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ORIGINAL PAPER

Distributive Syringe Sharing and Use of Syringe Services Programs (SSPs) Among Persons Who Inject Drugs

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Abstract
Monitoring distributive syringe sharing (DSS) and syringe services program (SSP) use among persons who inject drugs (PWID) is important for HIV prevention. PWID aged ≥ 18 in 20 US cities were recruited for National HIV Behavioral Surveillance in 2015 using respondent-driven sampling, interviewed and offered HIV testing. Bivariate and multivariable analyses via log-linked Poisson regression with generalized estimating equations were conducted to examine associations between demographic and behavioral variables and DSS. Effect of SSP use on DSS by HIV sero-status was assessed by including an interaction between SSP and sero-status. Analyses were adjusted for sampling design. Among 10,402 PWID, 42% reported DSS. DSS was less likely to be reported among HIV-positive compared to HIV-negative PWID (aPR = 0.51, CI 0.45–0.60), and among those who primarily obtained syringes from SSPs versus those who did not (aPR = 0.82, 95% CI 0.77–0.88). After adjustment, those who primarily used SSPs were less likely to report DSS than those who did not among both HIV-negative PWID (aPR = 0.84, 95% CI 0.78–0.90) and HIV-positive PWID (aPR = 0.54, 95% CI 0.39–0.75). Findings support expansion of SSPs, and referrals to SSPs by providers working with PWID.

Keywords Syringe services programs · Distributive syringe sharing · Injection drug

Introduction

Persons who inject drugs (PWID) are at high risk of contracting blood-borne viruses, such as human immunodeficiency virus (HIV) and hepatitis C virus (HCV) due to risky injection practices [1]. In the United States, 9% of human immunodeficiency virus (HIV) infections diagnosed in 2016 were attributed to injection drug use [2]. Surveillance data show that reported cases of acute HCV infection have increased 3.5-fold from 2010 through 2016, with an estimated 41,200 new HCV infections in 2016 [3]. Recent trends indicate that there is an increase in diagnoses of acute HCV infection among young persons who have a history of injection drug use, and greater increases in non-urban areas than in urban areas [4].

Distributive syringe sharing (DSS), the passing of used syringes to another person, from an infected to a non-infected person is a central source of onward transmission among PWID for blood-borne viruses such as HIV and HCV. While DSS is extremely risky, it is also commonplace. One study of young adult PWID found that almost half (46%) reported DSS in the past 3 months, and more than one-third of HIV-positive PWID engaged in the behavior [5]. Another study among HIV-positive PWID found that 18% of participants reported lending syringes to HIV-negative/unknown status injection partners [6]. The percentage of PWID reporting DSS was even higher among HCV-positive PWID; in one intervention study 55% of HCV antibody positive PWID reported DSS at baseline [7]. Despite the high prevalence of DSS among PWID and the risk of transmission of blood-borne infections, studies on syringe sharing typically focus on receptive sharing (the use of used syringes), while studies on DSS prevention remain limited.

Disclaimer The findings and conclusions in this paper are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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Syringe Services Programs (SSPs) are a critical component to preventing transmission of HIV and other blood-borne infections among PWID [8]. There is over 25 years of evidence to support their effectiveness in reducing injection risk behaviors [1], [9–11] and reducing HIV [12–14], and HCV [15]. PWID who use SSPs report less DSS than those who do not use them [16], and acquiring a higher proportion of syringes from safe sources such as an SSP or pharmacy is associated with decreased odds of DSS among young PWID, a particularly vulnerable group [5]. Additionally, obtaining syringes from an SSP is protective against improper syringe disposal [17, 18], especially among HIV-positive individuals [19, 20]. Implementing interventions designed to prevent PWID with blood-borne infections from distributing their syringes to others is an important public health measure that could reduce subsequent transmission of HIV and HCV [5]. However, few studies have examined the association of SSPs with DSS across multiple, geographically diverse areas, and among HIV-positive PWID.

We document factors associated with DSS among PWID recruited from 20 geographically diverse cities in the US and assess the association between accessing SSPs and DSS by HIV serostatus. Results of this study can inform the design of intervention programs to prevent PWID with blood-borne infections from distributing their used syringes to others.

Methods

Sampling and Eligibility

Data for this analysis were collected in 2015 during the fourth cycle of National HIV Behavioral Surveillance (NHBS) among PWID. Methods for NHBS are described in detail elsewhere [21]. In short, NHBS was conducted in 20 metropolitan statistical areas (MSAs), which represented approximately 45% of all diagnosed HIV infections in urban areas with a population of at least 500,000 in 2014 [22]. Participation in the cycle was limited to persons who reported injecting a drug that was not prescribed for them during the past 12 months, and presented physical evidence of recent injection (e.g., track marks) or adequately described their injection practices.

Participants were recruited using respondent-driven sampling (RDS) [21, 23]. Recruitment started with a limited number of initial participants, called 'seeds', who were purposefully chosen by project staff. Eligible seeds were asked to recruit, using a system of coded coupons, up to 5 persons whom they knew personally and who injected drugs. Those persons, in turn, completed the interview and recruited others. Recruitment by eligible participants continued in successive waves until sample size was reached, or until a predetermined cut-off date.

Trained interviewers administered a standardized questionnaire using portable computers to collect information about behavioral risks for HIV infection, HIV testing history, and use of HIV prevention services. Blood-based rapid HIV testing was performed in the field for all consenting participants, and blood specimens were collected for supplemental laboratory-based testing. Persons were eligible if they were aged at least 18 years, residents of the city, able to complete the interview in English or Spanish, and able to provide informed consent. Participants received incentives for completing the interview and HIV testing. Participants who agreed to recruit others received an additional incentive for each recruit (up to 5) who completed the interview. No personally identifying information was collected during enrollment, interview, or HIV testing. Activities for NHBS were approved by the Centers for Disease Control and Prevention [24], [25] and by local institutional review boards for each of the 20 participating cities.

Measures

DSS was the primary outcome of interest for the analyses. DSS is any report in the past 12 months of giving a syringe to someone else to inject after the participant already injected with it. Other important factors in this investigation included the primary use of SSPs for obtaining syringes and HIV serostatus. Participants were considered to use SSPs as their primary source of syringes if they only obtained their syringes from a SSP in the past 12 months, or if a SSP was the most common place where they got their syringes in the past 12 months among all of their sources. HIV serostatus was determined from the valid NHBS test. Participants were considered HIV-negative if they had a non-reactive rapid NHBS HIV test result or a negative laboratory test result if a rapid test was not conducted, and did not report a previous HIV-positive test result. Participants were considered HIV-positive if they had a reactive rapid NHBS HIV test result confirmed by supplemental laboratory-based testing, or a positive result by laboratory-based testing without a rapid HIV test. Variables included demographic characteristics, drug use behaviors, and syringe use behaviors. Household income was dichotomized into at/below versus above the federal poverty level according to U.S. Department of Health and Human Services poverty guidelines 2015 [26]. Homelessness was defined as living on the street, in a shelter, a single-room occupancy hotel, or in a car, at any time during the past 12 months. Time since first injection was calculated based on participant age at first injection and current age. Receptive syringe sharing was defined as injecting with a needle or syringe that someone else had already injected with, and unsafe syringe disposal was defined as disposing of syringes in ways other than putting them in a medical waste container and/or by exchanging them at an SSP.

Hepatitis C diagnosis was measured by asking the participant whether they had ever been told by a health care provider they had Hepatitis C.

Data Analysis

Participants were included in this analysis based on the following criteria: eligible, no missing recruiter information, valid NHBS HIV test, complete interview, and valid responses. Descriptive analysis described participants in terms of their background characteristics, drug use behaviors and syringe use behaviors. Frequencies and percentages are reported for the full sample, and for those who report DSS.

Bivariate analyses via log-linked Poisson regression with generalized estimating equations were conducted to examine associations between demographic characteristics and behavioral variables and DSS as the outcome. Analyses accounted for RDS sampling methodology and the general dependence among observations linked to one another in recruitment networks by clustering on recruitment chain and adjusting for city and self-reported network size. Adjusted prevalence ratios (aPR), and 95% confidence intervals (CIs) are reported.

Multivariable analyses were used to assess the association between DSS as the outcome and the use of SSPs to obtain syringes and HIV serostatus. The association of SSP use and DSS by HIV serostatus was assessed by including an interaction term of SSP by HIV serostatus in the model. Background characteristic variables significant at p-values < 0.05 in bivariate analyses were considered for inclusion as covariates in the multivariable analyses. RDS sampling methodology was accounted for by clustering on recruitment chain and adjusting for city and self-reported network size. Variables were retained and considered statistically significant in the final models at $p < 0.01$. Adjusted prevalence ratios (aPR), and 95% confidence intervals (CIs) are reported. All analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

A total of 10,402 PWID were included in this analysis. The majority of participants were male (72%), 30 years or older (83%), had obtained a GED, high school education or higher (70%), were living at/below the poverty line (78%), and had been homeless in the past 12 months (64%). The overall HIV seroprevalence in the sample was 7%. Additionally, just under half (45%) had ever been told by a health care provider that they had HCV infection. The majority of participants had been injecting longer than 6 years (78%), and the primary drug injected was heroin (74%). The most common source for obtaining syringes was SSPs for 36% of PWID, followed by a pharmacy or drug store (25%), from a friend, relative, or sex partner (19%), and from a syringe or drug dealer, shooting gallery, or off the street (19%). One-third (34%) of PWID reported receptive syringe sharing, and the vast majority of PWID reported at least some unsafe syringe disposal in the past 12 months (81%). Less than half (42%) reported DSS (Table 1).

A total of 4318 participants reported DSS in the past 12 months (Table 2). Females were more likely to report DSS than males (aPR = 1.12, 95% CI 1.05–1.19), as were those less than 30 years old (aPR = 1.41, 95% CI 1.32–1.52), and those who were white (aPR = 1.72, 95% CI 1.48–2.00), Hispanic/Latino (aPR = 1.58, 95% CI 1.39–1.80), or other race/ethnicity (aPR = 1.55, 95% CI 1.30–1.85) as compared to black. PWID who were homeless in the past 12 months were more likely to report DSS than PWID who were not (aPR = 1.51, 95% CI 1.40–1.62), PWID who were incarcerated in the past 12 months were more likely to report DSS than PWID who were not (aPR = 1.35, 95% CI 1.27–1.43). PWID who engaged in unsafe syringe disposal were more likely than PWID who did not unsafely dispose of syringes to report DSS (aPR = 1.79, 95% CI 1.58–2.02). HIV-positive PWID were less likely to report DSS (aPR = 0.51, 95% CI 0.45–0.60) compared to HIV-negative PWID. Persons who initiated injection more than 6 years before the interview were also less likely to report DSS (aPR = 0.84, 95% CI 0.79–0.90) compared to persons who began injecting more recently. Persons who primarily inject powder cocaine (aPR = 0.78, 95% CI 0.70–0.87), crack cocaine (aPR = 0.71, 95% CI 0.52–0.98), or methamphetamine (aPR = 0.67, 95% CI 0.60–0.74) in comparison to heroin were less likely to report DSS. Finally, those who report SSPs as their most common syringe source (aPR = 0.82, 95% CI 0.77–0.88) compared to those who did not were also less likely to report DSS.

Adjusting for gender, age, race/ethnicity, homelessness, and incarceration in the 12 months prior to interview, the association between reporting SSPs as the most common syringe source and DSS was strongest among HIV-positive participants (Table 3). PWID who primarily obtained syringes from SSPs were less likely to report DSS than those who did not primarily obtain syringes from SSPs among both HIV-negative PWID (aPR = 0.84, 95% CI 0.78–0.90) and HIV-positive PWID (aPR = 0.54, 95% CI 0.39–0.75).

Discussion

In this sample of over ten thousand PWID from across 20 geographically diverse communities in the US, DSS was reported by over 40% of participants. We found that DSS was more common among PWID who were younger, female, white, Hispanic or other race compared to black, homeless,

Table 1 Demographic characteristics and behaviors among persons who inject drugs, 2015

	Total	
	n	%
Demographics		
Gender		
Female	2888	28
Male	7460	72
Transgender	52	1
Age[a]		
18–29	1769	17
30 +	8633	83
Race/ethnicity		
Black	3486	34
Hispanic/Latino[b]	2340	23
White	3996	39
Other	558	5
Education		
< High school graduation	3157	30
≥ High school graduation (or equivalent)	7244	70
Household income		
At/below federal poverty level	8020	78
Above federal poverty level	2303	22
Homeless[c], past 12 months		
Yes	6643	64
No	3759	36
Incarcerated, past 12 months		
Yes	3797	37
No	6598	63
Hepatitis C diagnosis, ever[d]		
Yes	4620	45
No	5738	55
HIV sero-status		
Positive	725	7
Negative	9677	93
Drug use behaviors		
Age at first injection[e]		
≤ 18 years	3816	37
> 18 years	6586	63
Years since first injection[f]		
≤ 6 years	2287	22
> 6 years	8052	78
Primary drug injected		
Heroin	7748	74
Speedball	1282	12
Powder cocaine	256	2
Crack cocaine	43	< 1
Methamphetamine	916	9
Prescription opioids[g]	50	< 1
Other	107	1
Syringe source and disposal		
Most common syringe source, past 12 months		
Syringe services program (SSP)	3743	36
Pharmacy or drug store	2576	25
Doctor's office, clinic, or hospital	122	1
Friend, relative, or sex partner	1943	19
Needle or drug dealer, shooting gallery, or off the street	1931	19
Some other place	74	1
Distributive syringe sharing, past 12 months[h]		
Yes	4318	42
No	6073	58
Receptive syringe sharing, past 12 months[i]		
Yes	3485	34
No	6911	66
Any unsafe syringe disposal, past 12 months[j]		
Yes	8407	81
No	1992	19
Total[k]	10,402	100

[a]Age—mean = 43.48 years; SD = 12.35

[b]Hispanics can be of any race

[c]At any time during the past 12 months, lived on the street, in a shelter, a single room occupany hotel, or in a car

[d]Ever been told by a health care provider they had Hepatitis C

[e]Age at first injection—mean = 23.12 years; SD = 8.47

[f]Injection duration—mean = 20.26 years; SD = 15.15

[g]Such as Oxycontin, Vicodin, morphine, or Percocet

[h]Defined as giving a needle the participant had already used to inject drugs with to someone else to inject with

[i]Injecting with a syringe or needle that had already been used by someone else

[j]Syringes were disposed of in ways other than a medical waste container or exchanging them at an SSP

[k]Numbers and totals may not add up to 100% due to missing data and rounding

and among those reporting unsafe syringe disposal. It was less commonly reported among those who were HIV-positive, not recently initiated injectors, and those primarily injecting cocaine, crack, or methamphetamine compared to heroin. Those using SSPs as their primary or only source of syringes were less likely to report DSS and this association was more pronounced among HIV-positive compared to HIV-negative participants.

DSS is a common risk for transmission of HIV and HCV among PWID. The frequency reported in our study (42%) was similar to the percentage of HIV-positive and HIV-negative PWID reporting DSS among a sample of men who have sex with men (MSM) in San Francisco [27]. However, this percentage was slightly lower than what was reported in earlier studies of DSS among non-MSM [5, 6], pointing

Table 2 Distributive syringe sharing among persons who inject drugs, 2015

	Distributive syringe sharing		Bivariate analysis[a]	
	n	%	aPR (95% CI)	*p* value
Demographics				
Gender				
Female	1258	44	1.12 (1.05–1.19)	0.0004
Male	3040	41	Ref	
Transgender	19	37	0.96 (0.69–1.34)	0.8086
Age				
18–29	1019	58	1.41 (1.32–1.52)	< 0.0001
30 +	3299	38	Ref	
Race/ethnicity				
Black	997	29	Ref	
Hispanic/Latino[b]	1063	46	1.58 (1.39–1.80)	< 0.0001
Other	241	43	1.55 (1.30–1.85)	< 0.0001
White	2008	50	1.72 (1.48–2.00)	< 0.0001
Household income				
At/below federal poverty level	3312	41	Ref	
Above federal poverty level	986	43	0.99 (0.93–1.06)	0.8354
Education				
< High school graduation	1291	41	Ref	
≥ High school graduation (or equivalent)	3026	42	1.00 (0.96–1.05)	0.9806
Homelessness[c], past 12 months				
Yes	3187	48	1.51 (1.40–1.62)	< 0.0001
No	1131	30	Ref	
Incarcerated, past 12 months				
Yes	1940	51	1.35 (1.27–1.43)	< 0.0001
No	2374	36	Ref	
Hepatitis C diagnosis, ever[d]				
Yes	1932	42	1.02 (0.95–1.09)	0.5584
No	2369	41	Ref	
HIV sero-status				
Positive	152	21	0.51 (0.45–0.60)	< 0.0001
Negative	4166	43	Ref	
Drug use behaviors				
Age at first injection				
≤ 18 years	1601	42	1.02 (0.97–1.06)	0.513
> 18 years	2717	41	Ref	
Years since first injection				
≤ 6 years	1119	49	Ref	
> 6 years	3178	40	0.84 (0.79–0.90)	< 0.0001
Primary drug injected				
Heroin	3323	43	Ref	
Speedball	543	42	0.98 (0.90–1.07)	0.6747
Powder cocaine	93	36	0.78 (0.70–0.87)	< 0.0001
Crack cocaine	15	35	0.71 (0.52–0.98)	0.0378
Methamphetamine	282	31	0.67 (0.60–0.74)	< 0.0001
Prescription opioids[e]	16	32	0.71 (0.42–1.29)	0.2136
Other	46	43	1.09 (0.92–1.29)	0.3143
Syringe source and disposal				
SSP most common syringe source[f]				

Table 2 (continued)

	Distributive syringe sharing		Bivariate analysis[a]	
	n	%	aPR (95% CI)	*p* value
Yes	1284	34	0.82 (0.77–0.88)	< 0.0001
No	3034	46	Ref	
Receptive syringe sharing, past 12 months[g]				
Yes	2920	84	Model not able to compute	–
No	1397	20	Ref	
Any unsafe syringe disposal, past 12 months[h]				
Yes	3841	46	1.79 (1.58–2.02)	< 0.0001
No	476	24	Ref	
Total[i]	4318	100	–	

Defined as giving a needle the participant had already used to inject drugs with to someone else to inject with

[a]Log-linked Poisson regression was generated using generalized estimating equations (GEE) clustered on recruitment chains stemmed from initial recruits ('seeds') in respondent-driven sampling. Prevalence ratios are adjusted (aPR) by IDU network size, and city of interview

[b]Hispanics can be of any race

[c]At any time during the past 12 months, lived on the street, in a shelter, in a single room occupancy hotel, or in a car

[d]Ever been told by a health care provider they had Hepatitis C

[e]Such as Oxycontin, Dilaudid, morphine, Percocet, or Demerol

[f]Needle or syringe exchange program is either the only, or the most common source of syringes, past 12 months

[g]Injecting with a syringe or needle that had already been used by someone else

[h]Syringes were disposed of in ways other than in medical waste container or exchanging them at an SSP

[i]Numbers and totals may not add up to 100% due to missing data and rounding

Table 3 Distributive syringe sharing by HIV serostatus and use of SSPs as the most common source of syringes among PWID

	Distributive syringe sharing		
	n (%)	aPR (95% CI)[a]	*p* value
HIV-positive			
SSP is most common syringe source[b]	33 (12)	0.54 (0.39–0.75)	0.0002
SSP is not most common syringe source	119 (27)	Ref	
HIV-negative			
SSP is most common syringe source[c]	1251 (36)	0.84 (0.78–0.90)	< 0.0001
SSP is not most common syringe source	2915 (47)	Ref	

Defined as giving a needle the participant had already used to inject drugs with to someone else to inject with

[a]Log-linked Poisson Regression was generated using generalized estimating equations (GEE) clustered on recruitment chains stemmed from initial recruits ('seeds') in respondent-driven sampling. Prevalence ratios are adjusted (aPR) by IDU network size, city of interview, gender, age, race/ethnicity, homelessness, and incarceration

[b]Syringe services program is either the only, or the most common source of syringes, past 12 months. Comparison with HIV-positive serostatus without SSP as most common syringe source

[c]Syringe services program is either the only, or the most common source of syringes, past 12 months. Comparison with HIV-negative serostatus without SSP as most common syringe source

to potential gains in prevention messaging for PWID. Nevertheless, the proportion was alarmingly high, even among those who were HIV-positive. Additionally, PWID who reported DSS were also more likely to report other risky syringe use behaviors such as receptive syringe sharing and improper syringe disposal.

Similar to prior studies [5, 6], younger age was related to DSS in this sample. Previous findings indicate that younger PWID are more likely to engage in risky behaviors such as receptive syringe sharing and condomless sex [28]. Contrary to findings by Metsch et al., but consistent with Golub et al. [5], and Huo and Ouellet [16], PWID who reported white race/ethnicity in this sample were the most likely to report DSS, with blacks least likely to report DSS. Prior research has shown that PWID living in areas with low HIV prevalence were more likely to engage in receptive and distributive syringe sharing than those living in areas of high HIV prevalence [29]. PWID in areas of lower prevalence may take fewer precautions if they have less knowledge about harm reduction, and awareness or access to related services. These same barriers may be at work among younger, white PWID, whose networks have historically had lower HIV prevalence than their black peers. Syringe sharing, even in areas of low HIV prevalence, poses high risk of HCV, endocarditis, and other infections.

PWID who experience incarceration or homelessness may be additionally vulnerable to risky injection practices and were more likely to report DSS in this sample. Prior data collected in British Columbia, which did not distinguish between receptive and distributive syringe sharing, showed that among community samples, PWID recently released from prison were significantly more likely to report sharing contaminated syringes as compared to individuals who did not report incarceration [30]. The authors postulated that this may be due in part to disruption in access to harm-reduction services (e.g., SSPs) while being incarcerated. Incarceration has also been independently associated with greater likelihood of distributive sharing among PWID during periods of uncontrolled viral load [31]. Individuals experiencing homelessness may also have disruptions in access to health services. Additionally, they have other risk environments such as larger injection networks [32], and are more likely to inject in semi-public spaces [16].

Syringe sharing is influenced by social network and sexual and/or intimate relationship characteristics [33]. However, findings are mixed as to whether there are gender differences in DSS; while some studies have shown women reporting higher rates of DSS [5], others found no differences between women and men [6, 34]. Women in this sample were more likely to report DSS. Though the difference is small and the sample size is large, this finding may highlight the need for targeted prevention messaging to women, especially those who obtain their syringes from a sexual partner.

Although risky syringe use behaviors were prevalent in this sample, many PWID were seeking out prevention materials such as sterile syringes, and SSPs were a principal source. More than one in three PWID reported that SSPs were their primary source for sterile syringes and primarily obtaining syringes at SSPs was associated with less DSS. This is similar to a finding from Golub et al. [5], who reported that the odds of DSS were lower for PWID who obtained a higher proportion of their syringes from safe sources such as a pharmacy or SSP. Notably, the association of SSPs with decreased DSS in our study was stronger among HIV-positive than HIV-negative PWID. This finding is important, as HIV-positive PWID may transmit HIV infection when sharing their used syringes with others. Interventions that have the ability to interrupt the introduction of HIV into PWID networks are a key component to reducing transmission. That primary use of SSPs for sterile syringes was significantly associated with reduced DSS among those who are HIV-negative is also important, as these individuals may transmit other infections, such as HCV, and SSPs are an important source of safer injection education and HIV prevention counseling.

Limitations

This analysis is subject to several limitations. First, the data are self-reported, and subject to social desirability bias. Therefore DSS may be more common in all groups than what is reported here. Further, given transmission risks, PWID who are HIV-positive may be more likely to under-report syringe sharing behaviors than those who are HIV-negative, especially DSS. This analysis showed that obtaining sterile syringes primarily from an SSP was associated with less DSS for both HIV-negative and HIV-positive PWID. Prior research has shown that statistically controlling for social desirability had a negligible impact on the magnitude of associations between injection risk behaviors and HIV serostatus [35]. Second, this analysis is cross-sectional, and therefore it is not possible to infer causality. Associations with DSS may be related to other characteristics not included in this analysis. Third, this analysis did not investigate whether PWID knew the HIV-status of their syringe sharing partners. It is possible that PWID are attempting to reduce their own harms or the harm to others by sharing only with those with concordant HIV status. However, the high prevalence of unrecognized infections and pervasiveness of other infections such as HCV underscores the importance of reducing syringe sharing among all PWID. Finally, HCV testing was not conducted as part of the survey, and therefore this analysis relied upon self-report. Future research should use both rapid and laboratory-based HCV testing to enhance the accuracy of measurement, and to distinguish between cleared and current infections.

Conclusions

PWID can greatly reduce their risk of acquiring and transmitting HIV, viral hepatitis and other blood-borne infections by using a sterile syringe for every injection. While DSS was common among PWID in this study, those who used SSPs as their primary source of syringes were significantly less likely to engage in DSS. Importantly, the association between SSPs and reduced DSS was strongest among HIV-positive PWID. Through sterile syringe provision and other services, SSPs provide HIV-positive PWID concrete tools to prevent HIV transmission in addition to providing HIV-negative PWID tools and education to prevent HIV acquisition. An additional benefit of implementing SSPs to reduce DSS may be a reduction in used syringes in the community. Safe syringe acquisition is associated with safe syringe disposal [36].

Younger PWID in this sample were more likely to engage in DSS. The current context of the national opioid crisis that has contributed to increased injection drug use among young PWID [37], increases in acute HCV infection associated with injection drug use [38], and HIV outbreaks linked to injection of prescription opioids in a rural community [39], underscore the importance of scaling up effective, evidence-based intervention efforts to reduce syringe sharing. This scale-up is particularly essential to reducing outbreak risks for PWID who are younger, more recently initiated to injection and in previously low prevalence communities. A study of young PWID showed that initial injection risks were related to later injection risks such as receptive sharing; however, results pointed to a potential protective influence of SSPs on these initial injection experiences [40]. SSPs provide critical prevention activities for PWID. In addition to sterile syringes, SSPs may offer other prevention materials such as condoms, safer injection equipment (e.g., alcohol pads), and HIV and HCV testing [41]. They also serve as a primary linkage to other critical services such as HIV care, treatment, pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) services; hepatitis C treatment, and hepatitis A and B vaccinations; screening for other sexually transmitted diseases and tuberculosis; partner services; prevention of mother-to-child HIV transmission; and other medical, social, and mental health services. SSPs dispose of used syringes; provide education on safer injection practices and wound care; provide overdose prevention (e.g., naloxone distribution), and; provide referral to substance use disorder treatment programs including medication-assisted treatment. That SSPs may also reduce distributive syringe sharing among HIV-positive PWID highlights their benefit as a means to reduce transmission from HIV-positive PWID in addition to preventing acquisition among HIV-negative PWID.

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