

# Correlates of injection-related wounds and skin infections amongst persons who inject drugs and use a syringe service programme: A single center study

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## Abstract

Risk factors associated with wounds and skin infections amongst persons who inject drugs may have changed in the era of fentanyl and now stimulant coinjection. We assessed the number of injection site wounds and skin infections and associated factors amongst 675 persons who inject drugs in a syringe services programme. Of this sample, 173 participants reported a total of 307 wounds and skin infections. Significant factors associated with increased number of wounds and skin infections were age 30 or older, female gender, ever experiencing homelessness, cocaine injection, and injecting between 5 and 10 years. Wounds and skin infections were common amongst syringe services programme clients and are associated with certain risk factors that may help to design effective interventions. Given the high prevalence of wounds in syringe services programme clients, wound care clinicians can make a significant difference and improve outcomes. We also shed light on correlates of wounds and skin infections in persons who inject drugs in order to spur further research to devise efficacious interventions for this underserved group.

## KEYWORDS

cutaneous wounds, injection drug use, syringe service programmes

## 1 | INTRODUCTION

In the past decade, there has been a significant increase in the use of opioids in the United States.<sup>1</sup> As a result, there has been a concurrent rise in injection drug use with an estimated 2.5 million persons who inject drugs

(PWID) in North America.<sup>2,3</sup> Syringe services programmes (SSPs) have been recognised as an efficacious, evidence-based intervention to prevent the spread of infectious diseases amongst PWID.<sup>4-6</sup> In fact, in 2017, the Centers for Disease Control and Prevention reported a greater need for SSPs.<sup>7</sup> Amongst PWID, wounds and skin infections (WSI, e.g., abscesses, cellulitis, ulcers) represent a significant cause of morbidity with reported

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prevalence estimates of up to 35%.<sup>8</sup> Moreover, in PWID WSI may be a marker for the severity of their substance use disorder.<sup>9</sup> Even though PWID may be able to self-diagnose injection-related WSI without difficulty, they often delay pursuing treatment due to stigma and fear of withdrawal.<sup>10-13</sup> This is especially concerning because some injection-related WSI can be life threatening such as wound botulism and necrotizing fasciitis.<sup>14,15</sup> Additionally, correlates amongst PWID with WSI receiving service at SSP have not been well described in the era of fentanyl and now stimulant coinjection, providing an opportunity to identify PWID at risk for inferior outcomes. We hypothesised that there are specific risk factors associated with WSI in PWID that use SSPs (e.g., socio-demographics, frequency of injection, re-using needles) that may be amenable to additional intervention. Therefore, we designed a retrospective cohort study to investigate the risk conferred by certain covariates amongst PWID that have WSI at the Infectious Disease Elimination Act (IDEA) SSP in Miami, Florida.

## 2 | METHODS

### 2.1 | Human subjects

This study was deemed non-human subject research by the Institutional Review Board of the University of Miami (IRB # 20190740).

### 2.2 | Participants

Data were analysed for 675 participants of the IDEA SSP between December 2016 and October 2019 who had more two or more visits to exchange syringes after enrolling into the programme. Programme participants received no compensation for enrolling into the SSP or for providing data.

### 2.3 | Data collection

We performed a retrospective review of the IDEA SSP participant database.<sup>16,17</sup> A baseline behavioural assessment was developed and implemented by the SSP staff for initial enrollment into the SSP as part of standard operating procedures to comply with state law reporting requirements. All SSP staff underwent trainings to ensure standardisation of the assessment, which was administered anonymously. In addition, data are collected at each exchange visit, including the number of syringes disposed, number of syringes distributed, number of

### Key Messages

- we assessed the number of injection site wounds and skin infections and associated factors amongst persons who inject drugs at a syringe service programme
- wounds and skin infections were common in our syringe service programme and highlight the potential role for wound care specialists
- significant factors associated with increased number of wounds and skin infections were age 30 or older, female gender, ever experiencing homelessness, cocaine injection, and injecting between 5 and 10 years

naloxone kits distributed, and self-report of injection-related infection. If a participant reported a WSI, they were referred to the weekly on-site wound care clinic. A more in-depth description of the wound care clinic has been previously published.<sup>18</sup> Data were linked by unique participant ID that is assigned to each participant during enrollment to ensure anonymity. By statute, no personal identifying information was collected from participants. All data were collected using REDCap software.<sup>19</sup>

### 2.4 | Primary outcome

The primary outcome for this analysis was the self-reported number of injection-related WSI reported by participants. During each exchange visit, participants were asked about wounds and skin infections (“Since your last visit to the exchange, have you had a skin or soft tissue infection due to injection drug use (e.g., abscess) or wounds at injection sites?”). The number of WSI reported was determined by aggregating the total number of self-reported WSI during a participant’s daily syringe exchange visits from December 2016 to October 2019.

### 2.5 | Covariate measures

Participants’ baseline enrollment data were used to assess the associations between socio-demographics, substance use, and injection-related risk behaviours with reported number of WSI. Socio-demographic measures included age, biological sex (male/female), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic), educational attainment (<high school/≥high school), annual income

(<\$14 999/≥\$15 000), housing status (experiencing homelessness/not experiencing homelessness), sexual orientation (gay, lesbian, bisexual/straight, heterosexual), and age of first injection. Participants reported which substance(s) they had injected in the previous 30 days (heroin, cocaine, methamphetamine, crack-cocaine, speedball, and fentanyl). In addition, participants reported if they shared injection equipment in the previous 30 days (dichotomized into 'shared any' versus 'shared none'), how many times, on average, per day did they inject in the previous 30 days (Less than daily, 1–2, 3–4, 5–7, 8–10, 11–15, >15), and whether they reused their own syringes (yes/no). Cutoffs in number of injections per day and income were determined by approximate equal distribution between the categories.

## 2.6 | HIV/HCV status

Participants were offered rapid HIV and HCV testing. In addition, participants were also asked to self-report current HIV and HCV status. If HIV/HCV antibody testing was declined, the self-reported measure was used for disease status, which has been shown to be reliable.<sup>20</sup> Only baseline data regarding HIV and HCV status was used for this analysis.

## 2.7 | Statistical analysis

Descriptive statistics were generated to provide an overview of the study sample. Continuous variables were reported as medians and interquartile ranges (IQR) and dichotomous variables were reported as frequencies and percentages. Due to over-dispersion in the outcome variable of WSI ( $\mu = 0.35$ , variance = 0.93), we used negative binomial regression, which has been used to handle over-dispersion in the outcome variable.<sup>21</sup> Bivariate and multivariable negative binomial regression models were used to assess socio-demographics, substances injected, and injection-related risk with our outcome. The time (in months) since enrollment into the programme was calculated and used as an offset term in the regression models. Variables included in the models were based on prior evidence of association.<sup>8,22–25</sup> Based on the significant correlation between sharing injection equipment and reusing syringes, sharing injection equipment was excluded from the final model based on prior evidence showing an association between reusing syringes and WSI. Coefficients of the regression model were interpreted as unadjusted and adjusted incidence rate ratios (IRR and aIRRs). All descriptive and regression analyses were performed using SAS statistical software (Version 9.4; SAS Institute, Cary, NC), and all tests were performed at a significance level of .05.

## 3 | RESULTS

### 3.1 | Characteristics of IDEA SSP participants

A total of 675 participants were identified. Of this sample, the majority were over 30 years old (76.4%), male (75.2%), Non-Hispanic White (53.5%), and had a yearly income less than \$15 000 (56.3%). In addition, 39.9% of the sample reported ever experiencing homelessness. One hundred and seventy three participants (26.1%) reported a total of 307 WSI. A majority reported injecting heroin (79.6%) but concurrent stimulant use was common (cocaine 27.6%, methamphetamine 15.9%, crack 9.2%, speedball 20.2%). An overwhelming majority of the participants reported syringe reuse (71.8%). 11.5% reported or tested HIV positive and 47.5% reported or tested HCV positive (Table 1).

### 3.2 | Factors associated with WSI

In the adjusted negative binomial regression, significant factors associated with increased number of WSI were age greater than 30 (aIRR = 2.44, 95% CI: [1.32, 4.55]), female gender (aIRR = 1.67, 95% CI: [1.02, 2.70]), ever experiencing homelessness (aIRR = 1.71, 95% CI: [1.12, 2.63]), cocaine injection (aIRR = 1.96, 95% CI: [1.18, 3.26] and 5 to 10 years of injecting substances (aIRR 1.77, 95% CI: [1.01, 3.09]) (Table 2).

## 4 | DISCUSSION

SSPs have been the standard of care for harm reduction in PWID.<sup>4–6</sup> The utility of this strategy for the prevention of infectious disease has led to the growth of SSPs throughout the United States.<sup>26</sup> Moreover, studies of PWID who use SSPs have allowed for the implementation of successful interventions in this vulnerable patient population.<sup>27</sup> Amongst PWID, it has been reported that up to 68% have had a wound or an abscess due to injection drug use which is associated with significant morbidity and occasional mortality in this population.<sup>8,14,28</sup> Therefore, understanding the risk factors that are associated with WSI in PWID may be of value for clinicians who care for these patients by suggesting strategies for harm reduction.

In this study, 173 SSP participants (26.1%) reported a total of 307 WSI over the study period. This relatively high incidence highlights the important role that wound experts can play in improving outcomes for PWID. The incidence of WSI in this population also highlights the

**TABLE 1** Baseline descriptive statistics of IDEA SSP participants (N = 675)

Characteristics	N (%)
Age (median, IQR)	37 (31-45)
Biological sex	
Male	504 (75.2)
Female	166 (24.8)
Race/ethnicity	
Non-Hispanic White	350 (53.5)
Non-Hispanic Black	28 (4.3)
Hispanic	276 (42.2)
Income status	
<\$14 999 a year	344 (56.3)
>\$15 000 a year	267 (43.7)
Educational attainment	
<High school/GED	332 (49.7)
≥High school/GED	336 (50.3)
Housing status in previous 6 months	
Ever experiencing homelessness	251 (39.9)
Never experiencing homelessness	378 (60.1)
Sexual orientation	
Gay/lesbian/bisexual	124 (18.6)
Straight/heterosexual	544 (81.4)
Substances injected in previous 30 days	
Heroin	537 (79.6)
Cocaine	186 (27.6)
Methamphetamine	107 (15.9)
Crack-Cocaine	62 (9.2)
Speedball	136 (20.2)
Fentanyl/carfentanil	95 (14.1)
Shared injection equipment in previous 30 days	
Yes	232 (34.4)
No	443 (65.6)
Reused syringes in previous 30 days	
Yes	452 (71.8)
No	178 (28.3)
Average number of injections per day	
Less than daily	51 (7.7)
1-4 times a day	335 (50.2)
5-7 times a day	155 (23.2)
8-10 times a day	74 (11.1)
11-15 times a day	22 (3.3)
>15 times a day	30 (4.5)
Number of years injecting (median, IQR)	9 (5-17)
HIV-positive	77 (11.5)
HCV-positive	314 (47.5)

Note: Self-report and/or testing via: rapid HIV test via fingerstick using OraQuick Advance Rapid HIV-1/2 Antibody test (OraSure Technologies, Inc Bethlehem, PA) or Chembio SURE CHECK HIV 1/2 Assay (Chembio Diagnostic Systems, Inc. Medford, NY) and a rapid HCV test via fingerstick using OraQuick HCV Rapid Antibody Test (OraSure Technologies, Inc Bethlehem, PA).

importance of proper connection between SSPs and wound care centers. It may even be effective for the SSP to set up an associated wound clinic to provide access to care for a population that generally has limited access to healthcare.<sup>29</sup> By setting up a wound care clinic at an SSP site, PWID can be connected with healthcare providers instantaneously to accurately diagnose and treat the WSI without worry of loss to follow-up and it allows for PWID at SSPs to be educated about preventing, recognising, treating, and escalating care of wounds.<sup>13</sup>

The literature strongly supports the utility of SSPs for harm reduction in this high-risk population.<sup>7,30-32</sup> Our findings suggest that sociodemographic factors such as age > 30, female gender, and homelessness all contribute to morbidity associated with WSI. These nonmodifiable risk factors, and limited public assistance for homes and suitable hygiene, highlight SSPs as plausible mechanism to reduce the number of WSI and associated complications. The increased risk of WSI in women is consistent with previous reports and could be secondary to smaller veins, injecting 'second' (i.e., after a different person) and injection by partners.<sup>33</sup> Interestingly, increasing age was associated with higher WSI risk but increased years injecting was not, which warrants further investigation. Importantly, cocaine injection was shown to be associated with higher incidence of WSI, consistent with prior literature, and even more critical in the fourth wave of the US overdose crisis with coinjection of opioids and stimulants.<sup>25</sup> SSPs may play an important role in providing tailored safe-injection education based on specific substances used. Reduction of WSI incidence in this population may prevent future complications such as sepsis, propagation of infection, emergency room visits, and hospital admissions.<sup>23</sup> The potential role of SSPs in the prevention of WSI reinforces the historically important goal of prevention of HIV and hepatitis C. Additionally, the discovery that age 30 or greater, female gender, and homelessness are associated with increased WSI count (and potential subsequent complications) can be leveraged to stratify patients by risk to develop WSI and to counsel the patients appropriately.

Our findings can be leveraged to tailor specific interventions to subsets of PWID (i.e., women, older PWID, and PWID experiencing homelessness) accessing SSPs to maximise harm reduction. For example, in order to address the high prevalence of wounds in PWID in Miami, we founded a weekly wound clinic at the SSP to properly diagnose and manage the WSI associated with injection drug use.<sup>18</sup> Mobile outreach and community-based SSPs can serve as a low barrier setting for wound care and infection screening can improve health of PWID, thereby helping reduce healthcare costs.<sup>13,34</sup>

**TABLE 2** Unadjusted and adjusted negative binomial regression results for correlates of number of self-reported injection-related wounds and skin infections

Characteristic	IRR	95% CI	aIRR	95% CI
Age				
>30 years old	<b>1.69</b>	<b>[1.01, 2.86]</b>	<b>2.83</b>	<b>[1.51, 5.29]</b>
≤30 years old	REF	-	REF	-
Biological sex				
Female	<b>1.59</b>	<b>[1.01, 2.50]</b>	<b>1.68</b>	<b>[1.03, 2.73]</b>
Male	REF	-	REF	-
Race/ethnicity				
Hispanic	1.02	[0.67, 1.56]	1.11	[0.71, 1.74]
Non-Hispanic Black	0.54	[0.16, 1.76]	0.60	[0.18, 1.97]
Non-Hispanic White	REF	-	REF	-
Housing status				
Experiencing homelessness	<b>1.98</b>	<b>[1.30, 3.01]</b>	<b>1.81</b>	<b>[1.18, 2.78]</b>
Not experiencing homelessness	REF	-	REF	-
Substances injected				
Heroin	1.12	[0.64, 1.95]	0.97	[0.48, 1.93]
Cocaine	<b>1.64</b>	<b>[1.05, 2.56]</b>	<b>1.96</b>	<b>[1.18, 3.26]</b>
Methamphetamine	1.19	[0.67, 2.11]	1.46	[0.74, 2.91]
Speedball	1.36	[0.83, 2.22]	0.65	[0.36, 1.17]
Fentanyl	1.06	[0.57, 1.98]	1.14	[0.62, 2.12]
Reusing syringes				
Yes	1.27	[0.77, 2.11]	1.17	[0.68, 1.99]
No	REF	-	REF	-
Number of injections per day				
>5	1.27	[0.84, 1.91]	1.30	[0.82, 2.08]
≤4	REF	-	REF	-
Years injecting				
≤5 years	1.14	[0.70, 1.86]	1.31	[0.78, 2.22]
5-10 years	1.42	[0.86, 2.35]	<b>1.96</b>	<b>[1.12, 3.44]</b>
≥10 years	REF	-	REF	-

Note: Bolded values indicate  $P < .05$ .

Although our findings are consistent with previous literature showing a high prevalence of wounds in PWID, it is possible that PWID at our SSP reported WSI because they knew that they could receive on-site care in a non-stigmatising environment. This study was also limited by the lack of longitudinal data collection on injection-related behaviours limiting our ability to examine changes in risk over time once engaged in utilising SSP services. In addition, many of the clients did not return to the IDEA SSP after their initial visit, an expected challenge in this population. Finally, our study demonstrates a series of associations, but causality is not clear and therefore should be further investigated.

In conclusion, SSPs are an effective method to reduce overall harm in PWID through intervention and on-site integrated services. WSI are common amongst SSP clients and are associated with certain risk factors that may help to design effective, tailored interventions for harm reduction. Given the high prevalence of WSI in SSP clients, proper wound care has the potential to significantly improve health outcomes. We hope to shed light on correlates of WSI in PWID in order to inspire further research to devise efficacious interventions such as substance-specific education on safe injection practices for this underserved group.

## CONFLICT OF INTEREST

The authors of this review article have NO conflict of interest to declare. The authors declare that this retrospective cohort and has NOT been published previously.

## ETHICS STATEMENT

This study was deemed not human subjects research by the Institutional Review Board of the University of Miami (IRB # 20190740).

## DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

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