

UCSF

UC San Francisco Previously Published Works

Title

Injection risk behavior among women syringe exchangers in San Francisco.

Permalink

<https://escholarship.org/uc/item/54j831tr>

Journal

Substance use & misuse, 40(11)

ISSN

1082-6084

Authors

Lum, Paula J
Sears, Clare
Guydish, Joseph

Publication Date

2005

Peer reviewed

Citation: Lum, P., Sears, C., & Guydish, J. (2005). Injection risk behaviors among women syringe exchangers in San Francisco. Substance Use and Misuse, 40,1681-1696.

Injection Risk Behavior Among Women Syringe Exchangers in San Francisco

Paula J. Lum, MD MPH¹, Clare Sears, MA², Joseph Guydish, PhD².

AUTHOR VERSION

1. The Positive Health Program, Department of Medicine, University of California, San Francisco and San Francisco General Hospital
2. The Institute for Health Policy Studies, Department of Medicine, University of California, San Francisco

Keywords: AIDS, HIV, Syringe Exchange, Injection Drug Use, Women

ACKNOWLEDGEMENTS: This research was conducted with the support of grants from the San Francisco AIDS Foundation, the National Institute of Mental Health (T32 MH-19105-10), the California-Arizona node of the NIDA Clinical Trials Network (U10 DA-105815), and the NIDA San Francisco Treatment Research Center (P50 DA-09253). We thank the San Francisco AIDS Foundation's HIV Prevention Project. Dedicated to the memory of Roslyn Allen

Corresponding author: Joseph Guydish, PhD, Institute for Health Policy Studies, 3333 California St., Suite 265, San Francisco, San Francisco, CA 94118; tel (415) 476-0954; fax (415) 476-0705; email: joseph.guydish@ucsf.edu.

ABSTRACT

Women who inject drugs in cities where syringe exchange programs (SEPs) are well established may have different risks for HIV infection. In 1997, we interviewed 149 female syringe exchangers in San Francisco, CA, a city with high rates of injection drug use that is home to one of largest and oldest SEPs in the United States. In this report, we describe their sociodemographics, health, and risk behavior, and we examine factors associated with recent syringe sharing. Fifty percent of respondents were women of color and the median age was 38 years. Most (86%) injected heroin and nearly half were currently homeless or had recently been incarcerated. One-third of all women reported needle sharing in the prior month. This was higher than the rate of needle sharing reported by a mixed gender sample of San Francisco exchangers in 1993, although it resembled the rate reported by a mixed gender sample in 1992. In a multivariate analysis, syringe sharing was associated with age, housing status, and sexual partnerships. Syringe sharers were more likely to be young, homeless, or have a sexual partner who was also an injection drug user. While wide access to sterile syringes is an important strategy to reduce HIV transmission among injection drug users (IDU), syringe exchange alone cannot eradicate risky injection by female IDU. Additional efforts to reduce risky injection practices should focus on younger and homeless female IDU, as well as address selective risk taking between sexual partners.

INTRODUCTION

Injecting drug use is a major route of transmission for HIV in the United States (Centers for Disease Control and Prevention, 2002; Centers for Disease Control and Prevention, 2003), and women who inject drugs are at significant risk of infection (Davis et al., 1998; Freeman et al., 1994; Hader et al., 2001; Prevots et al., 1996). Of the more than 150,000 AIDS cases reported among women nationwide, through December 2002, injecting drug use accounted directly for 39% of cases (Centers for Disease Control and Prevention, 2003). Early research among predominantly male injection drug users (IDU) documented risk factors for HIV infection, including frequency of injection, number of injections shared or needle sharing, early age of initiation, cocaine injection, and shooting gallery attendance (Chaisson et al., 1989; Chitwood et al., 1995; Friedland et al., 1985; Moss et al., 1994; Schoenbaum et al., 1989; Vlahov et al., 1990). Later studies, however, suggested that female and male IDU engaged in injection risk behavior differently (Bennett et al., 2000; Dwyer et al., 1994; Gollub et al., 1998; Miller and Neaigus, 2001) and that risk factors for HIV infection among IDU differed between the sexes (Bruneau et al., 2001; Kral et al., 1997; Strathdee et al., 2001; van Ameijden et al., 1999). Studies reporting exclusively on HIV transmission in female IDU detected additional risk among women of color (Magura et al., 1993; Watters et al., 1994), women who engaged in prostitution (Astemborski et al., 1994; Watters et al., 1994), who were out of drug treatment (Bruneau et al., 2001), and who had a history of sexually transmitted disease (Strathdee et al., 2001; Watters et al., 1994). However, far less is known about the determinants of HIV-related risk behavior among female injectors since the establishment in the U.S. of syringe exchange programs (SEPs).

SEPs are one public health strategy to prevent the transmission of HIV for persons who reuse contaminated syringes for drug injection (Centers for Disease Control and Prevention, 2001). In

contrast with most other industrialized nations, there has been substantial political opposition to SEPs in the U.S., including a federal funding ban that prohibits using government monies to support these programs and State paraphernalia laws that hamper operation by criminalizing syringe possession or distribution (Jaffe, 2004; Lurie, 1995; Vlahov et al., 2001). Operating in a tenuous legal and political climate, SEPs have nonetheless received the support of volunteers, community based organizations and some local governments and, since their establishment in the U.S. in 1982, they have served increasing numbers of IDU (Bluthenthal et al., 1998; Des Jarlais et al., 2000). San Francisco's SEP was launched in 1988 by a group of volunteers, and it is now one of largest and oldest in the U.S., operating legally since 1993, when the local government declared a public health emergency.

Many cities with SEPs have reported decreases in HIV incidence in IDU (Des Jarlais et al., 2000; Gibson et al., 2001). In San Francisco, HIV incidence among IDU declined from 3.9 per 100 person years of observation (PYO) to 1.2 per 100 PYO by 1990 (Moss et al., 1994). However, no reductions in HIV prevalence among IDU in San Francisco (range 8-10%) have been documented in the last ten years (Kral et al., 2001; Watters, 1994). Reports of continued syringe sharing by SEP clients are not uncommon (Paone et al., 1997; Valenciano et al., 2001; Wood et al., 2002). Most studies of SEP clients report on predominantly male populations, although one study of female exchangers reported elevated injection risk behaviors among sex workers (Paone et al., 1999). A better understanding of factors associated with syringe sharing among female SEP users can inform interventions to reduce further the transmission of HIV and other blood borne pathogens among female IDU.

In July 1995, the San Francisco AIDS Foundation's HIV Prevention Project (SFAF-HPP) launched an indoor women-only SEP site and, in 1997, SFAF-HPP contacted the authors to

request a program evaluation to assess and improve SEP services for female IDU. We subsequently interviewed a sample of female IDU recruited from the women-only and mixed-gender SEP sites in San Francisco. Although participants did not experience direct benefits from the study, we presented our findings to SFAF-HPP who used the data to inform planning decisions and enhance program-level services for female IDU. In this paper, we report on our data from the women-only and mixed-gender SEP sites. First, we describe the sociodemographic, health, and risk behavior characteristics of female syringe exchangers in San Francisco. Second, we examine factors associated with risky injection behavior in settings where SEPs are well established.

METHODS

Study Population

We recruited a stratified sample of female syringe exchangers for anonymous, cross-sectional interviews from all twelve sites of the SFAF-HPP in operation at the time of the study. For the purposes of the program evaluation, one-third of the study sample was recruited from street-based SEPs, one-third from a storefront SEP, and one-third from an indoor SEP open to women. The street-based SEPs were located in eight different neighborhoods throughout the city and each operated for a two-hour period, one day per week. The storefront SEP was located in the South of Market district and operated on three different weekdays, for two-hours per day. The women-only SEP operated from an indoor location in the Mission district and was open for a two-hour period, one day per week. All of these SEPs offered syringe exchange, ancillary injection supplies (cotton, cookers, water, and bleach), condoms and referrals; the storefront and women-only SEPs also offered on-site medical care.

Study participants were recruited at the SEP sites by a member of the interview team. This team consisted of eight women, diverse in age and ethnicity, all of whom had prior outreach or interview experience with female drug users. After a potential study participant had completed her syringe exchange transaction, an interviewer approached the woman to describe the study and invite her to participate, explaining that participation was voluntary and not a condition of using SEP services. If the woman was interested in participating, the interviewer then screened for study eligibility. Eligibility criteria were self-reported age greater than 17 years, history of drug injection during the preceding 30 days, and syringe exchange at that site on the day of recruitment. A female IDU accompanying a male syringe exchanger was considered eligible if syringes he exchanged were also for her own use, and five women entered the sample under this eligibility criterion. A total of 190 women were recruited and 163 (86%) agreed to participate. Most who declined cited lack of time, and they did not differ significantly from those who agreed to participate by observed ethnicity or recruitment venue. Two women chose to terminate the interview before completion and these interviews were subsequently excluded from analysis. An additional 12 interviews were excluded because of eligibility criteria or because they were repeated interviews, leaving a total sample size of 149. All interviews were conducted between May and September 1997.

Data Collection

After providing informed consent, participants accompanied the interviewer to a nearby quiet café or fast food restaurant to complete a 30-40 minute face-to-face survey. Data collection occurred during hours of SEP operations, so that the study sample was representative of persons attending SEPs. After completion, participants were offered \$20 compensation for time spent in

the study, as well as referrals to medical care, drug and alcohol treatment, emergency housing, and other social services. All study procedures were approved by the Committee on Human Research at the University of California, San Francisco.

Measures

The survey collected information on participants' demographics, health status, drug use, SEP utilization patterns, syringe sources, and sexual behavior. Questions were based on variables used in prior studies of SEP participants in San Francisco (Guydish et al., 1998; Guydish et al., 1995) with additional variables of interest submitted by an all-female community advisory board. The survey was pre-tested with 5 female IDU using the study procedures described above.

Sociodemographic variables included age, race, education, housing, residence with other IDUs ("do you live with anyone else who injects drugs"), and incarceration. Health variables included self-reported health status ("how do you rate your health?"), insurance status, health care utilization, HIV testing and infection status, and lifetime prevalence of selected medical conditions. We also collected data on recent (12-month) history of physical and sexual assault.

Drug use variables included the frequency and types of injected and non-injected drugs, drug treatment, and injecting partners and practices. Syringe sharing was defined as the borrowing or lending of a used syringe in the prior 30 days. Other injection-related risk behavior in the past 30 days included the number of syringe-sharing occasions, number of sharing partners, order of sharing, bleaching when sharing, and sharing ancillary injection equipment, such as cookers, cottons, and rinse water.

SEP-specific variables included the duration of SEP exposure, categorized as new (less than one year), moderate (1-5 years), and long-term (> 5 years), and the frequency of SEP attendance

in the prior month (dichotomized as weekly or more vs. less than weekly), as well as time spent and services received there. Syringe source variables included self-reported number of syringes owned (“how many needles do you own right now?”) dichotomized as more than twenty vs. twenty or less, percent of syringes obtained from exchange dichotomized as 100% (SEP sole source of syringes) vs. <100% (sources of syringes other than SEPs), number of times use each syringe, dichotomized as 1 (single use) vs. > 1 (syringe re-use), and perceived access to new syringes (“can you get enough needles to use each needle one time only?” Yes/No).

Sexual behavior variables included the number, gender, and type of sex partners (main, casual, and sex-trade) in the last thirty days, as well as types of sex (vaginal, anal and oral sex) practiced in the last thirty days. We operationally defined “sex trade” as transactions in which vaginal, anal, or oral sex was traded for drugs, money, or a place to stay. Percent condom use in the preceding 30 days for oral, vaginal, and anal sex were assessed for sex with male partners. Higher risk sexual behavior was defined as less than 100% condom use AND more than one sexual partner in the prior 30 days.

Statistical Analysis

Survey data were analyzed to describe the characteristics of female IDU attending SEPs and to examine factors associated with syringe sharing. Summary statistics included frequency tables for categorical variables and medians and interquartile ranges (IQRs) for continuous variables. Continuous variables were categorized for frequency tables using logical cutoffs. Bivariate associations between predictor variables and outcome variables were analyzed using the Chi-Square test of association or Fisher’s Exact test for small cell sizes. The Mantel-Haenszel Chi-Square was used to test ordinal bivariate associations. We examined the independent effects of

the predictor variables on recent needle sharing using multivariate logistic regression (Hosmer and Lemeshow, 1989). Variables selected for inclusion in multivariate models were those found to have a Chi-Square p-value < 0.05 on bivariate analyses or considered potential confounders based on expected biologic and behavioral inference. Multivariate models were evaluated using logistic regression methods. The final model was constructed with significant predictors entered simultaneously. Adjusted odds ratios (ORs) and 95% confidence intervals are reported for the model. All statistical analyses were performed using the Statistical Analysis System (SAS) version 6.12 statistical package for IBM-PC.

RESULTS

Baseline Characteristics of Female Syringe Exchangers

Sociodemographics and health status. Among the 149 participants enrolled, the median age was 38 years (IQR = 28-45) and 50% were women of color (26% African American, 12% Latina, and 13% another non-white ethnicity, including 3% Native American, 1% Asian, 1% Pacific Islander, and 8% “Other Race”; Table 1). Most had a high school education and lived currently with another IDU. Nearly half were currently homeless, and as many had been incarcerated during the last two years. Most of the 63 homeless respondents reported currently staying in hotel rooms (37%), on the streets (33%) or with a friend (21%); a small proportion stayed with family (5%) or in a shelter (3%). Few (15%) participants reported full or part-time employment, while 63% reported illegal income sources. The most commonly reported income-generating strategies were under-the-table jobs (48%), drug sales (42%), prostitution (36%), and panhandling (35%). Most respondents (83%) had previously been pregnant, although fewer (59%) reported having children of any age. Thirty seven percent had children under 18 years old, but of these 55 women,

only 15 (27%) currently lived with their children. One third (33%) of women reported a physical assault and 11% percent reported a sexual assault in the prior year.

When asked to rate their health, few women (5%) reported excellent health status, and more than half (54%) reported either fair or poor health (data not shown). Two-thirds had no health insurance, yet nearly all sought health care in the prior year, primarily from free clinics (68%) and emergency departments (63%), but also from SEPs offering medical care (33%). Nearly all (96%) women had been previously tested for HIV and most had received an HIV test within the last 12 months (Table 1). The median number of prior HIV tests was six (IQR=3-10). Nine women (6%) reported they were HIV-positive, half of whom had been diagnosed in the preceding year. Few respondents knew about hepatitis C virus (HCV), and only 22% reported known HCV infections. The most common prior health conditions were pregnancy (83%), injection-related skin and soft tissue infections (70%), drug overdose (59%), and sexually transmitted infections (STIs) (55%).

Drug use behavior. The median age of first injection was 20 years (IQR = 17-25), and 42% reported a family member injecting drugs while they were growing up. Many (73%) reported a history of drug treatment and methadone detox (47%), methadone maintenance (36%) and outpatient (34%) were the most commonly accessed modalities. Almost two-thirds (64%) had entered treatment voluntarily at least once, although 22% reported at least one treatment episode mandated by the criminal justice system. Few (14%) were in treatment at the time of interview and 54% reported interest in entering treatment if a slot were available. Most women were frequent heroin injectors (Table 2). Most (62%) reported a main injecting partner, someone with whom they usually purchased, prepared, and injected their drugs. Several (36%) reported more than one injecting partner in the prior month.

Table 1. Selected sociodemographic and health characteristics, N=149

Variable	N (%)	Syringe sharing N (%)	p-value
All	149 (100)	52 (35)	--
Age (median 38 years, IQR=28-45)			
>=30	108 (72)	29 (27)	.001
18-29	41 (28)	23 (56)	ns
Ethnicity			
White	74 (50)	32 (43)	.034
Non-white	75 (50)	20 (27)	ns
Education			
>= High School	99 (67)	31 (31)	ns
< High School	50 (33)	21 (42)	ns
Lives with IDU	98 (66)	43 (44)	.001
Homeless	63 (43)	32 (51)	.0003
Recent incarceration	65 (44)	31 (48)	.003
HIV test in prior year (n=141)	101 (72)	30 (30)	.045
Selected lifetime health conditions			
HIV/AIDS	9 (6)	2(1)	ns
Hepatitis C virus	31 (22)	13 (42)	ns
Pregnancy	124 (83)	39 (31)	.049
Skin or soft tissue infection	105 (70)	33 (31)	ns
Drug overdose	88 (59)	34 (39)	ns
Sexually transmitted infection	81 (55)	35 (43)	.024
Physical assault in last year	49 (33)	22 (45)	ns
Sexual assault in last year	17 (11)	10 (59)	.028
Illegal Source of Income	94 (63)	35 (37)	ns
Any Children	88 (59)	25 (28)	.038
Family history of IDU	62 (42)	30 (48)	.003

Fifty-two participants (35%) reported sharing a syringe in the preceding 30 days (Table 2). Of these, few (24%) consistently bleached their syringes between uses, and the majority (71%) used the syringe after their syringe-sharing partner (data not shown). Twenty-seven women (18%) reported sharing syringes on more than five occasions in the preceding 30 days, and 14 (9%) reported more than one syringe-sharing partner. Many participants reported inconsistent cleansing of the injection site and ancillary equipment sharing in the prior 30 days, and this was highly correlated with recent syringe sharing (Table 2).

SEP utilization and syringe sources. Most women (83%) had been attending SEPs for more than one year, and many attended at least weekly (Table 2). They arrived primarily on foot (72%), followed by public transportation (16%) (data not shown). Respondents from the women-only SEP spent significantly more time there than respondents from SEP sites that served men and women together (40 vs. 10 minutes; $p=0.0001$). On the day of recruitment, respondents exchanged an average of 33 needles (range=1-400). Most exchanged for themselves, but half (54%) also exchanged syringes for others. Respondents also reported obtaining other services at SEPs, including other safer injection supplies, i.e., cotton, alcohol wipes, bleach (91%), condoms (81%), emotional support (68%), food (38%), health care (33%), and clothing (23%).

SEPs were the sole source of new syringes for most participants, and the median number of syringes currently in possession was twenty (Table 2). During the 16-week study period, women exchanged 172,000 syringes at SFAF-HPP sites (personal communication, SFAF-HPP). Half the women (53%) felt they had access to enough syringes to use a brand new needle for each injection, but few (33%) reported one-time use. Most women (67%) re-used their own syringes and deployed each an average of three times before it was discarded or exchanged.

Table 2. Selected drug use behavior in last 30 days and SEP utilization, N=149

Variable	N (%)	Syringe sharing N (%)	p-value
All	149 (100)	52 (35)	
Frequency of injection			
Less than daily (0-30)	54 (36)	14 (26)	ns
Daily or more (>30)	95 (64)	38 (40)	.083
Drugs injected			
Heroin	128 (86)	44 (34)	ns
Amphetamine	51 (34)	24 (47)	.025
Cocaine	28 (19)	11 (39)	ns
Main injecting partner	92 (62)	38 (41)	.037
Number of injecting partners, n=148			
0-1	94 (64)	24 (26)	ns
>1	54 (36)	28 (52)	.026
Shared cooker, cotton, or rinse water	91 (61)	44 (48)	.001
Cleaned skin before injection			
Always	57 (38)	10 (18)	ns
Not always	92 (62)	42 (46)	.0005
SEP exposure, n=144			
Long-term (>5 years)	49 (34)	16 (33)	ns
Moderate (1-5 years)	71 (49)	27 (38)	ns
New (< 1 year)	24 (17)	7 (29)	ns
SEP attendance \geq weekly, n=146	103 (71)	31 (30)	ns
Syringes only from SEP, n=148	130 (88)	41 (32)	.014
Number of syringes owned			
>20	71 (48)	18 (25)	ns
\leq 20	76 (52)	33 (43)	.021
Syringe re-use	100 (67)	47 (47)	.001

Sexual behavior. Sixty percent of the women identified as heterosexual, 20% bisexual, and 9% lesbian; 73% reported steady sex partners, 51% reported IDU sex partners, and 31% reported sex trade partners (Table 3). Ninety-nine (67%) participants reported vaginal, anal, or oral sex with a man in the prior month. While only 30% of respondents reported consistent condom use, women with sex trade partners were more likely to report consistent condom use than women with non-paying partners (67% vs. 11%; $p=0.001$). Seventeen percent of all respondents reported less than 100% condom use AND more than one sexual partner in the prior 30 days.

Correlates of Syringe Sharing. On bivariate analysis, sociodemographic variables associated with recent syringe sharing were age under 30 years, white race, living with another IDU, current homelessness, incarceration, recent sexual assault, having any children and having a family history of IDU (Table 1). Education, employment, and illegal source of income were not significantly associated with recent needle sharing. Health variables associated with recent syringe sharing were history of an STI and an HIV test within the preceding year. A prior pregnancy was inversely associated with syringe sharing. Drug use variables associated with recent syringe sharing included injection of amphetamine, a main injecting partner, number of injecting partners, sharing ancillary injection equipment, and inconsistent skin cleansing prior to drug injection (Table 2). Recent syringe sharing also was associated with obtaining new syringes from sources other than SEPs, possessing fewer syringes, and re-use of one's own syringes (Table 2). There was no association between recent syringe sharing and SEP exposure or frequency of SEP attendance. Sexual variables associated with recent syringe sharing included having an IDU sex partner in the prior thirty days (Table 3). In a multivariate logistic regression model, recent syringe sharing was associated with younger age, current homelessness, and an IDU sex partner (Table 4).

Table 3. Selected sexual behavior in prior 30 days, N=149

Variable	N (%)	Syringe sharing N (%)	p-value
All	149 (100)	51 (34)	
Steady sex partner	109 (73)	37 (34)	ns
Casual sex partner	57 (38)	22 (39)	ns
Sex trade partner	46 (31)	16 (35)	ns
IDU sex partner (n=144)	74 (51)	38 (51)	0.001
Anal, vaginal, or oral sex with male	99 (67)	41 (41)	ns
Higher risk sex*			
Yes	26 (17)	11 (42)	ns
No	123 (83)	82 (67)	ns

*Higher risk sex = less than 100% condom use AND > 1 sexual partner in the prior 30 days.

Table 4. Logistic regression model of syringe sharing in prior 30 days.

Variable	Adjusted odds ratio	95% Confidence Interval
Younger Age	3.5	1.52-8.21
Current Homelessness	3.8	1.71-8.44
IDU Sex Partner	4.01	1.77-9.04

DISCUSSION

In this study, female IDU in San Francisco were shown to have precarious dual risk for HIV infection, not only via contaminated injection equipment but also through sexual contact with IDU or other high-risk partners. Despite regular and frequent SEP use, one-third (35%) reported sharing a used syringe for drug injection in the prior month. This was higher than the rate of

needle sharing (21%) reported by a mixed gender sample of San Francisco exchangers in 1993 (Sears et al., 2001), although it resembled the rate (36%) reported by a mixed gender sample in 1992 (Guydish et al., 1998). In our study, female syringe sharers were more likely to be young, homeless, and have a sexual partner who was also an IDU.

Previous research has identified young IDU as at high risk for HIV infection (Bailey et al., 2003; Guydish et al., 2000; Hahn et al., 2002). Younger age has been consistently associated with higher rates of injection risk behavior and blood-borne infection (Battjes et al., 1992; Fennema et al., 1997; Fuller et al., 2004; Garfein et al., 1996; van Ameijden et al., 1993) and one study found that young women IDU in San Francisco engaged in injection-related risk behaviors at higher rates than young men IDU (Evans et al., 2003). Our results suggest that the association of younger age and HIV risk persists among women who use syringe exchange programs. Young IDU are typically homeless runaways, who are often involved in the underground street economy. They make their living through prostitution, drug sales, theft, panhandling, pornography, or selling stolen property (Office of National Drug Control Policy, 2001). They often experienced a large number of negative events prior to leaving home and are more likely to have experienced traumatic life events, such as intergenerational drug abuse, forced institutionalization, and survival sex (Martinez et al., 1998).

We found that the life experiences of female syringe exchangers in San Francisco commonly include intergenerational drug use, homelessness, pregnancy, and incarceration. Homelessness has been associated with HIV infection among IDU in other North American cities (Strathdee et al., 1997), and we found an association between homelessness and continued syringe sharing in our study. State paraphernalia laws that criminalize the possession of syringes for illicit drug use may contribute to this risk factor by discouraging IDU to carry their own sterile syringes and

homeless IDU may make practical choices to borrow syringes so as to avoid arrest for syringe possession.

Our finding that recent syringe sharing occurs more often among female syringe exchangers, who report sex with another IDU, highlights the complexity of dual risk for women who use drugs and the challenge this poses to HIV prevention programs. Previous research supports our finding that women's syringe sharing behavior is frequently embedded in sexual relations (Booth, 1995; Davies et al., 1996; Dwyer et al., 1994; Freeman et al., 1994; Gollub et al., 1998; Latkin et al., 1998; MacRae and Aalto, 2000; Sherman et al., 2001; Tortu et al., 2003). As women have historically assumed positions of deference and care-giving in both drug-using networks and the larger society, it is unsurprising that most female syringe sharers in our study reported injecting after their drug-using partners with the same needle. In contrast to a study of female SEP clients in five U.S. cities (Paone et al., 1999), we found that participants engaging in sex work did not report greater injection risk than non-sex workers. Participants in Paone's study were more likely to be African-American, Latina, currently in drug treatment, and currently housed than participants in this study, and these differences may contribute to the different relationship between sex work and injection risk reported here.

There are several limitations to our analyses. First, our small sample size may have limited our power to detect small but potentially important differences between study groups. Second, while some studies have shown that self-reported data by IDU are valid, others have suggested that IDU underreport risk behavior, particularly those related to illegal activities (Des Jarlais et al., 1999; McCusker et al., 1992). Our use of trained female interviewers with extensive prior experience working with female drug users may have mitigated this bias. In addition, our sample's self-reported HIV prevalence of 6% is consistent with previously estimated rates for

women drug users in San Francisco (SF-HPPC, 1996) and on the West Coast (Prevots et al., 1996), supporting the validity of this self-reported data. Third, this study focused on one subset of female IDUs – female syringe exchangers – and additional research is needed to investigate the risk behaviors of female IDU who do not use SEP. Fourth, our analysis relied upon linear models which, although standard in the field, have recently been criticized as inappropriate for understanding the complex, multi-dimensional, and non-linear processes of substance abuse (Buscema, 1998; Buscema, 2002). Finally, the data presented in this study were collected in 1997 and may not reflect the risk behaviors of women exchangers in San Francisco today. In particular, the women’s needle exchange site described here closed in 2002, following budget cuts and decreased site utilization, possibly driven by major gentrification and the relocation of IDUs to other neighborhoods. The ancillary services that were provided at the women’s sites (free medical care, HIV testing, free food and outreach workers) are now provided at most San Francisco SEP sites. Despite these changing circumstances, this study contributes important data to the limited number of published studies of HIV-risk among female IDU who use SEPs.

While wide access to sterile syringes is an important strategy to reduce HIV transmission among IDU, syringe exchange alone cannot eradicate risky injection by female IDU. Many female SEP clients engage in selective risk taking, i.e., choosing to share syringes with sexual partners with whom they have steady relationships and with whom they also do not use condoms (Valente and Vlahov, 2001). Interventions that address injection risk behavior between sex partners, as well as the potential influence of traditional gender roles, violence, and drug use needs on the dynamics of these relationships, are needed for young and novice female IDU. These interventions might focus on negotiation and communication skills that promote sterile syringe use, as well as condom use, in a setting that promotes rather than challenges trust and

intimacy. Syringe sharing in the era of needle exchange also appears to occur among those most vulnerable to infection, i.e., the young and homeless. On a structural level, interventions that address the greater health risks associated with new-onset injection and homelessness are also urgently needed. Programs that increase access to clean syringes may operate not only to reduce risk of infectious disease, but also as an avenue to drug treatment and other health and social services. For SEPs to succeed as a bridge to treatment, treatment systems may also require change to increase access and availability of services, and to reduce stigma associated with injection drug use. Policy initiatives mandating treatment as an alternative to incarceration for drug-involved offenders, like those currently operating in Arizona and California (Administrative Office of the Courts, 1999; Speigman, Klein, Miller, & Noble, 2003), offer one example of this type of system change.

Despite a host of competing concerns for active female injectors, SEPs in San Francisco have evolved into points of regular contact with most women visiting on a weekly basis. Few other HIV prevention programs report such regular voluntary attendance. SEPs, and female-focused SEPs in particular, may offer an ideal community platform to apply new intervention strategies toward women drug users at continued risk.

REFERENCES

- Astemborski, J., Vlahov, D., Warren, D., Solomon, L., Nelson, K. E. (1994). The trading of sex for drugs or money and HIV seropositivity among female intravenous drug users. *Am J Public Health* 84(3): 382-387.
- Bailey, S. L., Huo, D., Garfein, R. S., Ouellet, L. J. (2003). The use of needle exchange by young injection drug users. *J Acquir Immune Defic Syndr* 34(1): 67-70.

- Battjes, R. J., Leukefeld, C. G., Pickens, R. W. (1992). Age at first injection and HIV risk among intravenous drug users. *Am J Drug Alcohol Abuse* 18(3): 263-273.
- Bennett, G. A., Velleman, R. D., Barter, G., Bradbury, C. (2000). Gender differences in sharing injecting equipment by drug users in England. *AIDS Care* 12(1): 77-87.
- Bluthenthal, R. N., Kral, A. H., Erringer, E. A., Edlin, B. R. (1998). Use of an illegal syringe exchange and injection-related risk behaviors among street-recruited injection drug users in Oakland, California, 1992 to 1995. *J Acquir Immune Defic Syndr Hum Retrovirol* 18(5): 505-511.
- Booth, R. E. (1995). Gender differences in high-risk sex behaviours among heterosexual drug injectors and crack smokers. *Am J Drug Alcohol Abuse* 21(4): 419-432.
- Bruneau, J., Lamothe, F., Soto, J., Lachance, N., Vincelette, J., Vassal, A., Franco, E. L. (2001). Sex-specific determinants of HIV infection among injection drug users in Montreal. *CMAJ* 164(6): 767-773.
- Buscema, M. (1998). Artificial neural networks and complex social systems. I. Theory. *Subst Use Misuse* 33(1): v-xvii, 1-220.
- Buscema, M. (2002). A brief overview and introduction to artificial neural networks. *Subst Use Misuse* 37(8-10): 1093-1148.
- Centers for Disease Control and Prevention (2001). Update: syringe exchange programs--United States, 1998. *Morb Mortal Wkly Rep* 50(19): 384-387.
- Centers for Disease Control and Prevention (2002). Update: AIDS--United States, 2000. *Morb Mortal Wkly Rep* 51(27): 592-595.
- Centers for Disease Control and Prevention (2003). HIV/AIDS Surveillance Report, 2002. 14: 1-40.

- Chaisson, R. E., Bacchetti, P., Osmond, D., Brodie, B., Sande, M. A., Moss, A. R. (1989). Cocaine use and HIV infection in intravenous drug users in San Francisco. *JAMA* 261(4): 561-565.
- Chitwood, D. D., Griffin, D. K., Comerford, M., Page, J. B., Trapido, E. J., Lai, S., McCoy, C. B. (1995). Risk factors for HIV-1 seroconversion among injection drug users: a case-control study. *Am J Public Health* 85(11): 1538-1542.
- Davies, A. G., Dominy, N. J., Peters, A. D., Richardson, A. M. (1996). Gender differences in HIV risk behaviour of injecting drug users in Edinburgh. *AIDS Care* 8(5): 517-527.
- Davis, S. F., Rosen, D. H., Steinberg, S., Wortley, P. M., Karon, J. M., Gwinn, M. (1998). Trends in HIV prevalence among childbearing women in the United States, 1989-1994. *J Acquir Immune Defic Syndr Hum Retrovirol* 19(2): 158-164.
- Des Jarlais, C., Perlis, T., Friedman, S. R., Chapman, T., Kwok, J., Rockwell, R., Paone, D., Milliken, J., Monterroso, E. (2000). Behavioral risk reduction in a declining HIV epidemic: injection drug users in New York City, 1990-1997. *Am J Public Health* 90(7): 1112-1116.
- Des Jarlais, D. C., Marmor, M., Friedmann, P., Titus, S., Aviles, E., Deren, S., Torian, L., Glebatis, D., Murrill, C., Monterroso, E., Friedman, S. R. (2000). HIV incidence among injection drug users in New York City, 1992-1997: evidence for a declining epidemic. *Am J Public Health* 90(3): 352-359.
- Des Jarlais, D. C., Paone, D., Milliken, J., Turner, C. F., Miller, H., Gribble, J., Shi, Q., Hagan, H., Friedman, S. R. (1999). Audio-computer interviewing to measure risk behaviour for HIV among injecting drug users: a quasi-randomised trial. *Lancet* 353(9165): 1657-1661.

- Dwyer, R., Richardson, D., Ross, M. W., Wodak, A., Miller, M. E., Gold, J. (1994). A comparison of HIV risk between women and men who inject drugs. *AIDS Educ Prev* 6(5): 379-389.
- Evans, J. L., Hahn, J. A., Page-Shafer, K., Lum, P. J., Stein, E. S., Davidson, P. J., Moss, A. R. (2003). Gender differences in sexual and injection risk behavior among active young injection drug users in San Francisco (the UFO Study). *J Urban Health* 80(1): 137-146.
- Fennema, J. S., Van Ameijden, E. J., Van Den Hoek, A., Coutinho, R. A. (1997). Young and recent-onset injecting drug users are at higher risk for HIV. *Addiction* 92(11): 1457-1465.
- Freeman, R. C., Rodriguez, G. M., French, J. F. (1994). A comparison of male and female intravenous drug users' risk behaviors for HIV infection. *Am J Drug Alcohol Abuse* 20(2): 129-157.
- Friedland, G. H., Harris, C., Butkus-Small, C., Shine, D., Moll, B., Darrow, W., Klein, R. S. (1985). Intravenous drug abusers and the acquired immunodeficiency syndrome (AIDS). Demographic, drug use, and needle-sharing patterns. *Arch Intern Med* 145(8): 1413-1417.
- Fuller, C. M., Ompad, D. C., Galea, S., Wu, Y., Koblin, B., Vlahov, D. (2004). Hepatitis C incidence--a comparison between injection and noninjection drug users in New York City. *J Urban Health* 81(1): 20-24.
- Garfein, R. S., Vlahov, D., Galai, N., Doherty, M. C., Nelson, K. E. (1996). Viral infections in short-term injection drug users: the prevalence of the hepatitis C, hepatitis B, human immunodeficiency, and human T- lymphotropic viruses. *Am J Public Health* 86(5): 655-661.

- Gibson, D. R., Flynn, N. M., Perales, D. (2001). Effectiveness of syringe exchange programs in reducing HIV risk behavior and HIV seroconversion among injecting drug users. *AIDS* 15(11): 1329-1341.
- Gollub, E. L., Rey, D., Obadia, Y., Moatti, J. P. (1998). Gender differences in risk behaviors among HIV+ persons with an IDU history. The link between partner characteristics and women's higher drug-sex risks. The Manif 2000 Study Group. *Sex Transm Dis* 25(9): 483-488.
- Guydish, J., Brown, C., Edgington, R., Edney, H., Garcia, D. (2000). What are the impacts of needle exchange on young injectors? *AIDS and Behavior* 4: 137-146.
- Guydish, J., Bucardo, J., Clark, G., Bernheim, S. (1998). Evaluating needle exchange: a description of client characteristics, health status, program utilization, and HIV risk behavior. *Subst Use Misuse* 33(5): 1173-1196.
- Guydish, J. R., Clark, G., Garcia, D. (1995). Evaluation of needle exchange using street-based survey methods. *J Drug Issues* 25: 33-41.
- Hader, S. L., Smith, D. K., Moore, J. S., Holmberg, S. D. (2001). HIV infection in women in the United States: status at the Millennium. *JAMA* 285(9): 1186-1192.
- Hahn, J. A., Page-Shafer, K., Lum, P. J., Bourgois, P., Stein, E., Evans, J. L., Busch, M. P., Tobler, L. H., Phelps, B., Moss, A. R. (2002). Hepatitis C virus seroconversion among young injection drug users: relationships and risks. *J Infect Dis* 186(11): 1558-1564.
- Hosmer, D. W. and Lemeshow, S. (1989). Applied Logistic Regression. New York, John Wiley & Sons.
- Jaffe, H. (2004). Public health. Whatever happened to the U.S. AIDS epidemic? *Science* 305(5688): 1243-1244.

- Kral, A. H., Bluthenthal, R. N., Lorvick, J., Gee, L., Bacchetti, P., Edlin, B. R. (2001). Sexual transmission of HIV-1 among injection drug users in San Francisco, USA: risk-factor analysis. *Lancet* 357(9266): 1397-1401.
- Kral, A. H., Lorvick, J., Bluthenthal, R. N., Watters, J. K. (1997). HIV risk profile of drug-using women who have sex with women in 19 United States cities. *J Acquir Immune Defic Syndr Hum Retrovirol* 16(3): 211-217.
- Latkin, C. A., Mandell, W., Knowlton, A. R., Doherty, M. C., Vlahov, D., Suh, T., Celentano, D. D. (1998). Gender differences in injection-related behaviors among injection drug users in Baltimore, Maryland. *AIDS Educ Prev* 10(3): 257-263.
- Lurie, P. (1995). When science and politics collide: the federal response to needle-exchange programs. *Bull N Y Acad Med* 72(2): 380-396.
- MacRae, R. and Aalto, E. (2000). Gendered power dynamics and HIV risk in drug-using sexual relationships. *AIDS Care* 12(4): 505-515.
- Magura, S., Kang, S. Y., Shapiro, J., O'Day, J. (1993). HIV risk among women injecting drug users who are in jail. *Addiction* 88(10): 1351-1360.
- Martinez, T. E., Gleghorn, A., Marx, R., Clements, K., Boman, M., Katz, M. H. (1998). Psychosocial histories, social environment, and HIV risk behaviors of injection and noninjection drug using homeless youths. *J Psychoactive Drugs* 30(1): 1-10.
- McCusker, J., Stoddard, A., McCarthy, E. (1992). The validity of self-reported HIV antibody test results. *Am J Public Health* 82: 567-569.
- Miller, M. and Neaigus, A. (2001). Networks, resources and risk among women who use drugs. *Soc Sci Med* 52(6): 967-978.

- Moss, A. R., Vranizan, K., Gorter, R., Bacchetti, P., Watters, J., Osmond, D. (1994). HIV seroconversion in intravenous drug users in San Francisco, 1985-1990. *AIDS* 8(2): 223-231.
- Office of National Drug Control Policy (2001). Pulse Check: National Trends in Drug Abuse, Executive Office of the President; Office of Programs, Budget, Research, and Evaluation.
- Paone, D., Cooper, H., Alperen, J., Shi, Q., Des Jarlais, D. C. (1999). HIV risk behaviours of current sex workers attending syringe exchange: the experiences of women in five US cities. *AIDS Care* 11(3): 269-280.
- Paone, D., Des Jarlais, D. C., Caloir, S., Jose, B., Shi, Q., Friedman, S. R. (1997). Continued risky injection subsequent to syringe exchange use among injection drug users in New York City. *AIDS Educ Prev* 9(6): 505-510.
- Prevots, D. R., Allen, D. M., Lehman, J. S., Green, T. A., Petersen, L. R., Gwinn, M. (1996). Trends in human immunodeficiency virus seroprevalence among injection drug users entering drug treatment centers, United States, 1988-1993. *Am J Epidemiol* 143(7): 733-742.
- Schoenbaum, E. E., Hartel, D., Selwyn, P. A., Klein, R. S., Davenny, K., Rogers, M., Feiner, C., Friedland, G. (1989). Risk factors for human immunodeficiency virus infection in intravenous drug users. *N Engl J Med* 321(13): 874-879.
- Sears, C., Weltzien, E., Gydish, J. (2001). A Cohort Study of Syringe Exchangers and Nonexchangers in San Francisco. *Journal of Drug Issues* 31(2): 445-464.
- SF-HPPC (1996). Epidemiologic Profile, Chapter 3. San Francisco, San Francisco HIV Prevention and Planning Council.

- Sherman, S. G., Latkin, C. A., Gielen, A. C. (2001). Social factors related to syringe sharing among injecting partners: a focus on gender. *Subst Use Misuse* 36(14): 2113-2136.
- Strathdee, S. A., Galai, N., Safaiean, M., Celentano, D. D., Vlahov, D., Johnson, L., Nelson, K. E. (2001). Sex differences in risk factors for HIV seroconversion among injection drug users: a 10-year perspective. *Arch Intern Med* 161(10): 1281-1288.
- Strathdee, S. A., Patrick, D. M., Currie, S. L., Cornelisse, P. G., Rekart, M. L., Montaner, J. S., Schechter, M. T., O'Shaughnessy, M. V. (1997). Needle exchange is not enough: lessons from the Vancouver injecting drug use study. *AIDS* 11(8): F59-65.
- Tortu, S., McMahon, J. M., Hamid, R., Neaigus, A. (2003). Women's drug injection practices in East Harlem: an event analysis in a high-risk community. *AIDS Behav* 7(3): 317-328.
- Valenciano, M., Emmanuelli, J., Lert, F. (2001). Unsafe injecting practices among attendees of syringe exchange programmes in France. *Addiction* 96(4): 597-606.
- Valente, T. W. and Vlahov, D. (2001). Selective risk taking among needle exchange participants: implications for supplemental interventions. *Am J Public Health* 91(3): 406-411.
- van Ameijden, E. J., Langendam, M. W., Notenboom, J., Coutinho, R. A. (1999). Continuing injecting risk behaviour: results from the Amsterdam Cohort Study of drug users. *Addiction* 94(7): 1051-1061.
- van Ameijden, E. J., Van den Hoek, J. A., Mientjes, G. H., Coutinho, R. A. (1993). A longitudinal study on the incidence and transmission patterns of HIV, HBV and HCV infection among drug users in Amsterdam. *Eur J Epidemiol* 9(3): 255-262.
- Vlahov, D., Des Jarlais, D. C., Goosby, E., Hollinger, P. C., Lurie, P. G., Shriver, M. D., Strathdee, S. A. (2001). Needle exchange programs for the prevention of human

immunodeficiency virus infection: epidemiology and policy. *Am J Epidemiol* 154(12 Suppl): S70-77.

Vlahov, D., Muñoz, A., Anthony, J. C., Cohn, S., Celentano, D. D., Nelson, K. E. (1990).

Association of drug injection patterns with antibody to human immunodeficiency virus type 1 among intravenous drug users in Baltimore, Maryland. *Am J Epidemiol* 132(5): 847-856.

Watters, J. K. (1994). Trends in risk behavior and HIV seroprevalence in heterosexual injection drug users in San Francisco, 1986-1992. *J Acquir Immune Defic Syndr* 7(12): 1276-1281.

Watters, J. K., Estilo, M. J., Kral, A. H., Lorvick, J. J. (1994). HIV infection among female injection-drug users recruited in community settings. *Sex Transm Dis* 21(6): 321-328.

Wood, E., Tyndall, M. W., Spittal, P. M., Li, K., Hogg, R. S., Montaner, J. S., O'Shaughnessy, M. V., Schechter, M. T. (2002). Factors associated with persistent high-risk syringe sharing in the presence of an established needle exchange programme. *AIDS* 16(6): 941-943.