Conflict of interest

The authors have no conflicts of interest including financial or non-financial.

Ethical Approval

The study protocol was reviewed and approved by the Institutional Review Board (IRB) at the University of California, San Francisco (UCSF) (#17-24062).

Informed Consent

All participants provided written informed consent.

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