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Interpersonal and Structural Factors Associated with Receptive Syringe Sharing among a Prospective Cohort of Female Sex Workers Who Inject Drugs

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Abstract

Aims: To determine the interpersonal and structural factors associated with receptive syringe sharing (RSS) among female sex workers who inject drugs (FSW-IDU), a group at high risk of HIV/HCV acquisition.

Design: SAPPHERE study, a prospective cohort study.

Setting: Baltimore, Maryland, USA.

Participants: 180 FSW-IDU. Mean age was 33 years, 77.1% were white, and 62.9% in a relationship/married.

Measurements: Surveys were conducted between April 2016 and February 2018. The main outcome was recent RSS (past 3 months). In addition to socio-demographic characteristics and drug use behaviors, we assessed factors at the interpersonal-level, including injection practices, intimate partner and client drug use, and exposure to violence. Structural-level factors included methods of syringe access.

Findings: Nearly all FSW-IDU used heroin (97.1%) or crack cocaine (89.7%). Recent RSS was reported by 18.3%. Syringes were accessed from needle exchange programs (64.6%), pharmacies (29.7%), street sellers (30.3%), or personal networks (29.1%). Some FSW-IDU had clients or intimate partners who injected drugs (26.3% and 26.9% respectively). Longitudinal factors

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independently associated with RSS in the multilevel mixed-effects model were recent client violence (adjusted odds ratio[aOR]=2.17, 95% CI:1.09–4.33), having an intimate partner who injected drugs (aOR=2.18, 95% CI:0.98–4.85), being injected by others (aOR=4.95, 95% CI:2.42–10.10), and obtaining syringes from a street seller (aOR=1.88, 95% CI:0.94–3.78) or from a member of their personal network (aOR=4.43, 95% CI:2.21–8.90).

Conclusions: Client violence, intimate partner injection drug use, being injected by others, and obtaining syringes from personal connections, appear to increase parenteral HIV/HCV risk among female sex workers who inject drugs.

Keywords

Women; HIV risk; injection drug use; substance use

Introduction

Female sex workers (FSW) and women who inject drugs (WWID) are distinct yet overlapping populations at high risk of HIV and hepatitis C virus (HCV) acquisition globally. The degree of overlap between these populations vary widely from 18% to 61% in the U.S., Canada, Mexico and Russia (1–4). Among FSW and WWID worldwide, HIV prevalence is high, at 12% among FSW (5) and 18% among WWID (6). In Europe, injection drug use (IDU) is the primary driver of HIV risk among FSW (7). HCV has a higher viral infectivity compared to HIV during parenteral transmission and more likely to survive in injection paraphernalia (8, 9); 52% of all people who inject drugs (PWID) globally are HCV-antibody seropositive (6), and small gender differences in HCV seroprevalence have been observed in some settings (10, 11). Receptive syringe sharing (RSS), involving reuse of a syringe used by someone else, is a key HIV/HCV risk factor among PWID, and the prevalence of RSS has been documented to be higher among WWID in the U.S. (12, 13).

Globally, there is growing recognition that contextual factors, including social environments and socioeconomic inequities, may shape individual-level susceptibility to disease (14–16). However, literature exploring interpersonal and structural determinants of parenteral HIV/HCV risk among FSW who engage in IDU (FSW-IDU) is limited (17). Connell's Theory of Gender and Power (18, 19) informs our understanding of the gendered dynamics surrounding HIV/HCV risk behaviors. The theory posits that women's agency in protecting their health is influenced by gendered inequities in labor, power, and emotional relations ("cathexis") manifested in the personal relationships between women and men; these gendered dynamics can shape HIV/HCV risk among FSW/WWID (20–23). For instance, the sexual division of labor within these dyads can shape women's unequal economic resources leading to limited money for drugs, leading to over-reliance on partners or engagement in sex work. Power imbalances can constrain women's control within relationships and promote client or partner use of physical or financial threats to demand sex. Cathexis can promote the enforcement of strict gender roles, including reliance on injection by male partners. Women's exposure to police and the criminal justice system reflects Connell's social structures at the institutional level: in some settings, police abuse their power over FSW to coerce sexual favors (24, 25). At the macro level, the criminalization of sex work and drug use disproportionately affects women in the U.S. (26).

Syringe sharing and access to syringes among WWID represent important manifestations of all three of Cornell's structures, with key implications for women's HIV/HCV risk. At the interpersonal-level, WWID report higher syringe sharing than their male counterparts and are more likely to share syringes with interpersonal connections including intimate partners (IP) and friends (27–29). Male IP-IDU and exposure to intimate partner violence (IPV) regardless of the partner's IDU are associated with RSS among WWID, revealing a gendered power imbalance constraining the ability to engage in safer IDU (30–32). Institutional and interpersonal factors that exert power over women's access to syringe services programs (SSPs) include childcare needs, neighborhood safety, and trauma history (26), which is particularly concerning given the effectiveness of SSPs in preventing blood-borne infections and other health morbidities (33, 34).

The few studies exploring the unique vulnerabilities of FSW-IDU show higher prevalence of HIV prevalence, unrecognized HIV infection, sexual risk, and RSS (1, 3, 35–39). To build on this literature, the current longitudinal study examines the relative contribution of clients and IPs, and structural factors in shaping HIV risk through RSS among FSW-IDU in an urban U.S. setting. We hypothesized that interpersonal (e.g., gender-based violence; GBV) and structural factors (e.g., relying on IPs for syringes) would elevate HIV/HCV risk.

Methods

The Sex workers And Police Promoting Health In Risky Environments (SAPPHIRE) study is a mixed methods study with a qualitative police ethnography phase and an observational prospective cohort of 250 cisgender FSW in Baltimore, Maryland (40). The study examined the role of the police on the HIV risk environment of street-based FSW. Recruitment and data collection occurred between April 2016 and February 2018 and there were five study visits (baseline, 3-/6-/9-/12-month follow-up). Methods have been published previously (40–42). Briefly, women were recruited through targeted sampling at street-based locations with sex work activity. Detailed description of the methodology have been published elsewhere (41). These locations (“recruitment zones”) were identified through geospatial analyses of secondary data sources (e.g., arrest data, 911 data) and corroborated through ethnographic work with Baltimore Police and interviews with community stakeholders, including former sex workers. The 12 recruitment zones ranged in size (ranging between 2 to 10 blocks) and were geographically diverse. In the current analysis, a median of 24 participants were recruited from each zone (IQR=6–36).

Women were approached on the street and if interested, screened in the study van. Eligibility criteria were: (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 recently (in the past 3 months); and (4) willing to undergo HIV and STI testing. After providing informed consent, participants completed a 50-minute computer-assisted personal interview (CAPI) with a trained interviewer and HIV/STI testing. Participants were permitted to complete any study visit as long as they were within the window period regardless of completion of their prior visit. Participants were compensated with \$70 for baseline and 12-month visits, and \$45 for 3-, 6- and 9-month visits. Retention rates at 3-, 6-, 9-, and 12-month were 81%, 74%, 76% and 73%, after excluding loss to follow-up due to

reasons that prohibited study participation during their follow-up window (e.g., deceased, incarcerated, enrolled in inpatient drug rehabilitation). The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Measures

In addition to determining key socio-demographic characteristics, our surveys captured aspects of FSW's lives, particularly those influenced by gender and power dynamics including frequency of sex work, being trafficked into sex work, having a pimp or manager, and interactions with sex work clients. Childhood abuse included pressured/forced sexual intercourse, or sexual touching, before the age of 18, and being 'pushed, grabbed, slapped, had something thrown at you, or were hit so hard you had marks or were injured before the age of 18'. GBV during adulthood was defined as pressured or forced vaginal or anal sex, physical violence, or being threatened or hurt with a weapon but ascertained separately by perpetrator type. We measured FSW interactions with police officers (who are mostly male in this context) including moving to unfamiliar areas to work due to policing, being searched and arrested by police. Engaging in dually illicit activities (drug use and sex work) places FSW at greater risk of police violence due to more frequent police interactions.

Baseline and follow-up surveys also included drug use items based on our previous work (43, 44). The primary outcome (recent RSS; in the past 3 months) was assessed using the first response of the following question: "In the last 3 months, did you use any of the following items that you know have been used by someone else?" Syringes or needles (yes/no). The survey also captured reuse of cookers and cotton. Drug use frequencies were measured at every visit using pre-defined categories, ranging from *daily use* to *1–3 times a year*, and by route of administration, which included the following: heroin (snorted/sniffed/injected), crack (smoked), cocaine (sniffed/snorted/injected), speedball ('injected heroin and cocaine together'), and non-medical painkillers ('taken by mouth or sniffed any prescription painkillers that were not prescribed by your doctor such as Percocet, Morphine, Oxycontin, Codeine, Fentanyl but not "over the counter" pills'). Binary variables (used recently; yes/no) were constructed from these items.

The survey also asked questions on FSW's access to sterile syringes and injection practices, which are also subject to gendered power dynamics, and structural forces. These included interpersonal factors describing interactions with clients and IP, such as IDU, and if respondents were injected by others and by whom. We also measured methods of syringe access (select all that apply: Baltimore City Needle Exchange Program/ Street needle seller/ Pharmacy/ From a sex worker/ From a friend/ From a drug dealer/ Other, specify) and police encounters were also measured at follow-up visits. We assessed proximity to SSPs by obtaining the geospatial street intersection locations provided by the Baltimore City NEP van during the study period (n=16 sites; this was the sole SSP in the city during this period) and overlaying these locations with the mapped recruitment zones created as part of the targeted sampling process (41). A binary variable indicating inclusion of an SSP in a recruitment zone was constructed.

Statistical analysis

The SAPPHERE cohort consisted of N=250 FSW. Non-IDU (n=66) and observations missing recent RSS (n=2) were excluded from the analysis resulting in n=175 FSW-IDU. We explored the unadjusted baseline associations between the outcome (recent RSS) and the individual, interpersonal and structural covariates that were selected *a priori* using theory and existing literature; these covariates are listed in Tables 1–3. Significant associations were detected using the Pearson's χ^2 test for binary and categorical covariates, and the Mann-Whitney-U test for continuous covariates. Adjustments for recruitment zone were not applied during this stage.

FSW-IDU (n=184) completed 654 study visits over the follow-up period; due to IDU cessation and initiation during the study, only visits where recent IDU was reported were considered for multivariate analysis resulting in 443 visits in the dataset. FSW (n=12) who did not report recent IDU at baseline but did at a subsequent visit were included. Bivariate associations between each time-varying covariate listed in Tables 1–3 and the outcome were modeled at this stage using multilevel mixed-effects logistic models, which accounted for intra-person correlations due to repeated measurements and variance clustering by baseline recruitment zone. Associations significant at the $p<0.1$ level are shown in Table 4. These variables were considered for multivariate modeling, with the exception of cooker/cotton reuse due to the established degree of concomitance between these behaviors and RSS.

Multivariate analysis was conducted using multilevel mixed-effects modelling consisting of a three-level model (visit: level 1, participant: level 2, recruitment zone: level 3) with a Bernoulli distribution, logistic cumulative distribution function and an unstructured covariance structure. We tested a full model (individual, social and structural-level covariates significant at the $p<0.1$ level) and several alternative models using manual stepwise deletion to narrow down the covariates. Given the high collinearity between the three IP variables (IPV, IP-IDU, and partner injected FSW), models that added one or two of these variables were compared to a model without these three variables. The lowest value of the Akaike information criterion (AIC) was used to select the final model among all models. Complete case analysis was used, resulting in 433 visits among n=180 FSW-IDU.

Results

Baseline prevalence and bivariate associations between recent RSS and individual and drug use factors for FSW-IDU (n=175) are located in Table 1. At baseline, 18.3% reported recent RSS (22.2%, 18.8%, 15.6% and 9.1% during follow-up). Median age was 33, most (77.1%) were Non-Hispanic White, in a relationship/married (62.9%) and recent homeless (68.0%). Half (52.6%) did not graduate high school. Almost half (46.9%) had been in sex work for 5 years or less, a minority had ever had a pimp/manager (12.0%) and most sold sex daily (71.4%). Almost all recently used heroin (97.1%) or crack cocaine (89.7%). Almost all FSW-IDUs were daily IDU (81.1%). Many reused cookers (30.9%) or cotton (20.0%) that had recently been used by someone else. Most who engaged in RSS also shared cookers/cotton (90.6%). A minority of the overall sample did not engage in RSS yet shared cookers/cotton (14.8%).

FSW-IDUs who engaged in RSS had significantly higher proportions of reusing cookers and cottons (both $p<0.001$), having IP-IDU ($p=0.001$) and being injected by a friend ($p=0.038$) or an IP ($p<0.001$) (Table 1). They also had significantly higher prevalence of client violence ($p=0.017$) and IPV ($p=0.003$) (Table 2).

There were strong associations between having an IP-IDU, being injected by an IP and IPV (χ^2 tests, all $p<0.001$). Syringe access from secondary sources (i.e., street sellers and personal networks, defined as IPs and friends) held separate bivariate associations with decreased SSP access (all $p<0.001$) (data not shown).

The baseline prevalence of interpersonal and structural factors (i.e., syringe access, police encounters) and their bivariate associations with RSS are located in Table 3. FSW had a mean of 100 male clients in the past 3 months (range 2–840). Of 116 FSW who had an IP, 94.8% were partnered with a male ($n=110$); 76.4% of this subsample had one male partner and 23.6% had more than one. Approximately a quarter of FSW-IDU had IDU clients/IPs (26.3% and 26.9%, respectively). Some women were recently injected by someone else (38.3%), including friends, acquaintances, IPs and family members. Experiences of violence were common among the sample, including childhood abuse (54.9%), and recent client violence (37.7%) and IPV (16.6%). Only 8.0% reported being trafficked into sex work.

FSW obtained syringes from an SSP (64.6%), pharmacies (29.7%), street sellers (30.3%) and IPs and/or friends (Table 3). Most (60.6%) were recruited from a zone that contained a SSP. Among those who received syringes from street sellers, only $n=16/53$ (30%) engaged in RSS (Table 3). Similarly, among those who relied on partners, friends, and others only $n=20/51$ (39%) reported RSS. Only $n=8/91$ (9%) who did not receive syringes from others (i.e., relied solely on SSP and pharmacies) engaged in RSS (Table 3). Notably, we observed that among FSW-IDU who were injected by someone else, 40% ($n=27/67$) did not receive syringes from others (i.e., relied solely on SSP and pharmacies). Recent police encounters included being referred to health/social services (12.6%), being asked to move on (72.6%), being searched (46.9%) and having drug paraphernalia (24.6%) or drugs confiscated (17.1%). About half had been arrested in the past 12 months (50.9%) and experienced some form of police violence (27.4%). Exploratory bivariate analysis demonstrated that obtaining syringes from street sellers (yes vs. no; $p=0.008$) or their personal network (yes vs. no; $p<0.001$) were separately associated with engaging in RSS.

Unadjusted analysis incorporating the longitudinal data from $N=184$ FSW-IDU ($N=433$ visits; Table 4) showed significant associations between recent RSS and recent client violence (odds ratio[OR]=3.79, 95% CI: 1.80–7.94), recent IPV (OR=2.91, 95% CI: 1.16–7.26), having an IP-IDU (OR=2.90, 95% CI: 1.39–6.06), being injected by others (OR=6.94, 95% CI: 3.46–13.93), obtaining syringes from a street seller (OR=2.56, 95% CI: 1.42–4.59) or from their personal network (OR=3.91, 95% CI: 2.15–7.11).

Factors independently associated with recent RSS in the final adjusted multilevel mixed-effects model were recent client violence (aOR=2.17, 95% CI: 1.09, 4.43), having an IP-IDU (aOR=2.18, 95% CI: 0.98, 4.85), being injected by others (aOR=4.95, 95% CI: 2.42–

10.10), obtaining syringes from a street seller (aOR=1.88, 95% CI: 0.94–3.78), or obtaining syringes from their personal network (aOR=4.43, 95% CI: 2.21–8.90).

Discussion

In this study of street-based FSW, IDU and exposure to GBV were extremely prevalent. This is one of the first studies to model and demonstrate strong associations between interpersonal and structural factors on RSS among FSW-IDU, a highly marginalized and vulnerable subpopulation of WWID. The associations supported the theory that gendered dynamics often shape HIV/HCV risk among WWID. At the interpersonal level, recent client violence and injection by others emerged as key correlates of RSS. Structurally, women who accessed syringes through street sellers and personal connections were more likely to engage in RSS. These findings underscore the importance of understanding the potential role of gendered power dynamics between FSW-IDU and key “others” in increasing vulnerability to health risks including HIV/HCV. Addressing the barriers to SSP access and other harm reduction services may also help reduce risk.

These results reveal the primacy of the sexual division of power in shaping the health of FSW-IDU. Two in five were recently exposed to client violence and almost one in six were exposed to IPV, higher than previously reported among FSW-IDU (36, 39). Even after adjustment, client violence doubled the odds of RSS, a novel finding in this population. This adds to existing FSW studies demonstrating associations between client violence and riskier substance use (45–47). Virtually all clients and IPs who perpetrated violence were men, supporting the theory that women’s agency and risk are situated within gendered power dynamics. Exposure to client violence may render these women vulnerable to riskier behaviors by pathways mediated by fear of further abuse, poor mental health or lowered self-esteem (31). Studies have found an association between GBV and engagement in IDU (48), but further research studying the link between violence and riskier injection practices are required among FSW-IDU, a uniquely vulnerable population. Despite the risk of client violence, some women engage in sex work due to pressure from IPs to pay for drugs, often in a context of limited formal and informal economic opportunities (49). Our data highlight the need for pragmatic interventions against GBV among FSW-IDU such as safety training, access to trauma-informed care and justice (21, 50, 51). These interactions occur in a structural context that often fails to provide adequate care, protection and justice to GBV victims, and one where FSW are criminalized and face additional barriers to accessing these services (52).

IP-IDU appeared to play a role in shaping HIV/HCV risk among FSW-IDU, which is consistent with previous research and Connell’s theory (30–32). Over one-quarter of IPs injected drugs, and injection by IPs was independently associated with RSS. Male partners may have power over FSW due to greater access to knowledge surrounding drug-related activities, including injection practices (2, 21). IPs who use drugs may also perpetrate violence in response to sex work disclosure, or threaten to report FSW to the police as a method of control (20, 49). Alternatively, the cathexis of social expectations of female subservience may influence some FSW-IDU to engage in RSS to build relationship intimacy, placing themselves at higher risk (53, 54). These dynamics may impede WWID to gain the

skills necessary to self-inject - a potentially empowering tool to protect their own health. For WWID who are not confident in self-injection practices or face barriers to accessing this knowledge, being injected by others may be a harm reduction strategy to mitigate other IDU-related health risks such as abscesses that can form from missed veins. The role of IPV and IP substance use will be examined in a forthcoming paper from this cohort to understand and intervene on this critical issue.

Being injected by others (notably friends, acquaintances, family and IPs) was also common among FSW-IDU and elevated the odds of RSS. Previous studies show that WWID are more likely to share syringes with interpersonal connections including IPs and friends (27, 28). This may reflect higher levels of trust and a low perceived risk of HIV acquiring HIV from close relationships, as observed in one study (37). While further research is necessary to understand these practices, strategies to empower FSW-IDU to self-inject could be useful in mitigating the risk of HIV/HCV acquisition.

We also examined the relationship between syringe access and RSS. Our study occurred in a city with a large and established SSP, a key structural intervention against HIV/HCV transmission. The Baltimore city SSP is free and accessible six days a week at a variety of locations. The null association between RSS and recent SSP use may be due to lack of syringe coverage for all injections or a gap in education around RSS that the SSP could address. Of concern was the finding that 35% of FSW-IDU did not access the SSP, and that utilization of secondary sources (e.g., street needle sellers, IPs, and friends) held associations with lower SSP access and higher RSS. Multiple gendered barriers to SSP access exist for WWID including fear of GBV, losing children, childcare issues, and drug-related stigma (26, 27, 55). This supports the theory that both interpersonal and structural determinants have a role in shaping HIV/HCV risk. The vast majority of FSW-IDU engaging in RSS also shared cookers (91%) and cotton (72%), which are further risk factors for HCV acquisition. In light of our findings, we urge researchers to include this population and consider the role of gender dynamics when designing HIV/HCV research and interventions.

These data also emphasize that while the mainstay of HIV/HCV prevention among FSW-IDU remains the distribution of male condoms and traditional forms of SSP, the social realities faced by FSW-IDU warrant the design and delivery of interventions that target and empower them to help challenge existing gender-based structures. Evidence-based HIV interventions tailored for FSW-IDU are rare (56, 57). Given their risk profiles, future interventions could include improved access to HIV pre-exposure prophylaxis (PrEP), female condoms, and tailored women-led SSPs that are trauma-informed and consider the needs of FSW (e.g., destigmatizing, offer unconventional hours etc) (52, 58, 59). Training around self-injection practices, particularly among new initiates, or non-IDU, may be useful (23). Access to trauma-informed care, including mental health treatment will likely be required given the high rates of violence (15, 26). Concurrent to initiatives to prevent violence, and bolstering their internal and external resources to buffer the effects of violence will be important in reducing HIV/HCV risk. These interventions will also require consideration of the dually-criminalized status of FSW-IDU, which has implications for service engagement and retention (26). Increasing access to SSPs embedded within existing

trauma-informed services that are tailored for women could be an effective method of service delivery.

Our findings should be interpreted in light of limitations. We did not ascertain specific dyadic interactions between FSW and their clients/IPs, rather we measured interactions occurring at the interpersonal-level (by partner type). The HIV serostatus and risk behaviors of injecting partners were not measured; it is challenging to ascertain relative risks that stem from these relationships. While we did not measure the number of injection partners or whether those providing syringes were also injection partners, it is theoretically plausible that this factor confounded or mediated the relationship between syringe access and RSS. However, our data suggest that despite overlap between these factors, they were distinct and individually provided important insights into RSS. Survey data has potential for social desirability bias. The study does not establish temporality though it is unlikely that RSS could lead to the contextual exposures (i.e., exposure to violence, assistance with injection, syringe access) modeled. The generalizability to other settings (e.g., where drug use patterns differ) is unknown.

These findings highlight the key role of interpersonal and structural risks in shaping health of FSW-IDU. Exposure to violence from clients and IPs is a pervasive issue and needs to be factored into future HIV/HCV intervention design among this population. Interventions targeting interpersonal and structural barriers to safety, sterile syringe access and risky injection practices will be necessary in reducing parenteral HIV/HCV risk among FSW-IDU.

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Table 1:

Baseline Individual-Level Factors Associated with Receptive Syringe Sharing among Female Sex Workers who Inject Drugs (N=175)

	RSS, past 3 months			p
	Total n (col %)	Yes n (col %)	No n (col %)	
Total (row %)	175 (100.0)	32 (18.3)	143 (81.7)	
Individual characteristics				
Age (median, IQR)	33 (28–39)	35 (28–40)	33 (28–38)	0.754
Race/ethnicity				
Non-Hispanic White	135 (77.1)	27 (84.4)	108 (75.5)	
Non-Hispanic Black	18 (10.3)	1 (3.1)	17 (11.9)	
Hispanic or Other	22 (12.6)	4 (12.5)	18 (12.6)	0.33
Did not graduate high school	92 (52.6)	13 (40.6)	79 (55.2)	0.134
Relationship status				
Single	64 (36.6)	11 (34.4)	53 (37.1)	
Married/in a relationship	110 (62.9)	21 (65.6)	89 (62.2)	0.755
Homeless, past 3 months	119 (68.0)	23 (71.9)	96 (67.1)	0.603
Minor (age<18 years) at sex work entry	41 (23.4)	11 (34.4)	30 (21.0)	0.106
Been in sex work 5 years	82 (46.9)	12 (37.5)	70 (49.0)	0.241
Frequency of sex work, daily	125 (71.4)	22 (68.8)	103 (72.0)	0.711
HIV-positive	10 (5.8)	3 (9.4)	7 (4.9)	0.329
Drug use behaviors, past 3 months				
Heroin	170 (97.1)	32 (100.0)	138 (96.5)	0.283
Crack cocaine	157 (89.7)	30 (93.8)	127 (88.8)	0.406
Powdered cocaine	30 (17.1)	3 (9.4)	27 (18.9)	0.197
Prescription opioid misuse	47 (26.9)	8 (25.0)	39 (27.3)	0.76
Frequency of injection drug use				
Daily	142 (81.1)	27 (84.4)	115 (80.4)	
< Daily	33 (18.9)	5 (15.6)	28 (19.6)	0.605
Reused cookers	54 (30.9)	29 (90.6)	25 (17.5)	<0.001
Reused cotton	35 (20.0)	23 (71.9)	12 (8.4)	<0.001

Note: Categorical variables tested using Pearson's Chi-Squared, continuous variables tested using Mann-Whitney U test

Table 2:

Baseline Dyad-Level Factors Associated with Receptive Syringe Sharing at Baseline among Female Sex Workers who Inject Drugs (N=175)

	RSS, past 3 months			p
	Total n (col %)	Yes n (col %)	No n (col %)	
Total (row %)	175 (100.0)	32 (18.3)	143 (81.7)	
<i>Sex work history</i>				
Ever had a pimp/manager	21 (12.0)	5 (15.6)	16 (11.2)	0.485
<i>Violence</i>				
Childhood sexual or physical violence	96 (54.9)	20 (62.5)	76 (53.1)	0.523
Trafficked into sex work [^]	14 (8.0)	3 (9.4)	11 (7.7)	0.751
Client violence, past 3 months	66 (37.7)	18 (56.3)	48 (33.6)	0.017
Intimate partner violence, past 3 months	29 (16.6)	11 (34.4)	18 (12.6)	0.003
<i>Injection risk, past 3 months</i>				
Had IDU client(s)	46 (26.3)	11 (34.4)	35 (24.5)	0.250
Had IDU intimate partner(s)	47 (26.9)	16 (50.0)	31 (21.7)	0.001
Exclusively self-injected	108 (61.7)	10 (31.3)	98 (68.5)	<0.001
Injected by someone else	67 (38.3)	22 (68.8)	45 (31.5)	<0.001
...Client	1 (0.2)	1 (1.3)	0 (0.0)	
...Intimate partner	12 (6.9)	9 (28.1)	3 (2.1)	
...Friend	41 (23.4)	12 (37.5)	29 (20.3)	
...Acquaintance	14 (8.0)	5 (15.6)	9 (6.3)	
...Family member	8 (4.6)	2 (6.3)	6 (4.2)	

[^] Defined in this study as being coerced, threatened, pressured, misled, tricked, or physically forced into entering the sex trade.

Note: Categorical variables tested using Pearson's Chi-Squared, continuous variables tested using Mann-Whitney U test

Table 3:

Baseline Structural Factors Associated with of Receptive Syringe Sharing among Female Sex Workers who Inject Drugs (N=175)

	RSS, past 3 months			p
	Total n (col %)	Yes n (col %)	No n (col %)	
Total (row %)	175 (100.0)	32 (18.3)	143 (81.7)	
<i>Syringe access</i>				
Obtained syringes in past 3 months from:				
Needle Exchange / SSP	113 (64.6)	22 (68.8)	91 (63.6)	0.617
Pharmacies	52 (29.7)	11 (34.4)	41 (28.7)	0.539
Street seller	53 (30.3)	16 (50.0)	37 (25.9)	0.008
Personal network (e.g. Intimate partner, friend)	51 (29.1)	20 (62.5)	31 (21.7)	<0.001
Recruited at zone containing a SSP	106 (60.6)	19 (59.4)	87 (60.8)	0.878
<i>Police encounters</i>				
<i>Ever</i>				
Moved to a difference neighborhood to work	54 (30.9)	9 (28.1)	45 (31.5)	0.711
<i>Past 12 months</i>				
Moved to an unfamiliar area to work due to policing				
Arrested	89 (50.9)	17 (53.1)	72 (50.3)	0.777
Police sexual or physical violence	48 (27.4)	10 (31.3)	38 (26.6)	0.592
<i>Past 3 months</i>				
Referred you to health/social services	22 (12.6)	3 (9.4)	19 (13.3)	0.546
Asked you to move on from a specific stroll/other public space	127 (72.6)	26 (81.3)	101 (70.6)	0.132
Conducted a search of your person and property	82 (46.9)	17 (53.1)	65 (45.5)	0.432
Confiscated syringes or drug paraphernalia from you	43 (24.6)	11 (34.4)	32 (22.4)	0.154
Confiscated drugs from you	30 (17.1)	6 (18.8)	24 (16.8)	0.79

Note: Categorical variables tested using Pearson's Chi-Squared, continuous variables tested using Mann-Whitney U test

SSP=Syringe Services Program

Table 4:

The Relationship between, Dyad-level and Structural Factors and Receptive Syringe Sharing among a Longitudinal Cohort of Female Sex Workers who Inject Drugs (N=180 women, N=433 visits), Baltimore, Maryland

	OR (95% CI)	p	aOR (95% CI)	p
<i>Dyad-level, past 3 months</i>				
Ever had a pimp/manager	3.96 (1.21–12.97)	0.023	--	--
Client violence	3.79 (1.80, 7.94)	<0.001	2.17 (1.09, 4.33)	0.027
Intimate partner violence	2.91 (1.16, 7.26)	0.022	--	--
Intimate partner injected drugs	2.90 (1.39, 6.06)	0.005	2.18 (0.98, 4.85)	0.056
Injected by others	6.94 (3.46, 13.93)	<0.001	4.95 (2.42, 10.10)	<0.001
<i>Structural-level, past 3 months</i>				
Obtained syringes from street seller	2.56 (1.42, 4.59)	0.002	1.88 (0.94, 3.78)	0.076
Obtained syringes from personal network e.g. intimate partner or friend	3.91 (2.15, 7.11)	<0.001	4.43 (2.21, 8.90)	<0.001

Note: Multilevel mixed-effects models accounting for intra-person correlations and variance clustering by baseline recruitment zone. All covariates are dichotomous (yes/no), with the reference group being the “no” category. The within-person variance estimate was 1.8 and standard error was 1.6. The within-zone variance estimate and standard error was negligible (approached zero).