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BRIEF REPORT

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Injection-Related Infections and Self-treatment Practices Among People Who Inject Drugs in Rural Appalachia

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In this study of self-reported serious injection-related infections among people who inject drugs in rural Appalachia (n = 463), 50% reported reusing syringes/needles, 70.6% ever had an injection-site abscess, and 44.4% of those with a recent abscess took nonprescribed antibiotics. The study identifies opportunities to improve harm reduction services.

Adverse health outcomes from injection drug use, such as HIV, viral hepatitis, and serious injection-related infections (SIRIs), are major problems globally and in the United States, with the frequency of SIRI increasing since the early 21st century [1, 2]. Skin and soft tissue infections (SSTIs) are most common, with an estimated lifetime prevalence between 27% and 69% among people who inject drugs (PWID) [3–5]. Rates of infective endocarditis are also rising [6–8], especially among younger populations [9].

PWID with SSTI often attempt to self-manage rather than seek medical care, largely due to previous poor experiences with the health care system and/or fear of stigma [4, 10–15]. Self-management practices include lancing, use of nonprescribed antibiotics, and other remedies, such as applying warm compress [4, 11–13, 16]. Most studies on this subject have been done in urban settings in the United States [1, 3, 4, 6, 7, 12, 15, 17, 18], Canada, [19, 20], and Europe [3, 21, 22], with few done in more rural settings [4, 23]. Appalachian Kentucky is an important place to do this research because of the high prevalence of injection and SIRI [24, 25].

Understanding the frequency of SSTI, SIRI, and self-management practices among PWID is crucial for targeting harm reduction strategies and potentially reducing the burden of these infections. This study explores self-reported substance use characteristics, bacterial infections, and self-management practices in a cohort of PWID in rural Appalachian Kentucky.

METHODS

Design

Data were collected through studies taking place in 2 counties in rural Appalachian Kentucky: Kentucky Outreach Service (KyOSK) and Social Networks Among Appalachian People (SNAP). The methods for these integrated studies are described elsewhere [26, 27]. KyOSK aims to test the effectiveness of a kiosk in reducing negative outcomes relating to drug use [26], and SNAP is an observational cohort study focused on methamphetamine use [27].

Recruitment and Study Eligibility

Eligible participants for the KyOSK and SNAP studies were aged ≥18 years and reported using drugs to get high in the past 6 months (excluding alcohol, marijuana, and tobacco), and/or they had previously participated in a cohort study for which inclusion criteria included recent substance use [26, 27]. In recruitment for KyOSK and SNAP, study staff extended invitations to individuals whom they met through syringe service program (SSP) outreach and to participants who were enrolled in prior cohort studies [28, 29] and consented to be contacted about future research. Enrolled participants were invited to refer peers (up to 5 each, $10/peer). Participants were paid $35 and $30 for completion of the KyOSK and SNAP survey items, respectively.

Data Collection

Interviewer-administered surveys were used to collect data on demographic characteristics, houselessness, transportation access, drug-related behaviors, engagement in harm reduction services, and experience with injection-related infections. Houselessness was measured via "Have you been unstably housed in the past 6 months? 'Unstably housed' means you were living from place-to-place, 'couch surfing,' on the street, in a car, park, abandoned building, tent, campsite, squat or shelter." Participants were asked how far they resided from an SSP in walking or driving times. Behavioral variables included past 30-day injection frequency, drugs injected, receptive syringe sharing, syringe reuse, and syringe source (SSP, family/friends, person selling syringes, pharmacy, online, farm supply).

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Table 1. Descriptive Characteristics of a Sample of Rural People Who Injected Drugs in the Past 6 Months (n = 463)

	Total	Abscess in Past 6 mo	No Abscess in Past 6 mo
Sample	463	153 (33)	310 (67)
Demographic characteristics			
Age, y, mean (SD)	41.1 (9.1)	40.9 (8.9)	41.2 (9.2)
Sex			
Female	227 (49.0)	78 (51.0)	149 (48.1)
Male	236 (51.0)	75 (49.0)	161 (51.9)
Race: White	458 (98.9)	151 (98.7)	307 (99.0)
Unstably housed in the past 6 mo	210 (45.4)	74 (48.4)	136 (43.9)
Access to car in past 6 mo	154 (33.3)	52 (34.0)	102 (32.9)
Completed high school education	315 (68.0)	100 (65.4)	215 (69.3)
Monthly income, US $, mean (SD)	621 (1194)	646 (1543)	609 (978)
Lives within walking distance of an SSP	181 (39.0)	61 (42.1)	120 (42.7)
Substance use			
In past 30 d			
Days injected, mean (SD)	13.7 (12.4)	17.8 (11.9)	11.7 (12.2)
Any methamphetamine injection	262 (56.6)	106 (69.2)	156 (50.3)
Any heroin injection	175 (37.8)	74 (48.4)	101 (32.6)
Any fentanyl injection	99 (21.2)	38 (24.8)	61 (19.7)
Any cocaine injection	38 (8.2)	18 (11.8)	20 (6.4)
Any receptive syringe sharing	72 (15.5)	34 (22.2)	38 (12.2)
Any reuse of own syringe	230 (49.7)	94 (61.4)	136 (43.9)
Source of syringes			
SSP	146 (31.5)	66 (51.5)	80 (39.2)
Secondary exchange	41 (8.9)	10 (7,8)	31 (15.2)
Family, friends, or person selling syringes	124 (26.8)	44 (34.4)	80 (39.2)
Other: pharmacy, online, farm supply/veterinarian, stolen/found	32 (6.9)	13 (8.5)	19 (6.1)
Hepatitis C antibody positive	326 (70.8)	117 76.5)	209 (67.4)
Experience with serious injection-related infections and abscesses			
Lifetime experience			
Hospitalized for serious injection-related infection	110 (23.8)	51 (33.3)	59 (19.0)
Reasons for hospitalization (n = 110)			
Abscess	44 (40.0)	21 (13.7)	23 (7.4)
Sepsis	38 (34.5)	14 (9.1)	24 (7.7)
Endocarditis	30 (27.3)	14 (9.1)	16 (5.2)
Bone, spine, and/or joint	23 (20.9)	19 (12.4)	4 (1.3)
Brain	2 (1.8)	1 (0.6)	1 (0.3)
Experienced an abscess at an injection site	327 (70.6)	153 (100)	174 (56.1)
Self-treated an abscess in lifetime (n = 327)	149 (45.5)	64 (41.8)	85 (27.4)
Sought medical care for last abscess (n = 327)	105 (32.1)	44 (28.8)	61 (19.7)
Received education on safer injection practices in lifetime	122 (26.3)	44 (28.8)	78 (25.2)
Recent experience: past 6 mo			
Hospitalized for serious injection-related infection	21 (4.5)	13 (8.5)	8 (2.6)
No. of abscesses, mean (SD)	6.1 (17.4)	6.1 (17.4)	…
Self-treated abscess with antibiotics	68 (44.4)	68 (44.4)	…

Data are presented as No. (%) unless noted otherwise.

Abbreviation: SSP, syringe service program.

SIRI hospitalizations were captured with "Have you ever been hospitalized (spending ≥1 nights) for a serious infection like endocarditis, bone infection, skin abscess, sepsis, etc?" followed by questions on which infections and past 6-month hospitalizations. For abscess history, participants were asked, "Have you ever had pain, swelling, redness, warmth, hardness under your skin, heat, pus, or oozing at or near a place where you have injected drugs?" followed by whether they received medical care from a health care provider for their last abscess; whether they had ever tried to cut, lance, or drain the abscess themselves; the number of abscesses in the past 6 months; and whether they had taken oral antibiotics "not prescribed to them (obtained from a friend, off the street)" for an abscess. Participants were also asked if they had ever received education on how to safely inject drugs to prevent infection of the heart, bone, joints, or blood.

Statistical Analyses

Analyses for this report were restricted to participants with any injection drug use in the past 6 months and were performed in Stata version 18.0 (StataCorp). We conducted descriptive analyses for variables related to injection-related infections. The dependent variable, number of abscesses, was modeled as a count variable; therefore, multivariable negative binomial regression was used to examine factors associated with the number of abscesses experienced in the past 6 months. A forward elimination process was employed by which variables were entered into the model one at a time based on results of the bivariate analyses from most to least significant. The threshold for inclusion in the multivariable model was $\alpha \leq 0.05$, and a variance inflation factor was computed for the final model to test for the presence of multicollinearity. Incidence rate ratios and 95% CIs are reported.

RESULTS

From March 2023 to April 2024, 826 participants were recruited from existing cohort studies of PWUD [26, 27] (n = 304), outreach at community venues (n = 20), and peer referral (n = 412). Of these, 463 individuals reported injection drug use in the past 6 months and are included in the analyses. Table 1 describes demographic and behavioral characteristics of the sample. The average age was 41.1 years (SD, 9.1) and 49% were female. On average, participants injected 13.7 of the last 30 days (SD, 12.4), with 15.5% reporting receptive syringe sharing and 50% reusing syringes/needles. Overall, 33.0% (n = 153) had an injection site abscess in the past 6 months, 44.4% of whom self-treated with nonprescribed antibiotics.

Associations between demographic and behavioral characteristics and the number of injection-site abscesses in the past 6 months are described in Table 2. In the final multivariable model, fentanyl injection (adjusted incidence rate ratio [AIRR], 1.90; 95% CI, 1.06–3.40), receptive syringe sharing (AIRR, 2.44; 95% CI, 1.26–4.74), and syringe reuse (AIRR, 2.78; 95% CI, 1.63–4.75) were associated with having more injection-site abscesses. Participants who received syringes from family, friends, or persons selling syringes reported fewer abscesses (AIRR, 0.38; 95% CI, .21–.68).

Table 2. Factors Associated With Number of Abscesses in Past 6 Months (n = 462)

	IRR (95% CI)	Adjusted IRR (95% CI)
Demographic characteristics		
Age, y	0.97 (.93–1.00)	…
Sex		
Female	0.89 (.54–1.47)	…
Male	1 [Reference]	…
Race		
White	3.39 (.25–45.6)	…
Race other than White	1 [Reference]	…
Unstably housed in the past 6 mo	1.70 (1.03–2.80)[a]	…
Access to car in past 6 mo	0.84 (.49–1.44)	…
Completed high school education	0.77 (.35–1.41)	…
Monthly income, US $, mean (SD) (n = 457)	0.99 (.99–1.00)	…
Lives within walking distance of an SSP (n = 425)	0.63 (.37–1.06)	…
Substance use in past 30 d		
No. of days injected	1.06 (1.04–1.08)[a]	…
Any methamphetamine injection	2.34 (1.42–3.86)[a]	…
Any heroin injection	2.91 (1.77–4.78)[a]	…
Any fentanyl injection	3.43 (1.92–6.09)[a]	1.90 (1.06–3.40)[a]
Any cocaine injection	1.06 (.42–2.63)	…
Any receptive syringe sharing	3.38 (1.75–6.53)[a]	2.44 (1.26–4.74)[a]
Any reuse of own syringe	3.92 (2.43–6.33)[a]	2.78 (1.63–4.75)[a]
Received syringes from SSP	1.76 (1.03–3.00)[a]	…
Received syringes from family, friends, or person selling syringes	0.52 (.29–.93)[a]	0.38 (.21–.68)[a]

Abbreviations: IRR, incidence rate ratio; SSP, syringe service program.

[a] $P < .05$.

DISCUSSION

This study examined SIRI and self-management practices in a cohort of PWID living in rural Appalachian Kentucky. Results demonstrate that the study population has a high prevalence of adverse social determinants of health as well as frequent experiences with SIRI. Nearly half had recent housing instability, and two-thirds lacked transportation, which necessarily limits health care access, particularly in rural areas without public transportation services.

The majority (70.6%) had experienced an abscess at an injection site, and nearly half of those had self-treated. One study in a predominantly rural population of PWID in Fresno, California, found a 67% lifetime prevalence of abscess, with 79% self-treating [4]. These estimates in rural US populations are on the higher end of published ranges in more urban settings [5, 13, 30]. In our study, nearly half of participants with an abscess in the past 6 months self-treated with oral antibiotics not prescribed to them. This estimate adds to the limited literature reporting similar rates of self-treatment with nonprescribed antibiotics [4, 17] and has important implications for interventions addressing antimicrobial resistance and for development of harm reduction programs. Only 26% of this cohort reported ever receiving education on how to reduce its risk of injection-related infections.

The observed lifetime prevalence of 24% of hospitalization for SIRI is concerning and particularly notable given the relatively young age of the cohort. There were no estimates identified in the literature for direct comparison, as community-based cohort studies typically report infection types and not hospitalizations; however, hospitalization is typically required for infective endocarditis and sepsis. In the United States, the estimated lifetime

prevalence of endocarditis among PWID is 12% and that of sepsis is 9.8% [5], suggesting that this cohort is particularly affected.

In our adjusted analysis, syringe reuse and syringe sharing were the strongest correlates associated with a higher number of recent abscesses. There is a dearth of literature on syringe reuse, but our previous research [24] and a study among hospitalized PWID with SIRI [31] suggest that it is extremely common and may be underaddressed in many harm reduction programs. In addition, it provides further evidence in support of needs-based syringe distribution to encourage "one needle, one syringe, only one time" injection practices [32]. Some states still restrict the number of syringes distributed at SSPs and/or require "one-to-one" exchange [33].

The finding that fentanyl injection in the past 30 days is associated with an increased number of recent abscesses was not surprising. Ongoing changes in the drug supply, such as the introduction of xylazine, may exacerbate these issues [34]. In addition, the observation that the number of recent abscesses was 62% lower among those receiving syringes from family, friends, and/or persons selling syringes is interesting, and the causes underlying the association may be multifactorial. The finding could indicate that syringe coverage through these sources alone or in combination with other sources (eg, SSPs, pharmacies) is sufficient to reduce the need for syringe reuse and sharing, or the finding could be an artifact of confounding wherein those with access to syringes through these interpersonal sources have access to other supports that may reduce their risk for abscess.

Strengths of this study include having 2 sites and a relatively large community-recruited sample of PWID living in rural Appalachia, capturing a population generally underrepresented in research. Limitations to consider are the reliance on self-reported information, particularly for summarizing medical diagnoses. Previous qualitative research, however, demonstrates that PWID accurately recognize and describe SSTI and abscess [35], which increases confidence.

This study provides new insights into the burden of SIRI experienced by PWID living in Appalachia with respect to the high prevalence of hospitalizations, use of nonprescribed antibiotics, and specific risk behaviors such as syringe reuse. Implications for public health and future research include development and testing of educational, clinical, or policy-focused interventions along the substance use disorder care continuum to reduce injection-related harms.

Notes

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