

## Research paper

# Syringe disposal among people who inject drugs in Los Angeles: The role of sterile syringe source



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## ABSTRACT

**Background:** Few recent studies have investigated the prevalence of improperly discarded syringes in community settings by people who inject drugs (PWID). We examined whether syringe source was associated with the act of improper syringe disposal and amount of syringes improperly disposed of among PWID in Los Angeles, California.

**Methods:** A cross-sectional sample of PWID ( $N = 412$ ) was recruited and administered a structured questionnaire between July 2011 and April 2013. Descriptive analyses investigated syringe access and disposal practices among participants. Multivariate logistic regression analysis identified adjusted associations between syringe source (syringe exchange program [SEP] or pharmacy) and improper syringe disposal.

**Results:** Most participants were male (69%), homeless (62%) and low-income earners (64%). The majority (87%) of the sample received syringes from a SEP in the past six months, with 26% having received syringes from pharmacies and 36% from unauthorised sources (e.g., friend, drug dealer). Of more than 30,000 used syringes reportedly disposed of by participants during the past 30 days, 17% were disposed of improperly. Two percent of participants disposed of any used syringes at pharmacies, compared to 68% who used SEPs for syringe disposal. Having received sterile syringes from a SEP was independently associated with lower odds of improper syringe disposal; however, purchasing sterile syringes from pharmacies was associated with significantly higher odds of improper syringe disposal.

**Conclusion:** In a city with both SEPs and pharmacies as syringe source and disposal options for PWID, these findings suggest that while pharmacies are selling syringes, they are not as readily involved in safe syringe disposal. Given limits on SEP availability and the large geographic size of Los Angeles County, augmenting current SEP services and providing other community disposal sites, including pharmacy disposal, processes could reduce improper syringe disposal among PWID in Los Angeles.

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## Introduction

Recent research estimated that there are over 2000 community-acquired needlestick injuries in the United States (US) annually, costing the healthcare system \$9.8 million each year (Jason, 2013). However, the incidence of blood-borne viral infections (BBVIs) transmitted from needlestick injuries in the community is rare (Papenburg et al., 2008; Thompson, Boughton, & Dore, 2003). Regardless of the size of this public health problem, it is perceived by community members and politicians as a vital concern

(Blenkharn, 2008; Green, Martin, Bowman, Mann, & Beletsky, 2012; Stopka, Garfein, Ross, & Truax, 2007; Treloar & Fraser, 2007; Zavis, 2012). Yet, there have been surprisingly few studies assessing the prevalence of improperly discarded syringes in community settings (e.g., Doherty et al., 2000; Tookes et al., 2012; Wenger et al., 2011). People who inject drugs (PWID) are a source for improperly discarded syringes (Bluthenthal, Anderson, Flynn, & Kral, 2007). By studying the disposal practices of PWID, we can learn more about the scope of the problem and propose potential pragmatic solutions.

Syringe exchange programs (SEPs) are a primary means of syringe access and disposal among PWID in the US (Centers for Disease Control and Prevention, 2010; Tookes et al., 2012). The public health benefits of SEPs, including the prevention of BBVI transmission and reduction in risk behaviours, are well-recognised

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(Hurley, Jolley, & Kaldor, 1997; Wodak & Cooney, 2006). Although prior research in cities such as Baltimore, New York and San Francisco has indicated that SEP utilisation does not increase improper disposal of used needles (Bluthenthal et al., 2007; Coffin et al., 2007; Doherty et al., 2000; Fuller et al., 2002; Sherman, Rusch, & Golub, 2004; Tookes et al., 2012), many US cities and states have very few or no official or legal SEPs (amFAR; Green et al., 2012). Even in locations with SEPs, opening hours are often limited (Bluthenthal, Heinzerling, Anderson, Flynn, & Kral, 2008; Los Angeles County Department of Public Health), which further impedes proper syringe disposal for PWID (Treloar & Cao, 2005).

Another important means of syringe access and disposal among PWID is pharmacies. For example, the New York Expanded Syringe Access Demonstration Program was implemented in 2001 to overcome barriers to SEP utilisation and improve accessibility to, and availability of, syringes for PWID through non-prescription syringe sales at pharmacies (Fuller et al., 2007). In studies examining syringe disposal practices, access to sterile syringes was generally found to be associated with lower odds of improper syringe disposal (Cleland et al., 2007; Coffin et al., 2007). However, these studies did not distinguish between types of safe syringe access (i.e., SEPs or pharmacies).

Following the implementation of a similar program in California in 2005, the Disease Prevention Demonstration Project (California Department of Public Health), pharmacies became the second main legal source of syringes in the state in addition to SEPs (Lutnick, Cooper, Dodson, Bluthenthal, & Kral, 2013). In their capacity as providers of non-prescription syringes, Californian SEPs and pharmacies are required to provide 'consumers' with at least one of three disposal options: onsite disposal, the provision of sharps containers that satisfy state and federal standards, and/or the provision of mail-back sharps containers (California Department of Public Health). Despite having both SEPs and pharmacies as syringe source and disposal options since 2006, there is a lack of research on syringe access and disposal practices among PWID in Los Angeles.

We sought to determine the prevalence of syringe disposal by a sample of mostly marginalised (i.e., low-income, homeless) PWID via SEPs, pharmacies, and improper methods in Los Angeles, the largest city in California. In addition, we examined whether syringe source was associated with improper syringe disposal and amount of syringes improperly disposed.

## Method

### Sample

The sample was recruited as part of a large National Institute on Drug Abuse (NIDA)-funded mixed methods study examining initiation to injection drug use among PWID in San Francisco and Los Angeles (NIDA grant #R01DA027689). This article focuses exclusively on the Los Angeles participants (recent studies have thoroughly examined syringe disposal in San Francisco (Tookes et al., 2012; Wenger et al., 2011)). Between July 2011 and April 2013, PWID ( $N = 412$ ) were recruited from outreach sites (e.g., drug copping and sales areas, SEPs, drug treatment programs, homeless encampments, free food distribution locations) in Los Angeles neighbourhoods with high numbers of PWID. Individuals were eligible to participate in the study if they: (1) were aged 18 years or above; (2) were able to provide informed consent; and (3) had injected any drug in the past 30 days (as verified by visual inspection for evidence of recent injecting drug use; i.e., venepuncture marks). Participants were reimbursed \$20 for their time and travel expenses. Prior to study implementation, all procedures were reviewed and approved by the Institutional Review Boards at the University of Southern California and RTI International.

### Questionnaire design and administration

Following the provision of informed consent, study participants were administered a structured questionnaire designed to collect information on socio-demographic characteristics; mental and physical/general health; current/recent and lifetime drug use patterns, including involvement in risky injecting behaviours; needle/syringe access and disposal practices; and utilisation of drug treatment and other health and support services. Interviews were conducted in private settings at community-based field sites convenient for participants (e.g., soup kitchens, churches, SEPs). Field sites were chosen due to their close proximity to large numbers of PWID in Los Angeles. All questionnaires were interviewer-administered using laptop computers programmed with Questionnaire Design System (QDS) Version 2.6.1 software (Nova Research Company, Bethesda, MD, USA). Interviews lasted a median of approximately 35 min (range: 17–90 min).

### Measures

Respondents were asked to list all their sources of syringes during the previous six months. Options included: SEP; syringe distribution program or outreach worker; someone else who visited a SEP; pharmacy; unauthorised source (e.g., street, friend); own prescription for syringes; and shooting gallery or drug dealer. Participants were then asked to identify their primary source of syringes during the last six months.

Participants who reported disposing of used syringes in the past 30 days were asked to list their means of syringe disposal, including: returning them to a SEP; having someone else return them to a SEP; selling or giving them away; putting them in the trash; flushing them down a toilet; leaving them in a public place (e.g., street, sidewalk, park, parking lot); taking them to a hospital or clinic; taking them to a pharmacy; putting them in a public biohazard waste container; having them confiscated by police; or employing any other method of syringe disposal. 'Improper' syringe disposal was classified according to the definition outlined in previous research which compared syringe disposal practices among PWID in a city with, versus a city without, SEPs (Bluthenthal et al., 2007; Tookes et al., 2012); i.e., disposal of used syringes by: selling or giving them away; leaving them in a public place; putting them in the trash; flushing them down a toilet; or leaving in a sewer, manhole or gutter. Alternatively, 'proper' syringe disposal was classified as: returning syringes to a SEP; having someone else (e.g., partner, peer) return syringes to a SEP; putting them in a public biohazard waste container; having them confiscated by police; or returning them to a pharmacy. Participants were asked to specify how many syringes were disposed of via each method. Participants were categorised as having improperly disposed of most of their syringes when they reported that the total number of syringes disposed of via improper means was more than 50% of the total number of syringes disposed of via all disposal methods.

### Design and statistical analysis

Descriptive analyses (e.g., frequencies, medians) were used to examine participant characteristics, drug use patterns and risk behaviours, in addition to syringe access and disposal practices. Bivariate analyses identified unadjusted associations between potential confounding variables and syringe source [SEP or pharmacy (with or without prescription)] and improper syringe disposal outcomes (i.e., improperly disposed of any syringes in the past 30 days, improperly disposed of most syringes in that time). Bivariate analysis methods included the Mantel Haenszel Chi-square and Fisher's exact tests for categorical variables and the Wilcoxon signed-rank test for continuous variables. In multivariate logistic

**Table 1**  
Respondent socio-demographic and drug use characteristics and associated behaviours (N = 412).

	n (%)
<b>Age, median years (range)</b>	50 (18–76)
<b>Sex</b>	
Male	283 (69)
Female	128 (31)
Intersex	1 (<1)
<b>Race<sup>a</sup></b>	
Latino	168 (41)
African American	122 (30)
Caucasian	86 (21)
Other	35 (9)
<b>High school education or more</b>	240 (58)
<b>Homeless (current)<sup>a</sup></b>	254 (62)
<b>Income &lt; \$900/month<sup>a</sup></b>	264 (64)
<b>During past 30 days, illicit use of:</b>	
Heroin	361 (88)
Crack	124 (30)
Methamphetamine	114 (28)
Tranquilisers	104 (25)
Opiates	90 (22)
Methadone	80 (19)
Powder coke	56 (14)
<b>Syringe sharing past 30 days<sup>a</sup>:</b>	
Receptive	67 (16) <sup>d</sup>
Distributive	76 (18) <sup>e</sup>
	n = 385 <sup>b</sup>
<b>HIV positive (self-report)</b>	11 (3)
<b>All needle sources last 6 months</b>	
SEP, official outreach	360 (87)
Pharmacy (with or without prescription)	108 (26)
Unauthorised source <sup>c</sup>	149 (36)
<b>Primary needle/syringe source last 6 months</b>	
SEP, official outreach	296 (72)
Pharmacy (with or without prescription)	50 (12)
Unauthorised source <sup>c</sup>	66 (16)

<sup>a</sup> Missing data for one respondent.

<sup>b</sup> Number of participants who reported ever receiving the results of a HIV test.

<sup>c</sup> Includes: friend or family member, shooting gallery, drug dealer.

<sup>d</sup> Missing value for two respondents.

<sup>e</sup> Missing value for one respondent.

regression analysis, a stepwise backwards elimination process controlling for potential confounders, and forcing syringe source as exposure variables, identified adjusted associations with improper syringe disposal. All data analyses were conducted using Stata Version 13.0 (Statacorp LP, Texas, USA) with a significance level of  $p < 0.05$ .

## Results

### Sample characteristics

Most of the participants were male, with a median age of 50 years (Table 1). The vast majority (93%) were born in the US. There were numerous signs of disadvantage among participants. Most were homeless and only 17% reported earning any income from employment during the previous six months. The majority of participants earned less than \$900 in total from all sources (e.g., welfare benefits, SSI, recycling) during the previous month. Forty-two percent had been diagnosed with at least one type of psychiatric illness (e.g., depression, bipolar disorder) as an adult. Of the respondents who had ever been made aware of the results of a HIV test, 3% reported being HIV positive. Hepatitis C was more common (59%) among those who reported ever being tested for it ( $n = 186$ ). Heroin was the main illicit drug used by participants during the past 30 days. A small minority of participants reported sharing syringes in the last 30 days (16% reported receptive syringe sharing and 18% reported distributive syringe sharing).

**Table 2**  
Methods/locations ('proper' vs. 'improper') of syringe disposal and proportions of total syringes disposed via each means in the past 30 days, among those who disposed of syringes in that time (N = 368).

	n (%)	% of total needles disposed
<b>Syringe disposal methods/locations last 30 days</b>		
<i>'Proper' disposal methods/locations</i>		
SEP	251 (68)	67.2
Someone else returned to SEP	69 (19)	9.2
Public biohazard waste container	52 (14)	3.4
Confiscated by police	18 (5)	2.4
Pharmacy	6 (2)	0.5
Hospital or clinic	4 (1)	1.0
<i>'Improper' disposal methods/locations</i>		
Trash	83 (23)	4.3
Sold/gave away	37 (10)	1.1
Flushed down toilet	27 (7)	0.8
Left in public location	6 (2)	0.4
<i>Other<sup>a</sup></i>		
Total number syringes improperly disposed ( $n = 231$ )	5144	16.9
Total number syringes disposed	30,385	100

<sup>a</sup> Includes: ambulance, research study site, buried in unspecified location.

### Syringe access

The majority of participants received their sterile syringes from SEPs during the preceding six months (Table 1). More than one-quarter of participants had received sterile syringes from a pharmacy in the previous six months; however, only 12% reported that a pharmacy had been their main syringe source during that time. Participants reported obtaining a median of 30 sterile syringes (range: 1–2000 syringes) in the past 30 days from all sources. To provide an indication of syringe source options, Fig. 1 details the locations of Los Angeles-based SEPs and pharmacies at the time this project was conducted (note that not every pharmacy conducted sales of non-prescription syringes at the time).

### Syringe disposal

Of the total sample ( $N = 412$ ), 368 participants (89%) reported disposing of any used syringes in the past 30 days. These participants disposed of a median of 40 syringes during that time (range: 1–2000 syringes) (Table 2). SEPs were the most common location of syringe disposal, followed by the trash. Of the more than 30,000 used syringes disposed of during the past 30 days, nearly 17% were disposed of improperly; however, less than 1% of syringes were left in a public location.

Of the participants who disposed of used syringes in the past 30 days ( $N = 368$ ), less than 2% reported disposing of any used syringes at pharmacies, with these syringes comprising less than 1% of the total number of syringes disposed of by all respondents. In bivariate analysis, participants who reported receiving more than 30 syringes in the past 30 days were less likely to report improper syringe disposal compared to those who had received 30 or less syringes in the past 30 days (42% vs. 58%;  $p = 0.003$ ). These participants also were less likely to improperly dispose of the majority (i.e., >50%) of their syringes during that time (27% vs. 73%;  $p < 0.001$ ).

### Multivariate analysis of improper syringe disposal

In multivariate analysis, having received sterile syringes from a SEP at all ( $n = 333$ ; Adjusted Odds Ratio [AOR] = 0.51; 95% Confidence Interval [CI] = 0.26–0.98) or primarily ( $n = 254$ ; AOR = 0.44; 95% CI = 0.26–0.75) during the previous six months was significantly associated with lower odds of improper syringe disposal during the last 30 days as compared to those who did not receive syringes from a SEP (Table 3). They also had significantly lower

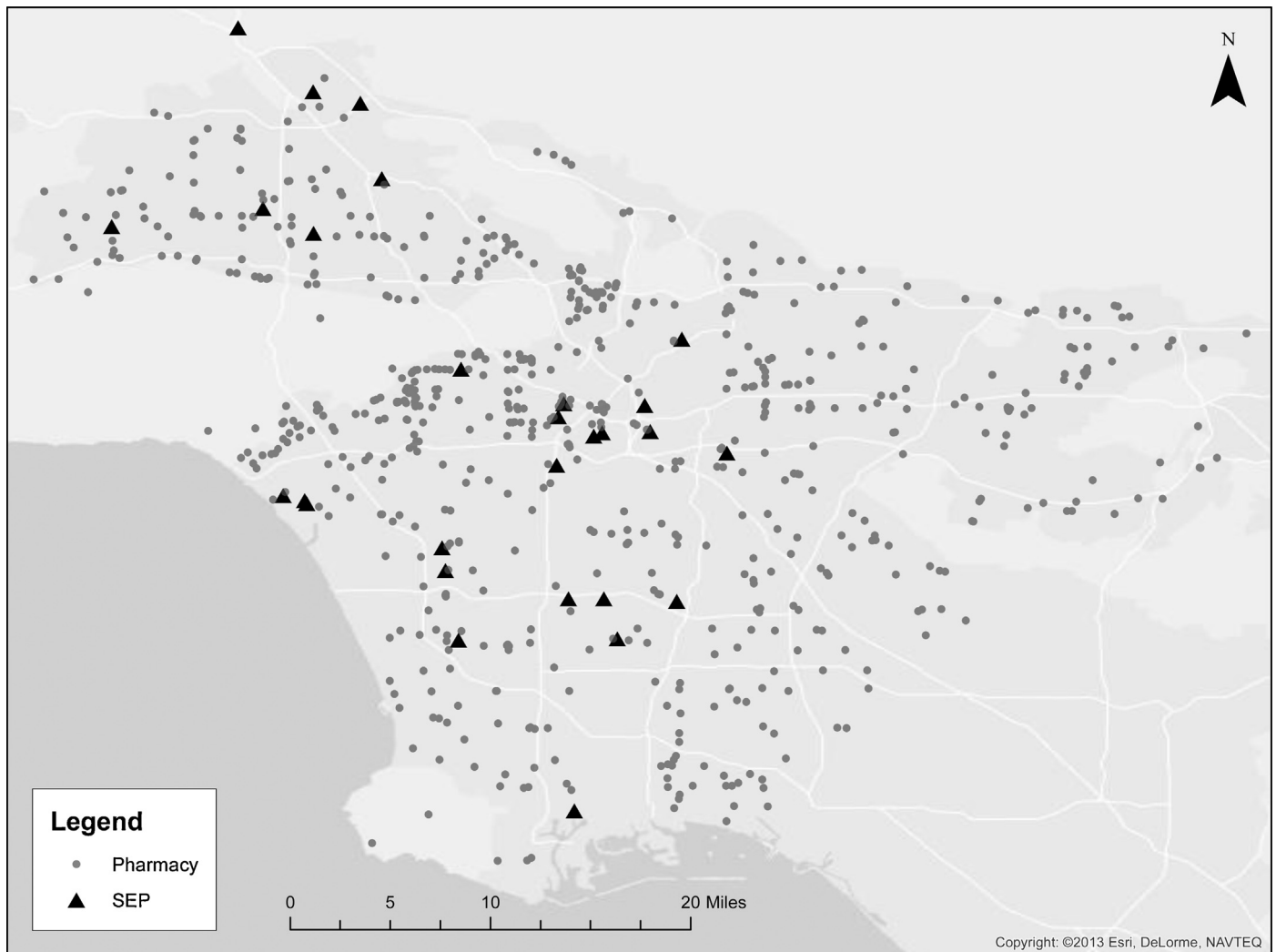


Fig. 1. Locations of syringe exchange programs (SEPs) and pharmacies in Los Angeles County.

odds of improperly disposing of the majority of their syringes. Having received sterile syringes from pharmacies at all ( $n = 103$ ; AOR = 2.23; 95% CI = 1.26–3.93) or primarily ( $n = 44$ ; AOR = 3.79; 95% CI = 1.29–11.19) during the last six months was associated with significantly higher odds of improper syringe disposal as compared to those who did not receive syringes from a pharmacy. However, pharmacy utilisation was not significantly associated with improper disposal of the majority of syringes in the last 30 days.

## Discussion

This study examined syringe access and disposal practices among PWID in Los Angeles, a city with both SEPs and pharmacies as syringe source and disposal options. PWID who used SEPs

had lower odds of improper disposal of syringes. This highlights the public health benefits of targeted sterile syringe access and disposal programs and echoes prior research conducted in other US cities involving PWID (e.g., Coffin et al., 2007; Fuller et al., 2002; Tookes et al., 2012). Receiving more than 30 syringes in the past 30 days was also associated with lower odds of improper syringe disposal, indicating that greater syringe coverage does not increase improper disposal (Bluthenthal et al., 2007).

In stark contrast, more than one-quarter of participants had received syringes from pharmacies in the past six months, but only 2% had disposed of syringes via pharmacies in the last 30 days. Given the high prevalence and geographical distribution of pharmacies in Los Angeles compared to SEPs (see Fig. 1), and their lack of both political controversy and need for external

Table 3

Adjusted Odds Ratios (AORs) for SEPs and pharmacies as syringe sources in relation to improper disposal practices among participants.

	Improper disposal last 30 days ( $N = 368$ ) AOR (95% CI)	Improperly disposed of >50% total syringes disposed last 30 days ( $N = 226$ ) AOR (95% CI)
SEP main syringe source (6 mths; $n = 254$ )	0.44 (0.26–0.75) <sup>a</sup>	0.19 (0.10–0.36) <sup>c</sup>
SEP source of syringes ( $y/n$ ; 6 mths; $n = 333$ )	0.51 (0.26–0.98) <sup>b</sup>	0.18 (0.08–0.39) <sup>d</sup>
Pharmacy main syringe source ( $n = 44$ )	3.79 (1.29–11.19) <sup>a</sup>	1.56 (0.61–3.99) <sup>c</sup>
Pharmacy source of syringes ( $y/n$ ; $n = 103$ )	2.23 (1.26–3.93) <sup>b</sup>	1.62 (0.86–3.08) <sup>d</sup>

<sup>a</sup> Controlled for recruitment site.

<sup>b</sup> Controlled for recruitment site and homelessness.

<sup>c</sup> Controlled for income (binary around the median (\$900)).

<sup>d</sup> Controlled for income (binary around the median (\$900)), unemployment last six months.



funding (Cooper et al., 2010), pharmacies would be appropriate venues for syringe disposal and education regarding proper disposal for PWID. Unlike SEPs, pharmacies are not typically provided a budget from external donors for syringe disposal, recovery and destruction. Financial support from local or state public health departments would likely be helpful in making pharmacy-based recovery and disposal more widely available. In New York, one study found that nearly all pharmacies were involved in sales of sharp containers (Tesoriero, Battles, Klein, Kaufman, & Birkhead, 2009); however in this study we did not assess this directly. Other research in Los Angeles did find that disposal options were not provided during pharmacy syringe purchase test of non-prescription syringe sales (Lutnick et al., 2013). Crucially, research has demonstrated reluctance among some pharmacists to distribute clean syringes to PWID (Lewis, Koester, & Bush, 2002; Reich et al., 2002). Consequently, PWID might be less likely to dispose of syringes at pharmacies to avoid further discrimination.

With such numbers of improperly disposed syringes among a population with high prevalence of BBVI, it is imperative that we explore and implement methods for reducing improper disposal among PWID in Los Angeles. Education of pharmacy staff, for example, has been suggested as a means of addressing discrimination and stigmatisation of PWID attempting to access or dispose of syringes at pharmacies (Lutnick, Case, & Kral, 2012; Lutnick et al., 2013). Such education should emphasise the important benefits to the wider community of safe/clean syringe distribution and disposal, and remind pharmacists that they are required to offer at least one disposal option as an authorised provider of non-prescription syringes (California Department of Public Health). Developing bridges between pharmacies and SEPs has also been suggested as a means of reducing syringe-related risk behaviours such as improper disposal (Riley et al., 2010). One seemingly straightforward approach, in consideration of the apparent benefits of SEPs, may simply involve improving access to, and availability of, such services. Augmenting the current operating hours and locations of syringe exchange and disposal services in Los Angeles (Los Angeles County Department of Public Health) would be a means of achieving this. Mobile SEP initiatives (e.g., 'backpack needle exchanges') have also shown to be feasible, beneficial and economical for distributing and disposing of injecting equipment (Hebert et al., 2008; Jones, Pickering, Sumnall, McVeigh, & Bellis, 2010).

Another approach worthy of consideration is expanding community syringe disposal sites, including low-cost syringe disposal bins or drop boxes that have been shown to be effective in multiple locales (e.g., de Montigny, Vernez Moudon, Leigh, & Kim, 2010; Devaney & Berends, 2008). Location of syringe disposal drop boxes could include pharmacies as well as other settings frequented by PWID, such as homeless shelters, food distribution sites, and areas known for drug purchases and use. A community-based syringe collection program in New York collected over 2.5 million used syringes at 79 drop boxes in 2006 (Klein et al., 2008). Implementation of such a program in Los Angeles County could be a useful and low-cost complementary strategy for safely removing used syringes.

Assessment of study results and conclusions should consider the following limitations. First, the time periods between the measurement of exposure variables (syringe source – last six months) and outcomes (improper disposal – last 30 days) are different. This may have affected the observed associations between syringe sources and improper disposal. Although asking participants about disposal methods over a six-month period may have increased the proportion of participants who had improperly disposed of syringes, it is unlikely that the primary source of syringes will have changed for many participants if the survey had focused on only the last 30 days

regarding syringe source venues. Second, our questionnaire did not ask participants to clarify the exact context regarding the disposal of syringes in the trash; it is possible that some syringes were first inserted into a puncture-proof container before being placed in the trash. This possibly resulted in an over-estimate of the prevalence of improper syringe disposal among participants. Third, because we recruited participants from SEPs, and our findings indicated that SEPs are associated with less improper disposal, our reported prevalence of improper disposal might be artificially low; however, the prevalence of improper disposal is not the main thrust of this article, but rather the association of SEP and pharmacy utilisation to source syringes with improper disposal, something that should not be biased because of our recruitment methods. Fourth, collecting data via self-report measures is potentially associated with social desirability bias and recall bias. Fifth, non-random recruitment of participants means that this study's findings may not be generalisable to other populations of PWID. Finally, the cross-sectional nature of the study prevented the identification of causal and temporal relationships between syringe source and disposal mechanisms.

This study investigated syringe access and disposal practices among PWID in Los Angeles. SEP utilisation was significantly associated with reduced odds of improper syringe disposal among the cross-sectional sample; however, receiving sterile syringes from pharmacies during the past six months was significantly associated with increased odds of improper syringe disposal in the last 30 days. These findings highlight the need to address an important public health issue with evidence-based, harm reduction policies, both in Los Angeles and in other areas with limited – or no – SEP coverage. Improving disposal mechanisms at pharmacies – which already cover much of the county – and expanding current SEP services (e.g., with regard to locations and opening hours) could reduce improper syringe disposal among PWID in Los Angeles.

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## Conflict of interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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