Awareness and Interest in HIV Pre-Exposure Prophylaxis Among Street-Based Female Sex Workers: Results from a US Context

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Abstract

Pre-exposure prophylaxis (PrEP) has the potential to be an empowering HIV prevention tool among female sex workers (FSW), yet little is known about PrEP awareness and interest in this population. Sex workers and Police Promoting Health in Risky Environments (SAPPHIRE) is a prospective cohort study of street-based FSW in Baltimore, MD. A cross-sectional analysis explored awareness and interest in PrEP among HIV-negative FSW. Multivariable Poisson regressions modeled associations between individual, interpersonal, and structural variables and PrEP awareness and interest. Of $n = 232$ FSW, 66% were white, half were less than 35 years old, 59% injected drugs daily, and 66% sold sex daily. Only 21% of FSW were aware of PrEP, though 74% were interested. PrEP awareness was associated with experiencing client condom coercion [adjusted incidence rate ratio (aIRR) = 0.50, 95% CI: 0.28–0.90] and condomless sex with an intimate partner (aIRR = 0.54, 95% CI: 0.30–0.98). PrEP interest was associated with perceiving PrEP as “very easy” to take (aIRR = 1.91, 95% CI: 1.49–2.45) and moving to an unfamiliar geographic area to sell sex (aIRR = 1.20, 95% CI: 1.04–1.39). Women who had a current gonorrhea or chlamydia infection were less likely to be interested in PrEP (aIRR = 0.75, 95% CI: 0.59–0.95). Though PrEP awareness among FSW is low, there are FSW who are significantly more likely to express interest in PrEP and outreach efforts should target these women. Results suggest that women-controlled HIV prevention methods may be important for reducing incidence among FSW.

Keywords: pre-exposure prophylaxis, sex work, HIV, prevention, awareness

Introduction

IN THE UNITED STATES, heterosexual women account for about 19% of new HIV infections.¹ Globally, female sex workers (FSW) have an elevated risk of HIV that is 13.5 times that of similarly aged women who do not sell sex. Despite documented high rates of HIV internationally,^{2–4} little research in the United States has focused on HIV among FSW. One large ($n = 8473$) surveillance study of heterosexual women at high risk of HIV infection reported that 16.6% of the sample sold or traded sex in the past year; HIV rates were higher among women who traded sex (3.7%) compared with women who had not traded sex (2.5%).¹

Structural vulnerability theory can help to understand—at least partly—why this HIV disparity may exist for FSW. Structural vulnerabilities exist when an individual or group’s position in society constrains behavior due to conflict with

existing power structures, elevating risk of negative health outcomes, and health disparities at a population level.⁵ The illegal nature of sex work in many countries contributes to sex work stigma and health outcomes that are associated with structural vulnerability, including elevated rates of client violence,⁶ police-related harassment and violence,⁷ and drug use.^{4,8,9} Structural vulnerabilities and their associated negative health outcomes can increase stigma related to sex work, serving as a barrier to HIV testing or treatment.^{10,11} Given the complicated nature of structural vulnerabilities and elevated risk of HIV among FSW, women-controlled HIV prevention methods are critical for FSW.

The development and early success of pre-exposure prophylaxis (PrEP) provides a biomedical opportunity in HIV prevention. To date, there have been 13 PrEP trials that have included women, 4 of which have included and reported data for FSW.^{12–15} Two trials found low effectiveness of PrEP, in

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part reflecting low adherence rates;^{12,15} however, two other studies of PrEP found that it is effective at HIV prevention given adherence.^{13,14} Simulated models from South Africa suggest that the addition of PrEP to current condom distribution and HIV testing and treatment efforts in the country could reduce HIV incidence among FSW and clients by 40%.¹⁶ Recognizing its potential in this population, clinical guidelines from the Centers for Disease Control and Prevention (CDC) list commercial sex work as an indicator for PrEP prescription among heterosexual women.¹⁷ PrEP is a unique innovation that gives FSW control over their HIV risk even in the face of many HIV prevention challenges.

Despite its promise, there is relatively little information about PrEP awareness or interest in the FSW population. Prior studies in China,¹⁸ Kenya,¹⁹ and Mexico²⁰ have found that although awareness of PrEP among FSW is low, interest is high. A study of street-based FSW ($N=60$) awareness and interest of PrEP in Baltimore, MD echoed these findings.²¹ That was, to our knowledge, the only prior study of PrEP attitudes among FSW in the United States, though a study of women accessing care at reproductive health clinics in Baltimore found that a history of selling sex was the most significant factor in PrEP interest.²²

Similarly, studies of PrEP attitudes among people who inject drugs and men who have sex with men (MSM) found that a history of sex work was a key factor associated with PrEP interest.^{23,24} Prior research has also found that experiencing intimate partner violence was an important factor in decreased interest in PrEP among FSW²² but experiencing violence from clients was associated with increased interest.²¹ In qualitative interviews, FSW associated PrEP with feelings of empowerment.²⁵ Research must expand to consider social and behavioral factors that are associated with PrEP use and attitudes among FSW in the United States, given the CDC prescription recommendation and the unique structural vulnerabilities that FSW experience.

Much of the literature on PrEP in the United States focuses on MSM, and it provides insights into awareness and attitudes about PrEP for other HIV high-risk vulnerable populations. Literature has found low awareness of PrEP but high interest among both MSM^{24,26–28} and “high risk” heterosexual women, among whom FSW are included.^{25,29} From qualitative data of “high risk” heterosexual women in six U.S. cities, women expressed frustration at not hearing about PrEP before enrolling in the study given its possibilities as an HIV prevention tool.²⁵ Finally, literature about PrEP awareness and use among MSM shows that access to HIV testing services can be an important context for learning about PrEP.^{24,26–28}

To address the gaps in the literature, this study examines the demographic, behavioral, and interpersonal factors that are associated with awareness and interest in daily oral PrEP (termed hereafter as PrEP) among a cohort of HIV-negative street-based cisgender FSW in Baltimore, MD. These data were collected as part of the Sex workers and Police Promoting Health in Risky Environments (SAPPHIRE) study.

Methods

Study participants

Sampling, recruitment, and participants in the SAPPHIRE study have been described elsewhere in detail.³⁰ Briefly, we used targeted sampling³⁰ to recruit FSW from 15 geographic

areas (termed hereafter as zones) across Baltimore city from April 2016 to January 2017. Eligibility criteria included: (1) age ≥ 15 years; (2) sold or traded oral, vaginal, or anal sex “for money or things like food, drugs or favors”; (3) picked-up clients on the street or at public places ≥ 3 times in the past 3 months; and (4) willingness to undergo HIV and sexually transmitted infection (STI) testing.

Study staff used a mobile van to recruit women in the zones that were identified as having high sex work activity. The survey was administered by an interviewer using a computer-assisted personal interview (CAPI) and lasted about 50 min. Women also provided self-administered vaginal swabs for gonorrhea, chlamydia, and trichomoniasis testing and trained staff conducted an OraQuick[®] Advanced Rapid HIV-1/2 test (Orasure Technologies, Bethlehem, PA). Participants received a \$70 VISA gift card after completing the baseline visit. The study was approved by the Johns Hopkins School of Public Health Institutional Review Board.

Outcomes

After a brief explanation about PrEP, we asked women, “have you heard of HIV PrEP before today?” and “how interested would you be in taking a pill every day to prevent HIV infection?” We recoded answer choices to interested (“very interested” or “somewhat interested”) and not interested (“not very interested” or “not interested at all”) in PrEP.

Independent variables

Demographics, structural vulnerabilities, mental health, and substance use. Demographics included age, race, ethnicity (Hispanic/not Hispanic), and highest education completed. Structural vulnerabilities included recent homelessness (in the past 3 months) and ever being arrested. We assessed PTSD symptoms in the past month by using the PTSD Checklist for DSM-V (PCL-5),³¹ with scores ≥ 33 indicating clinically significant PTSD levels (possible range: 0–80).³¹ We measured depressive symptoms in the past week by using The Revised Center for Epidemiologic Studies Depression 10-item scale (CESD-10),³² with scores ≥ 10 indicating depressive symptoms (possible range: 0–30).³² We also asked about substance use, including: (1) recently injected any drug (past 3 months), (2) injected daily, and (3) recently used injection paraphernalia used by someone else (past 3 months).

Health care. We asked whether women had health insurance and recently (past 3 months) used the following: (1) emergency room, (2) seeing “a doctor or other health care provider outside of an emergency room,” (3) needle exchange, and (4) HIV testing. Using available biological samples, we determined current gonorrhea and/or chlamydia infection. We asked a single question about self-reported ease of taking PrEP: “how easy would it be for you to take a pill each day to prevent HIV infection?” Given the distribution of responses, we collapsed responses into “very easy” and “not very easy” (comprised “somewhat easy,” “somewhat difficult,” and “very difficult”). We categorized self-reported health concern (past 3 months) as “mental health” (the most frequently endorsed category), “HIV or STI,” and “other concern.”

Sex work characteristics. Clients were defined as “people you’ve had oral, vaginal or anal sex with for money, food, drugs or favors.” We assessed: length of time in street-based sex work; where women found clients; and recent (past 3 months): frequency of street-based sex work (daily, weekly but not daily, or monthly); number of clients; and condomless sex with clients (if a condom was not used during every vaginal or anal sex instance with clients).

Response to police practices. We asked whether women behaved in any of the following ways (past 12 months) in response to police in the area of recruitment/sex trade (binary yes/no responses): (1) avoided carrying condoms “because they might get you in trouble with a police officer,” (2) avoided carrying identification, (3) moved to an unfamiliar area to work, and (4) rushed negotiations (i.e., “agreeing on price or checking them out”) with a client.

Clients and intimate partners. Intimate partners were defined as “regular sexual partners” who did not pay for sex. We determined condomless sex with intimate partners in the same way as with clients (see “Sex work characteristics” section). Sexual and physical violence were measured separately by using an adapted version of the Revised Conflict Tactic Scale.³³ If women responded “yes” to any of the questions, we classified them as having experienced physical or sexual violence from that perpetrator. Condom coercion was defined as a partner refusing to use a condom or removing a condom during sex after agreeing to use one; these were asked separately of intimate partners and clients.

Statistical analyses

The analytic sample comprised 232 FSW. The sample excluded participants who were HIV positive ($n=13$), missing HIV test results ($n=1$), or were born intersex ($n=1$). Women who answered “don’t know” ($n=2$) or “not applicable” ($n=1$) were also excluded from analysis. Differences between FSW who (1) heard/did not hear of PrEP; (2) were interested in/not interested in taking PrEP were compared by using Pearson’s chi-square tests for all discrete factors.

Statistical significance was set at $p < 0.05$.

We used Poisson regression with robust variance models to approximate log binomial models to estimate prevalence ratios and 95% confidence intervals. We selected Poisson regression models because they provide better estimates of relative risk for nonrare events (i.e., prevalence $>10\%$) than logistic regression.³⁴ Covariates significant at the $p < 0.20$ level were considered for inclusion in developing the final models. The Akaike information criterion and Bayesian information criterion were considered in selecting the final model. All analyses were conducted in Stata/SE 13.1 (College Station, TX).

Results

Demographic, vulnerability, substance use, and health care covariates

There were no significant bivariate differences between women who were aware of PrEP and women who were not in terms of demographics, structural vulnerabilities, substance use, and health care-related variables (Table 1). Women who

were interested in taking PrEP were more likely to have clinically significant PTSD scores (67% vs. 45%, $p=0.003$), had not recently visited the emergency room (47% vs. 63%, $p=0.03$), and were more likely to report that taking PrEP would be “very easy” than “not very easy” compared with women who were not interested (68% vs. 18%, $p < 0.0001$). Women who expressed PrEP interest tested positive for gonorrhea or chlamydia significantly less than those who did not (30% vs. 16%, $p=0.02$).

Only 21% of women were aware of PrEP, though 74% said they would be interested in taking it. There were no significant differences in PrEP interest between FSW who were aware and those who were unaware of PrEP (69% vs. 76%, $p=0.338$). Regardless of PrEP awareness, women who were interested in PrEP more frequently said it would be “very easy” to take compared with women who were not interested (unaware: 82% vs. 33%, $p < 0.0001$; aware: 82% vs. 27%, $p < 0.0001$).

Sex work, police, and client and partner violence covariates

Women who were not aware of PrEP were more likely to have experienced recent condom coercion from a client (47% vs. 27%, $p < 0.01$) and recently had condomless vaginal or anal sex with an intimate partner (48% vs. 27%, $p=0.001$) compared with those who were aware of PrEP. However, women who were interested in PrEP sold sex more frequently (52% vs. 71%, $p=0.01$), changed their behavior due to police practices [e.g., moved to an unfamiliar area to work (12% vs. 26%, $p=0.01$), avoided carrying condoms (3% vs. 17%, $p=0.01$), and experienced condom coercion from a client (30% vs. 47%, $p=0.02$) compared with women who were not interested in PrEP (Table 2).

Multivariable model: PrEP awareness

We examined correlates of PrEP awareness in unadjusted and adjusted models (Table 3). In unadjusted models, women were less likely to be aware of PrEP if they had experienced condom coercion from clients [incidence rate ratio (IRR)=0.50, 95% CI: 0.29–0.89], had an intimate partner (IRR=0.61, 95% CI: 0.37–1.00), and had condomless sex with an intimate partner (IRR=0.47, 95% CI: 0.26–0.85). In adjusted models, women who experienced condom coercion from clients were half as likely to hear about PrEP compared with women who had not experienced condom coercion [adjusted IRR (aIRR)=0.50, 95% CI: 0.28–0.90], and women who had condomless sex with an intimate partner were also less likely to hear about PrEP than women who did not have condomless sex with an intimate partner (aIRR=0.54, 95% CI: 0.30–0.98).

Multivariable model: interest in PrEP

We also modeled correlates of PrEP interest in unadjusted and adjusted models (Table 4). In unadjusted models, women were more likely to report interest in taking PrEP if they: had clinically significant PTSD scores (IRR=1.30, 95% CI: 1.08–1.57); reported ease in taking PrEP (IRR=2.05, 95% CI: 1.56–2.69); engaged in sex work daily (IRR=1.26, 95% CI: 1.05–1.52); moved to an unfamiliar area to work (IRR=1.23, 95% CI: 1.06–1.42) or avoided carrying condoms in response to police practices (IRR=1.32, 95% CI:

TABLE 1. AWARENESS OF AND INTEREST IN PRE-EXPOSURE PROPHYLAXIS (PrEP) BY DEMOGRAPHICS AND STRUCTURAL VULNERABILITIES, SUBSTANCE USE, AND HEALTH CARE AMONG FEMALE SEX WORKERS IN BALTIMORE, MD (N=232)

		PrEP awareness			Interested in taking PrEP		
	Total (N=232), n (%)	No (n=184), n (%)	Yes (n=48), n (%)	p	No (n=60), n (%)	Yes (n=172), n (%)	p
<i>Demographics and structural vulnerabilities</i>							
Age (<35)	117 (50.4)	89 (48.4)	28 (58.3)	0.22	31 (51.7)	86 (50.0)	0.82
Race/ethnicity							
Non-Hispanic white	152 (65.5)	125 (67.9)	27 (56.3)	0.32	41 (68.3)	111 (64.5)	0.71
Non-Hispanic black	54 (23.3)	40 (21.7)	14 (29.2)		14 (23.3)	40 (23.3)	
Hispanic or other	26 (11.2)	19 (10.3)	7 (14.6)		5 (8.3)	21 (12.2)	
Highest education level							
Less than grade 12	121 (52.2)	94 (51.1)	27 (56.3)	0.36	31 (51.7)	90 (52.3)	0.94
Graduated high school or equivalent	62 (26.7)	53 (28.8)	9 (18.8)		17 (28.3)	45 (26.2)	
At least some college	49 (21.1)	37 (20.1)	12 (25.0)				
Homeless, past 3 months	148 (63.8)	114 (62.0)	34 (70.8)	0.25	38 (63.3)	110 (64.0)	0.93
Arrested, past 12 months (n=231)	108 (46.8)	81 (44.0)	27 (57.5)	0.10	28 (46.7)	80 (46.8)	0.99
<i>Mental health</i>							
Clinically significant PTSD score (n=216)	132 (61.1)	110 (63.6)	22 (51.2)	0.14	26 (44.8)	106 (67.1)	0.003
Depression symptoms (n=227)	194 (85.5)	157 (86.7)	37 (80.4)	0.28	46 (80.7)	148 (87.1)	0.24
<i>Substance use</i>							
Daily injection drug use, past 3 months	136 (58.6)	108 (58.7)	28 (58.3)	0.96	33 (55.0)	103 (59.9)	0.51
Shared injection equipment, past 3 months	54 (23.3)	45 (24.5)	9 (18.8)	0.41	11 (18.3)	43 (25)	0.29
“Very Easy” to take PrEP	160 (69.0)	129 (70.1)	31 (64.6)	0.46	19 (31.7)	141 (82.0)	<0.0001
<i>Health care</i>							
Health insurance (n=231)	187 (81.0)	149 (81.4)	38 (79.2)	0.72	50 (83.3)	137 (79.7)	0.59
Emergency room use, past 3 months (n=230)	118 (51.3)	94 (51.4)	24 (51.1)	0.97	38 (63.3)	80 (47.1)	0.03
Used needle exchange, past 3 months	102 (44.0)	79 (42.9)	23 (47.9)	0.54	24 (40.0)	78 (45.4)	0.47
Saw doctor, past 3 months	109 (47.0)	90 (48.9)	19 (39.6)	0.25	31 (51.7)	78 (45.4)	0.40
HIV tested, past 3 months	81 (34.9)	63 (34.2)	18 (37.5)	0.67	24 (40.0)	57 (33.1)	0.34
Positive for gonorrhea or chlamydia (n=222)	45 (11.3)	36 (19.6)	9 (18.8)	0.90	18 (30.0)	27 (15.7)	0.02
Greatest health concern, past 3 months							
Mental health	54 (23.3)	47 (25.5)	7 (14.6)	0.15	20 (33.3)	34 (19.8)	0.09
HIV or STI	45 (19.4)	32 (17.4)	13 (27.1)		9 (15.0)	36 (20.9)	
Other	133 (57.3)	105 (57.1)	28 (58.3)		31 (51.7)	102 (59.3)	

PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection.

Bold values indicate significance at $p < 0.05$ level.

1.17–1.50); and experienced condom coercion with clients (IRR=1.20, 95% CI: 1.03–1.39) or intimate partners (IRR=1.21, 95% CI: 1.02–1.45). Women who had a current chlamydia or gonorrhea infection were less likely to be interested in taking PrEP.

In adjusted models, women who reported that taking PrEP would be “very easy” were nearly two times more likely to be interested in PrEP (aIRR=1.91, 95% CI: 1.49–2.45), had clinically significant PTSD scores (aIRR=1.17, 95% CI: 1.00–1.38), and moved to an unfamiliar area to work due to police interactions (aIRR=1.20, 95% CI: 1.04–1.39) and were also more likely to be interested in PrEP; whereas women who had a current gonorrhea or chlamydia infection

were less likely to be interested in PrEP (aIRR=0.75, 95% CI: 0.59–0.95).

Discussion

This is one of the first studies of awareness and interest in PrEP among FSW in the United States, with one of the largest FSW cohorts to date. We found that although awareness of PrEP was low, interest in PrEP was high, particularly among women who were characterized by structural vulnerability, which directly heightens their risk for HIV. Our results show that FSW who had experienced social and environmental HIV prevention challenges, including client condom

TABLE 2. PRE-EXPOSURE PROPHYLAXIS (PrEP) AWARENESS AND INTEREST BY SEX WORK CHARACTERISTICS, POLICE PRACTICES, AND CLIENT AND INTIMATE PARTNER VIOLENCE AMONG FEMALE SEX WORKERS IN BALTIMORE, MD (N=232)

		PrEP awareness			Interested in taking PrEP		
	Total (N=232), n (%)	No (n=184), n (%)	Yes (n=48), n (%)	p	No (n=60), n (%)	Yes (n=172), n (%)	p
Sex work characteristics							
Length in street-based sex work, years							
≤1	42 (18.1)	36 (19.6)	6 (12.5)	0.17	14 (23.3)	28 (16.3)	0.43
>1 to 5	73 (31.5)	61 (33.2)	12 (25.0)		19 (31.7)	54 (31.4)	
>5	117 (50.4)	87 (47.3)	30 (62.5)		27 (45.0)	90 (52.3)	
Frequency of street-based sex work, past 3 months							
Daily	153 (66.0)	122 (66.3)	31 (64.6)	0.96	31 (51.7)	122 (70.9)	0.01
Weekly	57 (24.6)	45 (24.5)	12 (25.0)		18 (30.0)	39 (22.7)	
Monthly	22 (9.5)	17 (9.2)	5 (10.4)		11 (18.3)	11 (6.4)	
Where women found clients							
Indoor	113 (49.1)	87 (47.8)	26 (54.2)	0.43	26 (44.1)	87 (50.9)	0.37
Online	67 (29.1)	52 (28.6)	15 (31.3)	0.72	13 (22.0)	54 (31.6)	0.16
Number of clients, past 3 months	84.1 (141.3)	87.3 (152.0)	71.8 (90.0)	0.49	57.0 (70.1)	94.3 (158.7)	0.08
Condomless vaginal/anal sex with clients, past 3 months	94 (40.5)	74 (40.2)	20 (41.8)	0.86	27 (45.0)	67 (39.0)	0.41
Response to police practices							
Rushed negotiations due to policing, past 12 months	133 (57.3)	105 (57.1)	28 (58.3)	0.87	28 (46.7)	105 (61.1)	0.05
Moved to unfamiliar area to work, past 12 months	52 (22.5)	41 (22.4)	11 (22.9)	0.94	7 (11.7)	45 (26.3)	0.02
Avoided carrying condoms, past 12 months	32 (13.9)	26 (14.2)	6 (12.5)	0.76	2 (3.3)	30 (17.4)	0.01
Client violence and condom coercion							
Physical or sexual violence, past 3 months	52 (22.4)	43 (23.4)	9 (18.8)	0.49	11 (18.3)	41 (23.8)	0.38
Condom coercion, past 3 months	99 (42.7)	86 (46.7)	13 (27.1)	0.01	18 (30.0)	81 (47.1)	0.02
Intimate partner condom use and condom coercion							
Had an intimate partner, past 3 months	149 (64.2)	124 (67.4)	25 (52.1)	0.05	36 (60.0)	113 (65.7)	0.43
Condomless vaginal/anal sex, past 3 months	102 (44.0)	89 (48.4)	13 (27.1)	0.001	30 (50.0)	72 (41.9)	0.27
Condom coercion, past 3 months (n=231)	24 (10.5)	19 (10.6)	5 (10.4)	0.98	3 (5.0)	21 (12.5)	0.10
Intimate partner violence							
Physical or sexual violence, past 3 months	40 (17.5)	32 (17.7)	8 (16.7)	0.87	8 (13.3)	32 (18.9)	0.33

PrEP, pre-exposure prophylaxis.

coercion and moving to unfamiliar areas to sell sex due to the police, are more likely to be interested in PrEP.

Hearing about PrEP was relatively rare, though two-thirds of women were interested in taking PrEP on learning about it, suggesting that current PrEP education and outreach efforts are not reaching this population that meets a CDC criterion for PrEP prescription. The Health Department is conducting two CDC-funded public education campaigns in Baltimore that aim at expanding knowledge of and accessing PrEP³⁵ that target MSM and transgender people. Although it is possible that some FSW are aware of PrEP because of this city-wide campaign, the campaigns are not targeting this population and the campaign messages may not be impacting FSW risk perception.³⁵ Despite this ongoing education effort, FSW in our sample in Baltimore are still widely unaware of PrEP.

In adjusted models of PrEP awareness, condom coercion with clients and condomless sex with an intimate partner were significantly associated with lower PrEP awareness. These findings underscore the overall importance of reaching the most vulnerable women—including those who are at heightened risk of abuse, violence, and victimization—as part of efforts to increase PrEP awareness among this key population. Prior research has found unique benefits of PrEP use among women who are subject to abuse from intimate partners, including discreet use without partner awareness and dual protection for women who also inject drugs, a significant sub-group of our sample of FSW.³⁶ Our findings lend support for extending these benefits to HIV protection from client-perpetrated violence. FSW who were unaware of PrEP may be a particularly vulnerable population of women and,

TABLE 3. POISSON REGRESSION MODELING PRE-EXPOSURE PROPHYLAXIS (PrEP) AWARENESS AMONG FEMALE SEX WORKERS IN BALTIMORE, MD (N=232)

	<i>Unadjusted Poisson regression</i>		<i>Adjusted Poisson regression^a</i>	
	<i>IRR (95% CI)</i>	<i>p</i>	<i>aIRR (95% CI)</i>	<i>p</i>
Vulnerabilities and health characteristics				
Arrested, past 12 months	1.54 (0.92–2.58)	0.10		
Clinically significant PTSD score	0.67 (0.39–1.14)	0.14		
Health insurance	0.89 (0.48–1.65)	0.72		
Greatest health concern, past 3 months				
Mental health	0.62 (0.29–1.33)	0.22	0.65 (0.30–1.39)	0.27
STI or HIV	1.37 (0.78–2.42)	0.27	1.37 (0.78–2.38)	0.27
Other	Ref (1.0)	—		
Sex work characteristics				
Length of time in street-based sex work, years				
1	Ref (1.0)	—		
>1 to 5	1.04 (0.57–1.88)	0.90		
5+	1.12 (0.49–2.58)	0.79		
Client condom coercion and violence				
Condom coercion, past 3 months	0.50 (0.28–0.89)	0.02	0.50 (0.28–0.90)	0.02
Intimate partner experiences				
Condomless vaginal/anal sex, past 3 months	0.47 (0.26–0.85)	0.01	0.54 (0.30–0.98)	0.04

^aAdjusted model includes results for all variables included in the final model.

aIRR, adjusted incidence rate ratio; IRR, incidence rate ratio; STI, sexually transmitted infection.

therefore, one of the most critical groups in need of PrEP education and outreach.

Our results also suggest that FSW may be interested in taking PrEP once aware of its availability, similar to other studies of FSWs.^{18–21} Ease of taking PrEP was the most significant association with interest in PrEP in adjusted models. This is self-reported ease of hypothetically taking PrEP, and further research will be required to understand the reality of

PrEP adherence for women. We also do not know the extent to which women are considering the contextual factors around daily PrEP management; the wording of the question may lead women to only consider the isolated act of taking a pill and not the circumstances by which one acquires PrEP. However, our findings suggest that there is a group of FSW for which there is high motivation and willingness to take PrEP and that there are health care settings that may be natural fits for intervention

TABLE 4. POISSON REGRESSION MODELING PRE-EXPOSURE PROPHYLAXIS (PrEP) INTEREST AMONG FEMALE SEX WORKERS IN BALTIMORE, MD (N=214)

	<i>Unadjusted Poisson regression</i>		<i>Adjusted Poisson regression^a</i>	
	<i>IRR (95% CI)</i>	<i>p</i>	<i>aIRR (95% CI)</i>	<i>p</i>
Health characteristics				
Clinically significant PTSD score	1.30 (1.08–1.57)	0.01	1.17 (1.00–1.38)	0.05
Current chlamydia or gonorrhea infection	0.77 (0.60–0.99)	0.05	0.75 (0.59–0.95)	0.02
Ease of taking PrEP				
Not very easy	Ref. (1.0)	—	Ref. (1.0)	—
Very easy	2.05 (1.56–2.69)	<0.0001	1.91 (1.49–2.45)	<0.0001
Sex work characteristics				
Frequency of street-based sex work in past 3 months				
Daily	1.26 (1.05–1.52)	0.02	1.16 (0.98–1.37)	0.08
<Daily	Ref. (1.0)	—	Ref. (1.0)	—
Ever met clients online	1.12 (0.96–1.31)	0.14		
Rushed negotiations due to policing, past 12 months	1.17 (0.99–1.37)	0.06		
Moved to unfamiliar area to work, past 12 months	1.23 (1.06–1.42)	0.01	1.20 (1.04–1.39)	0.01
Avoided carrying condoms, past 12 months	1.32 (1.17–1.50)	<0.0001	1.14 (0.99–1.31)	0.07
Client condom coercion and violence				
Condom coercion, past 3 months	1.20 (1.03–1.39)	0.02	1.13 (0.99–1.30)	0.08
Intimate partner condom coercion and violence				
Condom coercion, past 3 months	1.21 (1.02–1.45)	0.03		

^aAdjusted model includes results for all variables included in the final model.

aIRR, adjusted incidence rate ratio; IRR, incidence rate ratio; PrEP, pre-exposure prophylaxis.

implementation such as a clinic or needle exchange. Nearly half the sample reported seeing a doctor or using the needle exchange in the past 3 months, which are encouraging findings for future PrEP intervention contexts. The full potential of PrEP, particularly among vulnerable populations such as FSW, relies on strong and ongoing patient-provider interactions and may be the most useful to these populations when linked to other clinical and outreach services.³⁷ However, our findings raise concerns about the implementation of interventions as clinicians working with high HIV risk populations should already be aware of CDC PrEP prescribing guidelines; previous studies of physicians in a variety of health care settings have documented a similar disconnect between PrEP-eligible patients and physicians.^{38–40}

Future interventions for improving physician awareness of PrEP should consider improving physician-related factors and improving PrEP screening and prescription through enhanced workflow. Physician-related factors may include increasing provider knowledge about PrEP, particularly among generalists, and facilitating communication between physicians who had positive experiences providing PrEP to FSW and physicians who had not prescribed PrEP to disseminate information and provide guidance about important clinical considerations for this population.³⁸

Prior research has also demonstrated the effectiveness of an HIV risk score that is generated through electronic medical records of emergency department patients, alerting providers to PrEP eligibility.³⁹ Future research will need to validate these findings, but this intervention holds promise to improve workflow and provider awareness of PrEP in a busy environment such as the emergency department (where more than half of our sample recently sought care.).

HIV-related vulnerabilities were significantly associated with PrEP interest, including responses to police activity and gonorrhea and chlamydia infection. Clinically significant PTSD symptoms were significantly associated with an increase in PrEP interest, an encouraging finding given established associations between poor mental health and challenges to primary HIV prevention.^{41–43} Moving to an unfamiliar area to work to avoid the police was also significantly associated with greater interest in PrEP. Familiar areas to sell sex provide FSW more control over the services they provide and their risk for violence, particularly in street-based sex work where women often have less control over these HIV risks compared with venue-based sex work locations.^{44–46} Moving to unfamiliar areas to work can upend these safeguards and heighten the HIV risk environment for FSW because they are not as familiar with their work environment.

Results related to gonorrhea or chlamydia infection and PrEP interest were not in the expected direction: Women with a gonorrhea or chlamydia infection were less likely to be interested in PrEP. Given that STI infection can be an occupational hazard of sex work, it is not clear from the data whether STIs are a driver of diminished interest in PrEP by itself or whether STIs are correlated with more salient factors that drive PrEP interest such as more frequent sex work or condom coercion. STIs may be an indicator of the most structurally vulnerable women who have more immediate priorities than STI or HIV risk reduction. More research is needed to understand the relationship between STIs, vulnerability, PrEP interest, and potential uptake.

We found several marginally significant associations between PrEP interest and frequency of sex work and adverse experiences from clients and police. We found that women who may have less agency in making choices to engage in HIV prevention behaviors—such as FSW experiencing client condom coercion, more frequent sex work, or police harassment—also expressed more interest in PrEP than women who do not face similar structural constraints. Structural vulnerabilities constrain FSW agency over behaviorally based HIV prevention—such as condom use with clients or having safe locations to bring clients—but PrEP provides a unique opportunity for FSW to assert agency in HIV prevention. Similar results were echoed in prior literature about PrEP providing an opportunity for empowerment and agency in HIV prevention.²⁵

These results should be considered in light of several limitations. First, although we assessed awareness of PrEP, we did not ask about the extent of women's knowledge of PrEP. It is possible that the proportion of women in the sample who had full knowledge (rather than a passing awareness) of PrEP may be even lower than current results. Second, this sample comprised only street-based FSW in Baltimore and conclusions cannot be drawn about FSW in other contexts (i.e., brothels, exotic dance clubs) or geographic areas. Third, the study is cross-sectional, making the temporal relationship between variables difficult to determine. Finally, it is possible that because of the CAPI survey format and a social desirability bias, women may have underreported answers to sensitive questions.

This study—one of the first to examine PrEP attitudes among FSW in the United States—demonstrates high interest in PrEP among street-based FSW, despite low awareness. Results suggest that women may recognize important HIV prevention challenges in their lives; women-controlled methods such as PrEP may mitigate these challenges and provide women with agency in HIV prevention. Efforts should be made to raise awareness of PrEP in this population and for clinicians and public health professionals to consider and help mitigate a woman's challenges to and motivations for PrEP uptake in a clinical setting.

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