

## Safe Syringe Disposal is Related to Safe Syringe Access among HIV-positive Injection Drug Users

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Published online: 12 October 2006  
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**Abstract** We evaluated the effect of syringe acquisition on syringe disposal among HIV-positive injection drug users (IDUs) in Baltimore, New York City, and San Francisco ( $N = 680$ ; mean age 42 years, 62% male, 59% African-American, 21% Hispanic, 12% White). Independent predictors of safe disposal were acquiring syringes through a safe source and ever visiting a syringe exchange program. Weaker predictors included living in San Francisco, living in the area longer,

less frequent binge drinking, injecting with an HIV+ partner, peer norms supporting safe injection, and self-empowerment. Independent predictors of safe “handling”—both acquiring and disposing of syringes safely—also included being from New York and being older. HIV-positive IDUs who obtain syringes from a safe source are more likely to safely dispose; peer norms contribute to both acquisition and disposal. Interventions to improve disposal should include expanding sites of safe syringe acquisition while enhancing disposal messages, alternatives, and convenience.

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

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**Keywords** Injection drug user · HIV · Hepatitis C · Syringe exchange · Syringe disposal

### Introduction

Proper disposal of community-generated needles and syringes (“syringes”) is an important public health concern (US EPA, 2004). While persons with diabetes

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produce the vast majority of community-generated syringes, those disposed of by injection drug users (IDUs) present a particular concern due to the high prevalence of blood-borne infections in that population. In New York City, for example, 35% of the 48,876 people living with AIDS in 2001 acquired the disease through injection drug use (NYC DOH, 2002), while among IDUs the prevalence of hepatitis C is estimated to be 40%–85% (Strasfeld et al., 2003) and the incidence from 9.3 to 34.0 per 100,000 person years (Des Jarlais et al., 2003). Most of the billions of community-generated syringes used each year are believed to end up in household trash (Lurie, Jones, & Foley, 1998; Macalino, Springer, Rahman, Vlahov, & Jones, 1998), with a small proportion reaching disposal programs or discarded in public areas.

Proper disposal of community-generated syringes is an important goal for several reasons. While disposal of syringes from medical care facilities is extensively regulated, disposal of community-generated syringes has generally been exempt from regulation and given little attention by the public health system. Disposal of community-generated syringes in household trash is no longer recommended by the Environmental Protection Agency (US EPA, 2004) due to concerns for solid waste and custodial workers (Myers, Eppes, Lentini, & Jones, 2002) who may be at risk for needle-stick injuries and, potentially, blood-borne infections (Turnberg & Jones, 2002). To ensure safety for these workers, elimination of syringes in trash is a worthy public health objective (Jones & Coffin, 2002).

Attention to syringe disposal practices is also important because efforts to prevent blood-borne infections among IDUs by increasing syringe availability through syringe exchange programs (SEPs) have raised concerns about the fate of the additional syringes being distributed. While SEPs themselves capture millions of used syringes a year (24.9 million in 2002 [CDC, 2005]), the estimated number of injections each year by IDUs in the US ranges from 920 million to 1.7 billion, suggesting a far greater number of syringes in circulation (Lurie et al., 1998). Thus, legislation to deregulate syringe sales has repeatedly been tied to efforts to increase disposal options (Kassler & Ayotte, 2002; Klein, Estel, Candelas, & Plavin, 2002; Marks et al., 2002; Novotny, Cotton-Oldenburg, Bond, & Tracy, 2002; Wolfe et al., 2002).

Concerns that SEPs would increase improper disposal of syringes have proved unfounded: an early study found a decrease in discarded syringes with SEPs (Oliver, Friedman, Maynard, Magnuson, & Des Jarlais, 1992), two studies found no change (Doherty et al., 1997; Doherty et al., 2000), and one study reported an

increase in improper disposal *after* an SEP closure (Broadhead, Van Hulst, & Heckathorn, 1999). Most recently, no increase in improperly discarded syringes was detected on New York City streets following syringe deregulation (Fuller et al., 2002). In fact, findings hint that the twin public health objectives of safe acquisition and safe disposal of syringes may rest on closely-related behaviors. Safe acquisition of a syringe, the first stage in the community lifespan of the device, has been repeatedly associated with safer “use” of syringes—defined as reductions in syringe reuse and sharing (Coffin, 2000)—and more recently with safe disposal among young IDUs (Sherman, Rusch, & Golub, 2004). Thus, safe acquisition may encourage a general pattern of syringe behaviors that includes safe disposal.

An additional reason to focus on proper syringe disposal is that removal of syringes from circulation may itself be an important component of prevention of blood-borne disease transmission. HIV-1 may persist in syringes for up to 4 weeks (Abdala, Stephens, Griffith, & Heimer, 1999) and greater duration of syringe circulation is associated with increased HIV risk behaviors (Kaplan & Heimer, 1994). When few opportunities exist to dispose of syringes properly, they may remain in circulation for longer periods of time, elevating the risk of disease transmission. Evaluations of this hypothesis have resulted in conflicting results: one study found that unsafe syringe disposal was associated with unsafe sharing behaviors (Donoghoe, Stimson, & Dolan, 1992), while a more recent analysis found no association between syringe disposal and injection practices (Sherman et al., 2004).

Finally, IDUs often face legal threats if they attempt safe syringe disposal. Due to nearly ubiquitous drug paraphernalia and drug possession laws, an IDU can be at risk for arrest for possession of a syringe, particularly one that might contain even minute quantities of drug residue (Burris, Welsh, Ng, Li, & Ditzler, 2002). Such penalties make IDUs cautious, if not fearful, of collecting and transporting their used syringes to a safe disposal site (Springer, Sterk, Jones, & Friedman, 1999). While pharmacy-based syringe “take back” programs can recover substantial numbers of used syringes (Drda, Gomez, Conroy, Seid, & Michaels, 2002; Van Rossum & Friederichs, 2002), they do little to alleviate this threat of possible criminal repercussions if apprehended *en route*. Placing syringe disposal units in public places (e.g., pharmacies [Caranci et al., 2002; Klein et al., 2002], and in transit station bathrooms [Myers et al., 2002]) is likely to increase awareness of safe syringe disposal.

Because of public discomfort with drug injection, however, a more general shift in perception may be

required before disposal practices can be more widely improved (Jones & Coffin, 2002). Though larger social forces clearly influence syringe use habits, limited data are available on specific interventions that might affect syringe disposal habits, a public health goal of particular interest for efforts to prevent secondary transmission of HIV and other blood-borne pathogens. We evaluated whether the source of syringe acquisition was associated with syringe disposal practices in a large sample of HIV-positive IDUs. We hypothesized that acquiring syringes safely would be associated with safe disposal. We also identified characteristics of IDUs who handled syringes safely at both the time of acquisition and the time of disposal.

## Methods

### Participants

Baseline data were analyzed from the Intervention for Sero-Positive IDUs—Research and Evaluation (IN-SPIRE) study, a multi-site, randomized trial of a 10-session behavioral intervention to reduce risky sexual and injection behaviors and improve health care use and adherence among HIV-positive IDUs. The IN-SPIRE study, described in detail elsewhere (Purcell et al., 2004), enrolled 1,161 men and women in Baltimore, Miami, New York and San Francisco. All study activities were approved by the CDC Institutional Review Board (IRB), the IRBs at the four collaborating grantees, and by the IRBs of all subcontracting institutions to the four grantees.

Individuals were eligible for the study if they were at least 18 years old, able to communicate in English, confirmed to be HIV-positive by means of an oral specimen (OraSUre, OraSUre Technologies, Inc., Bethlehem, PA, USA) and reported both injection drug use in the past 12 months and engaging in sex with an opposite-sex partner in the past 3 months. Analysis was restricted to participants who reported injecting drugs within the past 3 months, answered questions regarding where they disposed of their syringes, and were from Baltimore, New York or San Francisco. In examining data stratified by site, we observed that few of the participants from Miami reported disposing of their syringes safely (the main outcome). Consultation with the principal investigator from Miami confirmed that participants in Miami lacked access to community resources for safe syringe handling as SEPs are illegal in Florida. Because participants from Miami faced a structural constraint that largely precluded their ability to engage in the

behaviors of interest, they were excluded from the analysis.

### Measures

All variables were collected by self-report through audio-computer-assisted structured interviewing (ACASI) (Questionnaire Development System, NOVA Research Company, Bethesda, MD). The recall period for all behaviors was 3 months prior to interview unless otherwise noted.

### Demographics

Demographic variables evaluated for their association with the dependent variable were age, race/ethnicity, gender, location (Baltimore, New York, or San Francisco), education, annual income level, employment, whether on disability (as a proxy for access to services), homeless status in the past year, whether participants had lived in the area (and presumably were familiar with it) for at least 1 year, and length of time respondent had known their HIV sero-positive status (less than versus 8.8 years or more, which represented a median split).

### Drug Use Correlates

Drug use variables included: frequency of alcohol use (less than once weekly versus once weekly or more, [median split]), binge use of alcohol defined as five or more drinks in a single day (less than once weekly versus once weekly or more, [median split]), duration of injection career (less than 21 versus 21 years or more, [median split]), type of drug used (poly drug use defined as heroin, crack, and cocaine; heroin only; crack and/or cocaine only; other), frequency of injecting (less than twice daily versus twice daily or more, [median split]), lending a syringe and other injection equipment to any injection partners in the past 3 months (yes, no), and whether or not the respondent had injected with an HIV+ partner in the past 3 months (yes, no).

Self-efficacy for safely injecting drugs was measured by a six-item scale developed by the study team regarding participants' confidence to properly clean or not lend syringes or other injection equipment (higher score indicated greater self efficacy; Cronbach's alpha = .85). Peer norms for safer drug injection was measured with four questions regarding "normative beliefs", i.e., whether participants felt close friends supported safe drug injection (from -2 for strongly disagree to +2 for strongly agree), and for each

normative belief, a question regarding “motivation to comply”, i.e., how strongly participants felt they should align themselves with their peers’ beliefs (from 1 for strongly disagree to 5 for strongly agree). Each normative belief response was multiplied by the corresponding motivation to comply response and the four scores were averaged for a final score ranging from -10 to +10 (higher score indicated peer norms supporting safer drug injection). A single question asked whether participants had ever used an SEP.

### *Psychosocial Correlates*

Three general psycho-social correlates were evaluated. Personal responsibility was measured via a seven-item scale that inquired about perceived responsibility to limit the spread of HIV during a variety of situations involving sex and injection drug use (higher score indicated greater responsibility; Cronbach’s alpha = .83) (Wolitski, Bailey, O’Leary, Gomez, & Parsons, 2003). Empowerment was assessed using a 28-item scale to measure perceived ability to influence one’s environment (higher score indicated greater empowerment; Cronbach’s alpha = .76) (Rogers, Chamberlin, Ellison, & Crean, 1997). Social support was measured using five items adapted from Barrera’s method for assessing general social support in community settings (higher score indicated greater perceived social support; Cronbach’s alpha = .87) (Barrera, 1980). Domains measured included directive guidance (that is, listened to personal problems and gave advice), positive social interaction, and instrumental support (that is, would lend money or help).

### *Syringe Acquisition and Disposal*

The principal independent variable of interest, usual source of syringe acquisition in the past 3 months, was categorized as safe (obtained from a drug store, hospital, SEP, or outreach worker), possibly unsafe (obtained from a friend, relative, sex partner, or someone who went to an SEP) or unsafe (obtained from a street dealer, ‘picked up off the street’, or ‘found it’). Although responses are not always entirely safe or unsafe, these categories are commonly accepted in HIV prevention literature (Normand, Vlahov, & Moses, 1995).

Our first dependent variable was participants’ usual method of syringe disposal in the past 3 months. The outcome was categorized as safe if a participant reported disposing of their syringes through a syringe disposal program either by themselves or through

someone else and as unsafe if the participant “threw them away”, “gave to friend”, or “sold” them. We coded “throw away” as unsafe because of the public health importance of eliminating syringes in household trash (Jones & Coffin, 2002).

The second dependent variable, “syringe handling”, classified IDUs by a combination of their syringe acquisition *and* disposal habits. To develop this variable we performed a cross-tabulation of acquisition and disposal variables, coded as above. “Safe syringe handlers” were defined as those IDUs who both acquired and disposed of syringes safely (33.0% of sample). All others were coded as “unsafe syringe handlers” (67.0% of sample).

### *Data Analysis*

We first generated frequencies to guide coding decisions. Cross-tabulations between independent variables and disposal and then handling were assessed using *t*-tests for continuous variables or the chi-square test for two proportions to identify significant bivariate associations. We then built logistic regression models for each outcome separately. All scales were dichotomized for modeling to simplify clinical interpretation. For the disposal analysis, potential correlates were evaluated as covariates to syringe acquisition, which was retained throughout the modeling process. For the handling analysis, all potential correlates were examined equally. Models were built by including all variables significant at  $P < .10$  and then removing them after examining the  $-2\log$  likelihood and their association with the outcome to achieve the final, most parsimonious model. As validation, we conducted a similar subanalysis with all SEP users excluded. All analyses were performed with the SAS v. 8.01 software package. All significant results are reported as odds ratio followed by a 95% confidence interval.

### **Results**

Of 1,161 participants, 941 reported having injected drugs in the past 3 months and answered the question about how they had recently disposed of their used syringes. Among respondents from Miami, only 9.8% reported safe disposal (6.3% via SEP) and 17.5% reported safe acquisition (2.0% via SEP); all respondents from this city were excluded, leaving 680 participants in the analysis. The number of participants was approximately equally divided across each of the

remaining three sites. The average age of participants was 42 years, and majority were African-American (59%), male (62%), and had moderate-to-low levels of education (73% completed 12<sup>th</sup> grade or less) (Table 1). The vast majority were unemployed (94%) and most were on disability (62%). While over one quarter were homeless within the past year, the sample could not be considered transient as most (66%) had lived in the area for at least 1 year. Participants had known their positive HIV infection status for an average of 8.8 years.

### Syringe Disposal

Overall, 52%, 31%, and 17% of respondents usually acquired syringes through safe, possibly unsafe, and unsafe means, respectively, and 42% disposed of syringes safely. The results of the univariate analysis are shown in Table 1. Safe acquisition was significantly (Chi square = 113.8,  $P < .0001$ ) associated with safe disposal. Safe disposal was also associated ( $P < .10$ ) with demographic, drug use, and psycho-social correlates. Safe disposal was associated with race/ethnicity and site, and was more likely among participants who were older, had been in the area for at least 1 year, and had a history of incarceration. Safe disposal was associated with longer injection careers, more frequent injecting, and less frequent binge alcohol use. Safe disposal was also more likely among those who had ever been to an SEP, injected with other HIV-positive persons, did not lend syringes to other IDUs, or perceived that their peers supported safer drug injection. Among psychological correlates, only an increased sense of empowerment was associated with safe disposal.

The results of multiple logistic regression analysis are shown in Table 2. Safe acquisition of syringes remained associated with safe disposal (adjusted OR = 7.3; 95% CI = 3.8, 14.2), after controlling for other correlates. Safe disposal was also more likely among IDUs in San Francisco compared to those in Baltimore (adjusted OR = 1.9; 95% CI = 1.2, 3.1), and among those who had lived in the area for at least 1 year (adjusted OR = 2.1; 95% CI = 1.4, 3.2). Participants who had ever patronized an SEP were also much more likely to have safely disposed of their syringes (adjusted OR = 5.8; 95% CI = 3.1, 10.7), as were those who did not weekly binge drink, injected with other HIV-positive IDUs, perceived that their peers supported safer drug injection, or reported a greater sense of empowerment.

Among respondents who had ever visited an SEP, 67.3% had obtained most of their syringes from an

SEP. Because such a high proportion of IDUs both acquire and dispose of syringes at SEPs, we examined the subset of respondents who had never attended an SEP, including respondents from Miami ( $N = 353$ ). Among this subgroup, 16.7% and 49.4% had acquired syringes through safe and possibly unsafe means, respectively (9.3% and 10.6% of whom had disposed safely); 34.0% acquired unsafely (1.8% of whom disposed safely). In multivariate analysis, safe disposal was more likely among respondents on disability (adjusted OR = 3.2; 95% CI = 1.2, 9.1), and those who had acquired through safe (adjusted OR = 5.4; 95% CI = 1.0, 29.4) or possibly unsafe means (adjusted OR = 7.4; 95% CI = 1.6, 33.0). Recently homeless respondents were less likely to dispose safely (adjusted OR = .3; 95% CI = .1, .9).

### Syringe Handling

Safe handling, reported by 33% of participants, was associated with several demographic, drug use and psychosocial correlates. The results of univariate analysis are shown in Table 3. Safe handling was associated with race/ethnicity and site, and was more likely among participants who were older, had been in the area for at least 1 year, or had a history of incarceration. Safe handling was associated with longer injection careers, use of drugs other than cocaine or heroin, and less frequent binge drinking. Safe handling was also more likely among those who had ever been to an SEP, did not lend syringes or other injection equipment to other IDUs, or perceived that their peers supported safer drug injection practices. When dichotomized for modeling, safe handlers also reported a higher sense of empowerment.

The results of multiple logistic regression analysis are shown in Table 4. Safe handling was more likely among participants in New York (adjusted OR = 2.6; 95% CI = 1.5, 4.5) or San Francisco (adjusted OR = 1.9; 95% CI = 1.1, 3.2) compared with those in Baltimore, and those who had lived in the area more than 1 year (adjusted OR = 1.6; 95% CI = 1.1, 2.5), while safe handling was less likely among IDUs who were of “other” race/ethnicity (adjusted OR = .3; 95% CI = .1, .7) compared to African-American. Participants who had ever patronized an SEP were much more likely to have safely handled their syringes (adjusted OR = 35.1; 95% CI = 10.9, 113.3), as were those who did not weekly binge drink, perceived that their peers supported safer drug injection or reported a higher sense of empowerment.

**Table 1** Demographic, drug use, and psycho-social characteristics of HIV-positive injection drug users by type of syringe disposal

	Total column % (n)	Syringe Disposal (row % [N])		Test statistic <sup>a</sup>
		Safe 33.3% (N = 313)	Unsafe 66.7% (N = 628)	
<i>Site</i>				
Baltimore	26.3 (247)	32.0 (79)	68.0 (168)	105.8***
Miami	27.2 (256)	9.8 (25)	90.2 (231)	
New York	21.9 (206)	45.6 (94)	54.4 (112)	
San Francisco	24.7 (232)	49.6 (115)	50.4 (117)	
Excluding Miami	Total	Safe 42.4% (N = 288)	Unsafe 57.6% (N = 392)	Test statistic <sup>a</sup>
<i>Source of syringe acquisition</i>				
Safe	52.0 (337)	63.5 (214)	36.5 (123)	113.8***
Possibly unsafe	31.0 (201)	26.4 (53)	73.6 (148)	
Unsafe	17.0 (110)	15.5 (17)	84.5 (93)	
<i>Demographics</i>				
<i>Age</i>				
<42 years	50.8 (348)	38.8 (135)	61.2 (213)	3.1 <sup>†</sup>
≥42 years	49.2 (337)	45.4 (153)	54.6 (184)	
<i>Race/ethnicity</i>				
African American	58.6 (395)	36.7 (149)	62.3 (246)	18.5***
White	12.1 (82)	63.4 (52)	36.6 (30)	
Hispanic	20.6 (139)	42.5 (59)	57.6 (80)	
Other	8.6 (58)	39.7 (23)	60.3 (35)	
<i>Gender</i>				
Male	61.9 (424)	43.5 (178)	58.0 (246)	1.8
Female	34.6 (237)	42.0 (103)	56.5 (134)	
Transgender	3.5 (24)	29.2 (7)	70.8 (17)	
<i>Education</i>				
<12 years	40.3 (275)	38.2 (105)	61.8 (170)	3.7
12 years	32.7 (223)	43.1 (96)	57.0 (127)	
>12 years	27.1 (185)	47.0 (87)	53.0 (98)	
<i>Annual income</i>				
<\$5,000	48.0 (317)	40.1 (127)	59.9 (190)	1
>\$5,000	52.0 (344)	43.9 (151)	56.1 (193)	
<i>Employed currently</i>				
No	94.4 (646)	42.1 (272)	57.9 (374)	.0
Yes	5.6 (38)	42.1 (16)	57.9 (22)	
<i>Ever incarcerated</i>				
No	28.7 (194)	36.1 (70)	63.9 (124)	4.0 <sup>†</sup>
Yes	71.3 (481)	44.5 (214)	55.5 (267)	
<i>On disability currently</i>				
No	38.5 (263)	41.4 (109)	58.6 (154)	.0
Yes	61.5 (420)	42.6 (179)	57.4 (241)	
<i>Homeless in past year</i>				
No	71.1 (482)	42.5 (205)	57.5 (277)	.2
Yes	28.9 (196)	40.8 (80)	59.2 (116)	
<i>In area</i>				
<1 year	33.8 (229)	29.7 (68)	70.3 (161)	21.3***
>1 year	66.2 (448)	48.2 (216)	51.8 (232)	
<i>Known HIV+ status</i>				
<8.8 years	47.9 (327)	43.4 (142)	56.6 (185)	.6
≥8.8 years	52.1 (355)	40.6 (144)	59.4 (211)	
<i>Drug use correlates</i>				
<i>Years injecting drugs</i>				
<21 years	48.0 (318)	36.5 (116)	63.5 (202)	5.7*
≥21 years	52.0 (344)	45.6 (157)	54.4 (187)	
# Injections daily in past 3 months				
0–1	77.7 (528)	40.3 (213)	59.7 (315)	3.4 <sup>†</sup>
2 or more	22.4 (152)	48.7 (74)	51.3 (78)	
<i>Type of drugs used</i>				
Heroin + crack/cocaine	82.9 (568)	42.4 (241)	47.7 (327)	5.9

**Table 1** continued

	Total column% (n)	Syringe Disposal (row % [N])		Test statistic <sup>a</sup>
		Safe 33.3%(N = 313)	Unsafe 66.7%(N = 628)	
Heroin only	8.3 (57)	42.1 (24)	57.9 (33)	
Crack/cocaine only	5.1 (35)	25.7 (9)	74.3 (26)	
Other	3.7 (25)	56.0 (14)	44.0 (11)	
<i>Alcohol use in past 3 months</i>				
0–1 time/week	64.8 (441)	43.8 (193)	56.2 (248)	1.3
2 or more times/week	35.2 (240)	39.2 (94)	60.8 (146)	
<i>Binge alcohol use in past 3 months</i>				
0–1 time/week	71.8 (489)	44.4 (217)	55.6 (272)	3.5 <sup>†</sup>
2 or more times/week	28.2 (192)	36.5 (70)	63.5 (122)	
<i>Ever been to syringe exchange</i>				
No	25.3 (173)	9.3 (16)	90.8 (157)	102.2***
Yes	74.7 (512)	53.1 (272)	46.9 (240)	
<i>Injected with HIV+ partner in past 3 months</i>				
No	53.6 (359)	37.3 (134)	62.7 (225)	8.1**
Yes	46.4 (311)	48.2 (150)	51.8 (161)	
<i>Shared syringes in past 3 months</i>				
No	79.1 (538)	43.9 (236)	56.1 (302)	2.9 <sup>†</sup>
Yes	20.9 (142)	35.9 (51)	64.1 (91)	
<i>Shared cotton/cookers/rinse water in past 3 months</i>				
No	51.2 (351)	44.2 (155)	55.8 (196)	1.3
Yes	48.8 (334)	39.8 (133)	60.2 (201)	
<i>Self-efficacy for safely injecting drugs</i>				
Mean (min–max)	3.6 (1.0–5.0)	3.7(1.0–5.0)	3.6(1.0–5.0)	-1.0
<i>Peer norms support safe</i>				
Injection Mean (min–max)	1.4 (-8.0–10.0)	1.8 (-7.5–10.0)	1.2 (-8.0–10.0)	-2.4*
<i>Psycho-social characteristics</i>				
<i>Personal responsibility to limit HIV</i>				
Mean (min–max)	4.3 (1.0–5.0)	4.3 (1.3–5.0)	4.3 (1.0–5.00)	1.0
<i>Personal sense of empowerment</i>				
Mean (min–max)	2.9 (2.0–3.8)	2.9 (2.0–3.8)	2.8(1.9–63.8)	-2.1*
<i>Perceived social support</i>				
Mean (min–max)	4.0 (1.0 –5.0)	4.0 (1.0–5.0)	4.0 (1.0–5.0)	-0.6

<sup>a</sup>  $\chi^2$  or two sample t-test, <sup>†</sup>  $P < .1$ , \* $P < .05$ , \*\* $P < .01$ , \*\*\* $P < .001$

INSPIRE study September 2001–December 2003

## Discussion

Fewer than half of the HIV-positive IDUs in our sample, who had long been injecting and aware of their

HIV status, practiced safe syringe disposal practices, suggesting an important focus for efforts to prevent secondary disease transmission. Safe syringe acquisition was the strongest independent predictor of safe

**Table 2** Multivariate predictors of safe syringe disposal among HIV-positive injection drug users

		Adjusted OR	95% CI
<i>Source of syringe acquisition</i>			
Unsafe	REF		
Possibly unsafe	1.97	.97, 3.98	
Safe***	7.31	3.78, 14.15	
<i>Site</i>			
Baltimore	REF		
New York	1.22	.75, 1.98	
San Francisco**	1.93	1.19, 3.14	
Living in area > 1 year (REF = no)***	2.07	1.36, 3.15	
Binge alcohol > once weekly (REF = 0–1 time weekly)*	.6	.38, .92	
Ever been to syringe exchange*** (REF = no)	5.79	3.13, 10.69	
Injected with HIV+ partner in prior 3mo* (REF = no)	1.52	1.03, 2.26	
Peer norms support safe injection* (REF = neutral/no support)	1.58	1.07, 2.26	
Personal sense of empowerment* (dichotomized at median)	1.67	1.13, 2.48	

\* $P < .05$ , \*\* $P < .01$ , \*\*\* $P < .001$

INSPIRE study September 2001–December 2003

**Table 3** Demographic, drug use, and psychosocial characteristics of HIV-positive injection drug users by safety of syringe handling (acquisition and disposal)

	Syringe Handling, row % (N)		Test statistic <sup>a</sup>
	Safe	Unsafe	
	33.0% (214)	67.0% (434)	
<b>Demographic</b>			
<i>Site</i>			
Baltimore	23.1 (55)	76.9 (183)	16.7***
New York	38.9 (77)	61.1 (121)	
San Francisco	38.7 (82)	61.3 (130)	
<i>Age</i>			
<42 years	27.5 (92)	72.5 (242)	9.4**
≥42 years	38.9 (122)	61.2 (192)	
<i>Race/ethnicity</i>			
African American	29.6 (109)	70.4 (259)	20.4***
White	52.5 (42)	47.5 (38)	
Hispanic	35.8 (48)	64.2 (86)	
Other	20.0 (11)	80.0 (44)	
<i>Gender</i>			
Male	32.7 (132)	67.3 (272)	1.7
Female	34.8 (77)	65.2 (144)	
Transgender	21.7 (5)	78.3 (18)	
<i>Education</i>			
<12 years	29.9 (76)	70.1 (178)	4.4
12 years	31.8 (67)	68.3 (144)	
>12 years	33.2 (71)	60.8 (110)	
<i>Annual income</i>			
<\$5,000	30.5 (93)	69.5 (212)	1.3
>\$5,000	34.8 (112)	65.2 (210)	
<i>Employed currently</i>			
No	33.0 (202)	67.0 (410)	.0
Yes	34.3 (12)	65.7 (23)	
<i>Ever incarcerated</i>			
No	25.4 (46)	74.6 (135)	6.6*
Yes	36.0 (165)	64.0 (293)	
<i>On disability currently</i>			
No	33.1 (84)	66.9 (170)	.0
Yes	33.2 (130)	66.8 (262)	
<i>Homeless in past year</i>			
No	33.5 (154)	66.5 (305)	.2
Yes	31.9 (58)	68.1 (124)	
<i>In area</i>			
<1 year	23.7 (51)	76.3 (164)	12.3***
>1 year	37.5 (160)	62.5 (267)	
<i>Known HIV+ status</i>			
<8.8 years	34.8 (108)	65.2 (202)	.9
≥8.8 years	31.3 (105)	68.8 (231)	
<i>Drug use correlates</i>			
<i>Years injecting drugs</i>			
<21 years	27.2 (82)	72.9 (220)	8.0**
≥21 years	37.7 (123)	62.3 (203)	
<i># Injections daily in past 3 months</i>			
0–1	32.1 (159)	67.9 (336)	1.1
2 or more	36.7 (55)	63.3 (95)	
<i>Type of drugs used</i>			
Heroin + crack/cocaine	33.7 (182)	66.3 (358)	9.8*
Heroin only	27.8 (15)	72.2 (39)	
Crack/cocaine only	15.6 (5)	84.4 (27)	
Other	54.5 (12)	45.5 (9)	
<i>Alcohol use in past 3 months</i>			
0–1 time/week	35.0 (145)	65.0 (269)	1.7

**Table 3** continued

	Syringe Handling, row % (N)		Test statistic <sup>a</sup>
	Safe 33.0% (214)	Unsafe 67.0% (434)	
2 or more times/week	30.0 (69)	70.0 (161)	
<i>Binge alcohol use in past 3 months</i>			
0–1 time/week	35.4 (163)	64.6 (297)	3.5†
2 or more times/week	27.7 (51)	72.3 (133)	
<i>Ever been to syringe exchange</i>			
No	2.0 (3)	98.0 (150)	87.4 <sup>b***</sup>
Yes	42.6 (211)	57.4 (284)	
<i>Injected with HIV+ partner in past 3 months</i>			
No	30.5 (103)	69.5 (235)	2.7†
Yes	36.6 (109)	63.4 (189)	
<i>Shared syringes in past 3 months</i>			
No	36.0 (183)	64.0 (325)	8.7**
Yes	22.6 (31)	77.4 (106)	
<i>Shared cotton/cookers/rinse in past 3 months</i>			
No	36.7 (121)	63.3 (209)	4.0*
Yes	29.2 (93)	70.8 (225)	
<i>Self-efficacy for safely injecting drugs</i>	3.7 (1.0–5.0)	3.6 (1.0–5.0)	
<i>Mean (min–max)</i>			-1.0
<i>Peer norms support safe injection</i>	1.9 (-8.0–10.0)	1.2 (-8.0–10.0)	
<i>Mean (min–max)</i>			-2.4*
<i>Psycho-social characteristics</i>			
<i>Personal responsibility to limit HIV spread</i>	4.2 (1.0–5.0)	4.3 (1.0–5.0)	
<i>Mean (min–max)</i>			1.4
<i>Personal sense of empowerment</i>	2.9 (2.0–3.6)	2.9 (2.0–3.6)	
<i>Mean (min–max)</i>			-1.5 <sup>c</sup>
<i>Perceived social support</i>	4.0 (1.0–5.0)	4.0 (1.0–5.0)	
<i>Mean (min–max)</i>			.2

<sup>a</sup>  $\chi^2$  or two sample *t*-test<sup>b</sup> Fisher's exact test used because a cell had fewer than 5 responses<sup>c</sup> When dichotomized at median, Pearson Chi-square 2-way test  $P = .07$ , thus included in multivariate modeling†  $P < .1$ , \* $P < .05$ , \*\* $P < .01$ , \*\*\* $P < .001$ 

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disposal, even controlling for use of an SEP and among respondents who never attended an SEP. This finding supported our hypothesis that acquisition and disposal practices are linked. Though causality cannot be established, we hypothesize that the association of living in the area longer and visiting an SEP with safe disposal may reflect greater familiarity with local services. In keeping with studies of syringe disposal among diabetics that identified convenience as the major barrier to proper disposal (Olowokure, Duggal, & Armitage, 2003), our results suggest that familiarity with local services—and thus awareness of convenient disposal options—may improve disposal practices.

**Table 4** Multivariate predictors of safe syringe handling (acquisition and disposal) among HIV-positive injection drug users

		Adjusted OR	95% CI
<i>Site</i>			
Baltimore	REF		
New York**	2.56	1.45, 4.51	
San Francisco*	1.9	1.13, 3.21	
<i>Race/ethnicity</i>			
African American	REF		
White	.144	.78, 2.67	
Hispanic	.72	.41, 1.28	
Other race/ethnicity**	.28	.12, .66	
Age ≥42 years (REF <42)*	1.65	1.11, 2.47	
Living in area > 1 year (REF = no)*	1.58	1.02, 2.44	
Binge alcohol > once weekly (REF = 0–1 time weekly)*	.61	.40, .96	
Ever been to syringe exchange*** (REF = no)	35.13	10.9, 113.31	
Peer norms support safe injection* (REF = neutral/no support)	1.56	1.05, 2.30	
Personal sense of empowerment* (dichotomized at median)	1.6	1.08, 2.36	

\* $P < .05$ , \*\* $P < .01$ ,

\*\*\* $P < .001$

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One-third of our participants handled syringes safely, further supporting a substantial overlap between these two behaviors. The overwhelming contribution of visiting an SEP to safe syringe handling is confounded by the fact that IDUs both acquire and dispose of syringes at SEPs. This finding does not suggest causality, but instead emphasizes the importance of the remaining independent predictors—such as familiarity with the area, less frequent binge drinking, and supportive peer norms—for predicting safe syringe handling. The associations with supportive peer norms and having HIV-positive injection partners are concordant with other reports that some HIV-positive persons select HIV-positive sex partners as a risk reduction strategy (Crepaz & Marks, 2002; Hart et al., 2005).

Of note, there was no independent association of disposal with drug “use” risk behaviors, such as sharing syringes or self confidence in safely administering drugs. Recent research among young IDUs identified only daily injection and safe acquisition as independent predictors of safe disposal, consistent with our finding that safely administering drugs was not a correlate of safe disposal (Sherman et al., 2004). While safe acquisition may in fact encourage safer injection practices, and safe acquisition may encourage safe disposal, safer injection does not appear to influence syringe disposal. Also notable was that IDUs’ sense of responsibility for preventing HIV transmission was not associated with safe disposal. Nonetheless, IDUs in this sample reported high levels of responsibility to limit HIV transmission to their sex partners (Latka et al., 2005), and so may be open to hearing and enacting messages to more safely discard their syringes.

Miami was excluded from this analysis due to the small number of respondents reporting safe disposal or acquisition of syringes. Miami was the only site in this

study with no legal SEP. Miami participants were also more likely to be homeless and less likely to have accessed other social service resources (data not shown). These findings suggest that HIV-positive IDUs in Miami may be in particular need of targeted services. The independent association of safe disposal with residence in San Francisco and safer handling with residence in San Francisco or New York is of unclear significance, but may be due to the existence of pharmacy syringe take-back programs in San Francisco (Drda et al., 2002) and the 4–6 year longer history of SEPs in both cities compared to Baltimore (Normand et al., 1995).

Interpretation of our data is subject to several limitations. The cross-sectional nature of this analysis bars us from drawing conclusions regarding the directionality of the associations we report. Having studied only a convenience sample of HIV-positive IDUs, the generalizability of our data to all IDUs is limited, yet the present focus on HIV-positive IDUs is of particular public health importance. Our disposal outcome variable was narrow in scope, limiting our ability to evaluate possibly safe means of disposal such as disposal in sealed containers in household trash and pharmacy disposal programs, although such programs were rare at the time of data collection (Jones & Coffin, 2002). Moreover, we were unable to fully evaluate the positive or negative contribution of non-prescription sale of syringes from pharmacies to disposal. Our outcomes only evaluated the “usual” method of acquisition and disposal: “safe” respondents may have acted “unsafely” almost as frequently. Finally, we did not evaluate details of syringe acquisition, such as the number of syringes picked up and disposed of at each transaction, which would have allowed us to better estimate the magnitude of proper and improper syringe disposal.

Our data have implications for interventions to improve the health of injectors and of the general public. Like diabetics, IDUs likely dispose of syringes by the most convenient means, suggesting that safe disposal messages and readily accessible syringe disposal units in public places would advance safe disposal practices. Our data suggest that syringe disposal initiatives should target non-SEP participants, new arrivals, and alcohol drinkers, while attempting to mold peer norms. Interventions that may improve safe disposal include expanding sites of safe syringe acquisition while enhancing safe disposal messages, alternatives, and convenience.

**Acknowledgments** This study was supported by the Centers for Disease Control and Prevention and the Health Resources and Services Administration (CDC/HRSA grant U50CCU317999). We would also like to acknowledge the following people for their contributions to this research: Susan Sherman, Roeina Marvin, Joanne Jenkins, Donny Gann, and Tonya Johnson (Baltimore); Clyde McCoy, Rob Malow, Wei Zhao, Lauren Gooden, Sam Comerford, Virginia Locascio, Curtis Delford, Laurel Hall, Henry Boza, Cheryl Riles (Miami); George Fesser, Carol Gerran, and Diane Thornton (New York); Caryn Pelegrino, Barbara Garcia, Jeff Moore, Erin Rowley, Debra Allen, Dinah Iglesia-Usog, Gilda Mendez, Paul Lum, and Greg Austin (San Francisco); Gladys Ibanez, Hae-Young Kim, Toni McWhorter, Jan Moore, Lynn Paxton, and John Williamson (CDC); and Lee Lam, Jeanne Urban, Stephan Soroka, Zilma Rey, Astrid Ortiz, Sheila Bashirian, Marjorie Hubbard, Karen Tao, Bharat Parekh, Thomas Spira (CDC Laboratory).

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