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Association of Self-Reported Abscess With High-Risk Injection-Related Behaviors Among Young Persons Who Inject Drugs

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Abstract

Abscess is a common source of morbidity for people who inject drugs. We used data from the Study to Assess Hepatitis C Risk to measure prevalence of abscess and identify factors associated with the history of abscess. Of 541 participants, 388 (72%) were male and 149 (28%) were female. Almost half ($n = 258$, 48%) reported ever having an abscess. Persons who inject drugs with an abscess history were significantly more likely to have more injection partners ($p = .01$), inject heroin daily ($p < .05$), and share cookers ($p = .001$) and less likely to report using new syringes with each injection ($p = .02$). Most reported self-treating their last abscess and increasing drug use when having an abscess. High-risk injection-related activity was associated not only with infections such as HIV and hepatitis C virus but also with abscess. Nurses should screen patients presenting with abscess for high-risk practices and provide prevention education.

Key words: abscess, high risk, injection drug use, people who inject drugs, risk behavior

Persons who inject drugs (PWID) are at high risk for negative sequelae, including hepatitis B virus, hepatitis C virus (HCV), HIV, and bacterial infections. Cutaneous abscess caused by bacterial infection (henceforth referred to as *abscess*) is among the most common sources of morbidity for PWID (Smith, Robinowitz, Chaulk, & Johnson, 2015) and is associated with HIV (Lloyd-Smith et al., 2005), homelessness, and unsterile injection practices such as failure to clean the injection site and lack of handwashing (Murphy et al., 2001; Phillips & Stein, 2010). Abscesses can lead to serious complications such as endocarditis, which has significantly increased in recent years among PWID younger than 40 years, as has septicemia, osteomyelitis, and other life-threatening infections related to injection drug use (IDU; Collier, Doshani, & Asher, 2018; Vakili & Crum-Cianflone, 2017). In the United States in 2012, hospitalizations due to infections related to illicit opioid injection cost more than $700 million (Ronan & Herzig, 2016), and, as other sequelae of the opioid crisis, including HIV (Peters et al., 2016), hepatitis C virus (Zibbell et al., 2017), overdose (Centers for Disease Control and Prevention [CDC], 2017a), and pneumococcal disease (Wiese et al., 2018) have increased, it is likely that abscess has as well, and the costs for treatment are much higher today. Abscess is a source of mortality among PWID and as many as 5% of patients hospitalized for IDU-related soft tissue infections die during the course of hospitalization (Tookes, Diaz, Li, Khalid, & Doblecki-Lewis, 2015). The high morbidity, mortality, and health costs related to abscess make this an important issue.

Research on global rates of abscess related to IDU is sparse, but there is strong evidence that the opioid epidemic is not confined to the United States and opioid use is increasing in many parts of the world including Europe, Canada, the Middle East, and China (Martins & Ghandour, 2017). IDU is already common throughout the world (Mathers et al., 2008). As abscess may be an indicator of unsterile injection practices and HIV risk, it is important for nurses to be educated on abscess and have tools for prevention.

Abscess resulting from IDU may be the result of poor injection hygiene, such as failure to clean the injection site or multiple injections with a single syringe (Ebright & Pieper, 2002; Fink, Lindsay, Slymen, Kral, & Bluthenthal, 2013; Murphy et al., 2001; Phillips, Anderson,

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& Stein, 2008; Phillips & Stein, 2010), or the type or quality of the substance injected, such as amphetamine-type substances with many adulterants or less-refined forms of heroin that require addition of an acid to dissolve the drug (Ciccarone & Harris, 2015; Dahlman et al., 2016; Strathdee et al., 2008; Summers, Struve, Wilkes, & Rees, 2017). Injecting cocaine and other stimulants can cause vasoconstriction, leading to tissue necrosis (Hope, Kimber, Vickerman, Hickman, & Ncube, 2008; Phillips et al., 2008; Strathdee et al., 2008). An association has also been found between abscess and injecting a mixture of heroin and cocaine (Fink et al., 2013; Phillips et al., 2008; Smith et al., 2015). Other injection-related risk factors for abscess include skin-popping (injecting subcutaneously, rather than into a vein) and booting (a process by which substances are pumped in and out of the vein during the injecting process; Ebright & Pieper, 2002; Fink et al., 2013; Summers et al., 2017). Homelessness and injecting outdoors have also been associated with abscess (Binswanger et al., 2008). A study of 201 PWID found an association between abscess and syringe sharing and sharing of ancillary injecting equipment, but a few other studies have examined the association between injection practices such as syringe sharing and abscess (Dahlman et al., 2016).

To better understand the association of high-risk injection practices and abscess among PWID and to identify appropriate interventions, we used data from the Study to Assess Hepatitis C Risk (STAHR) to examine the association between abscess and injection-related behaviors. Understanding factors that have been associated with abscess can help nurses screen for high risk injection-related behaviors, provide prevention education messages, and work to prevent future abscess as well as other infectious consequences of IDU such as endocarditis, HCV, and HIV.

Methods

The STAHR study was conceived to develop and pilot test different methods to recruit a sample of young adult PWID for HCV testing (Garfein et al., 2013). Men and women, ages 18 to 40 years, the age group at highest risk of HCV infection, who were living in San Diego and reported IDU in the previous 6 months were recruited to participate between March 2009 and June 2010. Recruitment methods have been described elsewhere (Garfein et al., 2013), but in short, participants were recruited via respondent-driven sampling, venue-based sampling, and street outreach sampling. A secondary goal of our study was to develop and pilot test instruments for collecting data from young PWID. Most data were self-reported using audio computer-assisted self-interviewing technology. We also used serological tests for HCV. Sociodemographic variables included age, gender, race/ethnicity, education, income, and housing status. Questions about substance use and injection practices included number of years of injecting and types of drugs used. Other questions included drugs ever injected, number of injections per day, drug type injected most frequently, number of injection partners, injection paraphernalia sharing, and the color of heroin and/or amphetamine-type substance used. Participants were asked about other risk-taking behaviors in the previous 3 months, including distributive syringe sharing; receptive syringe sharing; sharing of ancillary injecting equipment such as cookers, cottons, and rinse water; frequency of new (sterile) syringe use; and utilization of syringe service programs (SSPs). Participants were asked about number of abscesses ever experienced. For our substudy, only those who responded to the question "How many abscesses have you EVER had?" were included in the analysis. For those who reported a history of abscess, we asked about abscess characteristics (frequency, location), care, and changes in drug use patterns related to having the abscess ("When you had an abscess, did you ever use more drugs as a way to cope with the pain from the abscess?") and if they currently (in the previous 3 months) had an abscess. The STAHR study recruited 566 participants. Of the 566 participants, 25 (4.4%) did not report a history of abscess. Because the number of not reporting cases was less than 5%, we considered they were missing at random and were excluded from the analysis.

For those with and without a history of abscess, percentage and means (median) of selected demographic characteristics and IDU-related risk behaviors were calculated, and the difference in percentage and mean were tested with Pearson's chi-square test and *t*-test, respectively. The Cochran–Armitage trend test was used to detect linear trends in increasing injection-related risks (*never, ≤50% of the time, >50% of the time*) and their associations with history of abscess. Multivariable logistic regression was used to assess the association between history of abscess and injection-related behaviors. Each behavior variable was added individually into the model, which controlled for age, gender, race, housing status, HCV status, number of years injecting, injection drug of choice, and number of injection partners. All tests were two sided and a p-value of $<.05$ was considered statistically significant. Statistical analysis was conducted using SAS software version 9.3 (SAS Institute Inc., 2012). The University of California, San Diego Institutional Review Board approved all study procedures.

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Results

The demographic characteristics of 541 participants who responded to the question "How many abscesses have you ever had?" is presented in Table 1. The median age was 28 years (range = 18–40 years). Overall, 258 (48%) reported ever having an abscess. There were no differences in age, race, gender, housing status, self-reported HCV status, or average number of injections per day between those with and without a reported history of abscess. Those with a history of abscess were significantly more likely to report having injected for 5 or more years than those without an abscess history. They

Table 1. Sociodemographic and Behavioral Factors Associated With Reported History of Abscess Among Persons Who Inject Drugs, San Diego, 2009–2010 (*N* = 541)

Variables	Overall *N* (%) *N* = 541	Ever Abscess *n* (%) *n* = 258	No Abscess *n* (%) *n* = 283	*p*-Value[a]
Gender (4 missing)				
Male	388 (72.3)	173 (67.6)	215 (76.5)	
Female	149 (27.7)	83 (32.4)	66 (23.5)	.03[b]
Age (years; 4 missing)				
<24	154 (28.7)	66 (25.7)	88 (31.4)	
25–34	272 (50.7)	137 (53.3)	135 (48.2)	
35–40	111 (20.7)	54 (21.0)	57 (20.4)	.32
Race/ethnicity				
White	274 (50.6)	131 (50.8)	143 (50.5)	
Black	37 (6.8)	12 (4.7)	25 (8.8)	
Hispanic/Latino	148 (27.4)	69 (26.7)	79 (27.9)	
Other	82 (15.2)	46 (17.8)	36 (12.7)	.12
Housing status (6 missing)				
Housed	347 (64.9)	159 (62.4)	188 (67.1)	
Institutionalized	77 (14.4)	38 (14.9)	39 (13.9)	
Homeless	108 (20.2)	57 (22.4)	51 (18.2)	
Other	3 (0.6)	1 (0.4)	2 (0.7)	.59
HCV RNA (55 missing)				
Negative	390 (80.2)	169 (79.0)	221 (81.3)	
Positive	96 (19.8)	45 (21.0)	51 (18.8)	.57
No. of years of injecting (4 missing)				
0-4	219 (40.8)	77 (30.2)	142 (50.4)	
5-10	166 (30.9)	96 (37.6)	70 (24.8)	
11+	152 (28.3)	82 (32.2)	70 (24.8)	<.001[b]

Note. HCV = hepatitis C virus.
[a] *p*-Value from χ^2 statistics for percentage.
[b] *p*-Value ≤ .05 is significant.

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were also more likely to report a higher mean number of injection partners than those without a history of abscess (3.75 vs. 3.15, $p < .05$).

Those with an abscess history were significantly more likely than those without to have ever injected heroin (51% vs. 49%, $p = .01$), heroin mixed with cocaine (55% vs. 45%, $p < .05$), or heroin mixed with methamphetamine (60% vs. 40%, $p < .001$). They were more likely to report heroin, used alone or mixed with another drug, as their drug of choice, compared with those without a history of abscess. There was no difference between the two groups in the type of heroin (black tar vs. other, $p = .19$), type of methamphetamine (clear vs. other, $p = .27$), or location where injection most often occurred (primarily injecting indoors in a private residence, e.g., their own home, a friend's or relative's home, versus in a public space, e.g., outdoors, in a shooting gallery, at a bar; $p = .99$ [data not shown]). There was no difference in SSP utilization between the two groups: less than one-half of those without a history of abscess and half of those with a history of abscess reported SSP attendance in the previous 3 months. Those without an abscess history were more likely to report getting their syringes from a trusted source (i.e., SSP, pharmacy, or clinic) than those with an abscess history.

Of the 258 participants reporting a lifetime history of abscess, 71% reported having had more than one abscess and 12% reported having had 10 or more abscesses (Table 2). The most commonly reported abscess sites were the arm, leg, and buttock. Other locations included groin, torso, head, foot, and neck. One-fifth reported having an abscess at the time of the survey. Most (61%) reported increasing drug use when they had an abscess to cope with the pain, and 60% reported having self-treated their last abscess.

Compared with those who never reported an abscess, those with a history of abscess were more likely to report distributive syringe sharing ($p < .001$) and receptive syringe sharing ($p = .01$) in the previous 3 months (Table 3). Other injection-related risk factors significantly associated with a history of abscess included sharing a cooker, cottons, or rinse water in the previous 3 months and rarely, or never, using a new sterile syringe. Regardless of the type of risk behavior, with increasing engagement in injection-related risk factors (*never, <50% of the time, or >50% of the time*), the proportion of participants reporting a history of abscess increased significantly (p-value for trend $< .01$). More than one-third of those without abscess history and one-half of those with a history of abscess reported re-using syringes five or more times (data not shown).

Table 2. Characteristics of Abscess and Self-Treatment Among Persons Who Inject Drugs and Report History of Abscess ($n = 258$), San Diego, 2009–2010

	n (%)
Date of last abscess	
Current abscess	53 (21)
Not current, but within last 6 months	63 (24)
>6 months to ≤1 year	47 (18)
>1 year	95 (37)
No. of lifetime abscesses	
1	74 (29)
2–3	88 (34)
4–5	39 (15)
6–9	24 (9)
10+	32 (12)
Abscess site[a]	
Arm	193 (75)
Leg	81 (31)
Buttock	48 (19)
Other[b]	107 (41)
Increased drug use to cope with abscess pain	
Yes	158 (61)
No	100 (39)
Self-treated last abscess	
Yes	156 (60)
No	120 (40)

[a] Site on body where an abscess has ever been.
[b] Other" includes head, neck, torso, foot, groin, and other body parts.

In multivariate regression modeling, controlling for potential confounders, only engaging in distributive syringe sharing at least 50% of the time was independently associated with a history of abscess (adjusted odds ratio 1.92, 95% confidence interval 1.01–3.64; Table 4). Engaging in other risk behaviors had a similar association magnitude but did not reach statistical significance.

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Table 3. Association of Injection-Related Risk Behaviors With a Reported History of Abscess Among Persons Who Inject Drugs, San Diego, 2009–2010

Variable	Overall, *N* (%) (*n* = 541)	Ever Abscess, *N* (%) (*n* = 258)	No Abscess, *N* (%) (*n* = 283)	*p*-Value[a]	*p*-Value for Linear Trend[b]
Distributive syringe sharing in the last 3 months (17 missing)					
Never	279 (53.2)	116 (41.6)	163 (58.4)		
<50% of the time	178 (34.0)	91 (51.1)	87 (48.9)		
≥50% of the time	67 (12.8)	45 (67.2)	22 (32.8)	<.001[c]	<.001[c]
Receptive syringe sharing in the last 3 months (17 missing)					
Never	268 (51.1)	113 (42.2)	155 (57.8)		
<50% of the time	178 (34.0)	93 (52.2)	85 (47.8)		
≥50% of the time	78 (14.9)	46 (59.0)	32 (41.0)	.013[c]	.003[c]
Cooker sharing in the last 3 months (19 missing)					
Never	231 (44.3)	97 (42.0)	134 (58.0)		
<50% of the time	136 (26.1)	65 (47.8)	71 (52.2)		
≥50% of the time	155 (29.7)	91 (58.7)	64 (41.3)	.006[c]	.001[c]
Cotton sharing in the last 3 months (14 missing)					
Never	240 (45.5)	99 (41.3)	141 (58.8)		
<50% of the time	145 (27.5)	76 (52.4)	69 (47.6)		
≥50% of the time	142 (26.9)	78 (54.9)	64 (45.1)	.016[c]	.006[c]
Rinse water sharing in the last 3 months (18 missing)					
Never	230 (44.0)	93 (40.4)	137 (59.6)		
<50% of the time	139 (26.6)	73 (52.5)	66 (47.5)		
≥50% of the time	154 (29.4)	85 (55.2)	69 (44.8)	.008[c]	.003[c]
Frequency of use of new, sterile syringe, last 3 months (20 missing)					
Never	36 (6.9)	12 (33.3)	24 (66.7)		
<50% of the time	108 (20.7)	63 (58.3)	45 (41.7)		
≥50% of the time	377 (72.4)	177 (46.9)	200 (53.1)	.020[c]	.992

[a] *p*-Value from χ^2 statistics for percentage.
[b] With Cochran–Armitage trend test.
[c] *p*-Value ≤ .05 is significant.

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Discussion

Abscesses are common in PWID, and, although two-thirds of our cohort had been injecting for less than 10 years, almost half reported ever experiencing an abscess, and more than 10% reported having had 10 or more abscesses. The World Health Organization (2009) and the Harm Reduction Coalition (n.d.) have stated that abscess related to IDU was the result of poor injection technique, poor hygiene (i.e., lack of handwashing or cleaning the injection site), being infected with HIV, mixing drugs, and booting. Prevention education messages include hand washing, reducing the number of injections, and use of sterile syringes. Only one document on abscess care for PWID recommended referring patients to medication-assisted therapy (MAT) such as methadone treatment (Harris & Young, 2002). None mentioned specific injection-related risk behaviors that may also reduce occurrence of abscess.

We found associations between a history of abscess and many high-risk injection-related behaviors, including sharing syringes and ancillary injecting equipment, and a greater number of injection partners. Although the current guidance has addressed the use of sterile syringes, it has not addressed the use of sterile ancillary injecting equipment such as cookers. Research has found that PWID who report using sterile syringes still report sharing injecting equipment (Evans et al., 2003; Hahn, Evans, Davidson, Lum, & Page, 2010). Given the association of these activities with other infections, specifically, HIV and viral hepatitis, nurses should view patient presentation with an abscess as an indicator of risk, and screen for these viruses. Prevention messages should be expanded to address specific high-risk injection behavior, including individualized risk reduction education, referral to MAT or other available drug treatment, access to sterile injecting equipment, and education about risks associated with sharing injection equipment.

A large proportion of participants in our study reported not seeking care for their last abscess, opting instead for self-care. This has been reported elsewhere as a result of past experiences of shame and stigma when engaging with health care providers: PWID reported lancing their own abscesses to avoid similar experiences (Harris, Richardson, Frasso, & Anderson, 2018). Abscesses left untreated can lead to sepsis and endocarditis, conditions that are expensive to treat and can be fatal (Ronan & Herzig, 2016).

More work needs to be done to engage PWID in care. This may include reducing barriers such as cost, distance to care, and health care-associated stigma (Browne et al., 2016; Stephens, Young, & Havens, 2017). Stationing nurses to work at places commonly accessed by PWID, such as SSPs or shelters, may also help ensure that PWID receive necessary care and reduce complications of

Table 4. Multivariable Analysis of Factors Associated With Abscess History by Injection-Related Behaviors Among Injection Drug Use Living in San Diego, 2009–2010

Injection-Related Behaviors	AOR[a]	95% CI
Distributive syringe sharing in last 3 months		
Never	Ref	
<50% of the time	1.17	0.75–1.82
≥50% of the time	1.92	1.01–3.64
Receptive syringe sharing in last 3 months		
Never	Ref	
<50% of the time	1.15	0.73–1.81
≥50% of the time	1.36	0.76–2.45
Cooker sharing in last 3 months		
Never	Ref	
<50% of the time	1.05	0.64–1.75
≥50% of the time	1.56	0.94–2.61
Cotton sharing in last 3 months		
Never	Ref	
<50% of the time	1.49	0.92–2.41
≥50% of the time	1.15	0.68–1.92
Rinse water sharing in last 3 months		
Never	Ref	
<50% of the time	1.44	0.87–2.39
≥50% of the time	1.13	0.68–1.88
Frequency of use of new, sterile syringe, last 3 months		
Never	Ref	
<50% of the time	2.06	0.79–5.39
≥50% of the time	1.52	0.63–3.71

Note. AOR = adjusted odds ratio; CI = confidence interval; HCV = hepatitis C virus.
[a] The regression model controlled for age, sex, race, housing status, HCV status, number of years injecting, number of injections/day, injection drug of choice, and number of injection partners.

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untreated abscess. Overall, participants in our survey had low levels of SSP utilization. While there was no difference between the groups in SSP utilization, those with a history of abscess reported using each syringe more often before disposal than those without abscess history. Nurse education should not only encourage PWID to use SSP and pharmacy syringe services, but ensure that patients know where such services are and how to access them. Low rates of SSP and health care utilization impede the potential for intervention. Providing nursing care at SSPs as a part of a comprehensive approach to care for PWID may increase overall utilization of these services. There is some evidence that PWID are more likely to seek primary care if they first encounter a nurse working in an SSP (Artenie et al., 2015).

A 2013 technical report released by the U.S. Department of Health and Human Services (2013) has recommended the provision of a comprehensive approach to care, involving multiple, combined strategies to combat IDU-related sequelae, including access to sterile injecting equipment, screening for infectious disease, overdose prevention, and drug treatment programs. Establishing nurses at these facilities may result in improved overall care and lower rates of hospitalization. People who inject drug benefit when health care services are co-located with other programs. Hospitals and community clinics also play a role and can better treat PWID by offering comprehensive services including prevention education, screening for infectious disease, referrals to clean injection supplies and MAT, and addressing stigma within their institutions.

The majority of those with an abscess history in our study reported increasing drug use to cope with the pain related to the presence of an abscess. This is an important finding: Not only were PWID self-treating their pain and discomfort, they could also be at heightened risk for more abscesses, other bloodborne infections, or overdose during this period. Although we did not assess what specific drugs were used to cope, other studies have shown that PWID were likely to increase opioid use as a coping strategy (Harris et al., 2018). Improving opportunities to prevent abscesses by increasing access to sterile injecting equipment may contribute to a reduction in injection frequency and thereby reduce other negative sequelae of IDU.

The consequences of IDU are at shocking highs. Rates of overdose (Centers for Disease Control and Prevention, 2017a), endocarditis, and osteomyelitis (Collier et al., 2018), and HCV infection (Centers for Disease Control and Prevention, 2016) have all been on the rise. Addressing underlying causes of increased drug use is critical. Further, those with a history of abscess were also more likely to report mixing the drugs they injected, which also may put them at higher risk for overdose and HCV infection (Betts et al., 2015).

Although there is some evidence for an association between abscess and homelessness (Binswanger et al., 2008), we did not find one. It may be that syringe re-use, which was high in our study, coupled with overall low SSP usage, was more strongly associated with abscess formation than was cleanliness of the physical environment. More research is needed in this area. Some studies have shown an association between heroin type and abscess (Ciccarone & Harris, 2015; Summers et al., 2017). In our study, however, although heroin use was associated with history of abscess, heroin type did not differ between groups. The prevalence of abscess found in our study was similar to that reported in other studies, ranging from a 55% lifetime prevalence, with 2% reporting past year abscess (Phillips & Stein, 2010), to 70% reporting lifetime abscess, with 29% reporting abscess in the past 12 months and 11% in the last 30 days (Dahlman et al., 2016).

Limitations

There are some limitations to this work. Our study was limited to PWID ages 18 to 40 in San Diego and is not representative of all PWID. The group consisted primarily of White males and was young. Future research should examine abscess in older PWID populations and among a more diverse group, including in international settings. Our cross-sectional survey relied on self-report. We did not verify the presence of abscess, nor review medical records to confirm reported history. It is possible that some of the abscesses described were not a result of IDU activity or that they would not be classified as an abscess by a health care professional. People who reported self-treating their abscesses may in fact have accessed care but not reported it. Some of the factors that other studies have found to be associated with injection-related abscess, such as cleaning injection sites (Murphy et al., 2001; Phillips et al., 2008; Phillips & Stein, 2010), were not included in our study.

Although we gathered data on lifetime abscess history, we focused our analysis on IDU-related risk from the previous 3 months, due to the small number of participants reporting abscesses in the past 3 months. This snapshot of risk may not be representative of the individual's IDU practices at the time when the abscess developed. Our data were also relatively old and may not reflect current injection practices. However, IDU is on the rise globally (Degenhardt, et al., 2017), and our research showed that the presence of an abscess was an indicator of

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Key Considerations

- Abscesses resulting from IDU may be indicators of unsafe injection practices, including syringe re-use and sharing injection equipment. Given the high risk of HIV associated with these practices, nurses caring for patients with abscesses should educate patients about safer use and the risks associated with these practices.
- Persons who inject drugs with abscesses report increasing their drug use to cope with the pain, placing them at higher risk of more abscesses, HIV, HCV, and overdose. Persons who inject drugs should be encouraged to seek proper and prompt care for abscesses and be educated about the risks associated with increasing drug use.
- Many persons who inject drugs report self-treating abscesses. Community-based organizations frequented by persons who inject drugs, such as syringe services programs, should be encouraged to have nurses on staff to provide care, education, and referral.

risky injection practices. One in ten new HIV diagnoses reports a history of IDU (CDC, 2017b). Future research should examine current risk practices. The high risk reported in our group suggests that presenting for abscess care is an important opportunity to intervene, educate, and screen for other associated infections and that efforts to get PWID to access necessary care need improvement.

Conclusion

Young adult PWID in San Diego who had experienced an abscess were more likely to engage in risky injection-related behaviors, including sharing injection equipment, higher rates of drug use, and a higher number of injection partners. Nurses who treat patients for abscess should screen these patients for risk, provide prevention education, and refer them to SSPs and MAT. Despite the frequency of abscess in this population, the high rate of self-treatment suggests that a critical opportunity for intervention is frequently missed. More work needs to be done to encourage PWID to access health care and to train nurses to identify abscess-related risk factors and provide appropriate interventions.

Disclosures

The authors report no real or perceived vested interests related to this article that could be construed as a conflict of interest.

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