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## Background

- Injection-related bacterial and fungal infections can lead to serious conditions including infective endocarditis, osteomyelitis, epidural abscesses, and sepsis.
- Syringe reuse by people who inject drugs (PWID) could increase risk for these infections.
- While many studies have focused on syringe sharing as a risk factor for injection-related infections, few have focused on syringe reuse.
- Few studies have explored syringe reuse, particularly in rural settings where access to a clean syringe for each injection may be reduced by limited harm reduction infrastructure.
- Kentucky has been especially hard-hit by drug-related harms with high vulnerability to HIV/HCV outbreaks among PWID<sup>1</sup> and high rates of opioid-use associated infective endocarditis hospitalizations.<sup>2</sup>

## Objectives

- This study describes syringe reuse among PWID in rural Appalachian Kentucky and identifies demographic and behavioral factors associated with syringe reuse.

## Methods

- We recruited 338 people who use drugs in rural Appalachian Kentucky. Eligibility criteria include being a resident of one of five counties in Appalachia Kentucky, being age 18 or older, and using opioids to get high or injecting any drug in the last 30 days. For this analysis, we included only those who had injected drugs in the past 30 days (n=238).

## Recruitment

- We recruited participants from February 2018 to February 2020 through respondent-driven sampling. In this sampling process, “seeds,” were asked to distribute coupons to peers who may be good candidates for the study. Seeds were reimbursed \$10 per peer who redeemed a coupon following the peer’s enrollment in the study.

## Data Collection and Outcome Measure

- Interviewer-administered surveys elicited data on demographics, substance use, syringe service program (SSP) use, and injection behavior.

## Independent Variables

- We included sex (categorical), age (continuous), education status (categorical), homelessness in the past 6 months (categorical), access to transportation (categorical), and self-reported history of endocarditis or osteomyelitis infection (categorical).
- We also queried drug injection practices, including whether the person injected heroin, fentanyl, prescription opioids, methadone, buprenorphine, cocaine or crack, benzodiazepines, and amphetamine or methamphetamine in the last 30 days. We also assessed frequency of injection in the last 30 days (ordinal), use of a needle that had been used by someone else (binary), and the number of people an individual shared injection equipment with in the last 30 days (continuous).
- We assessed participants’ self-report of having ever visited an SSP (binary) and self-reported travel distance to the nearest SSP site (ordinal).
- We also examined where they needles were obtained in the past 30 days (categorical).
- We asked participants about the current street price of a needle in their community and analyzed it as a categorical variable due to skewness. Specifically, we categorized street price as less than \$3 USD, more than \$3 USD but less than \$5 USD, and \$5 or more.

## Outcome Variables

- The outcome measure of interest was syringe reuse measured by the question, “In the past 30 days, in general, how many times did you use each of your own syringes?” We treated syringe reuse as continuous in the multivariable model.

## Analysis

- We computed descriptive characteristics by computing frequencies for categorical and ordinal variables and means, standard deviations, medians, and interquartile ranges were used to describe continuous variables.
- Using the PROC GENMOD procedure in SAS 9.4, we estimated negative binomial generalized linear models with a log link function to conduct unadjusted and adjusted analyses.
- In order to select variables to be included in the multivariable model, we conducted unadjusted analyses to determine if a statistically significant relationship existed between the independent variables and syringe reuse.
- For a variable to be considered for inclusion in the multivariable regression model, the variable had to be associated with the outcome in unadjusted analyses. A final model was created through manual backward elimination where the variable with the least significant p-value was removed (only p > 0.05), and the model fit was reassessed.

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## Sample Description

- The sample was predominantly male (60%) and had an average age of 35. Approximately 30% did not complete high school and 39% were experiencing homelessness.
- 57% had used an SSP and most (73%) were not within walking distance of an SSP.
- The most common drug used to get high was methamphetamine, followed by heroin. The majority (57%) reported injecting at least two times per day.
- 31% reported obtaining needles from a drug or street dealer.
- 85% reported that the street price of a syringe in their community was greater than \$3 USD per syringe.
- 9% reported having been hospitalized in their lifetime for endocarditis or osteomyelitis.

## Results

- On average, PWID used each syringe nine times (standard deviation 14.7; median: 3, interquartile range: 2-10)**
- Syringe reuse was positively associated with being male, experiencing homelessness, having limited access to transportation, recent use of methamphetamine and buprenorphine “to get high”, injection frequency, number of injection equipment sharing partners, receptive syringe sharing, living further from an SSP, obtaining needles from a street dealer, and reporting a street price of \$5 USD or more per needle.
- In the multivariable model, syringe reuse was higher among men, those who injected more frequently, those who injected buprenorphine and/or methamphetamine, engaged in syringe sharing, reported a higher street syringe price, and lived further from the SSP.

### Multivariable model assessing correlates to syringe reuse among PWID

Characteristic	ARR (95% CI)	P-value
Male (Reference group: female)	1.39 (1.04-1.85)	0.026*
Education		
Less than high school	Reference	--
High school diploma	0.95 (0.69 – 1.32)	0.772
Some College	0.77 (0.50 – 1.18)	0.227
College graduate	0.59 (0.31 - 1.14)	0.115
Injected buprenorphine <sup>1</sup>	1.46 (1.10 – 1.95)	0.009*
Injected methamphetamine <sup>1</sup>	2.12 (1.45 - 3.12)	<0.001*
Used needles that had been used by someone else <sup>1</sup>	1.76 (1.30 – 2.38)	<0.001*
Number of injection equipment sharing partners <sup>1</sup>	1.01 (0.99 – 1.04)	0.290
Injection frequency <sup>1</sup>		
< Daily	Reference	---
Daily	1.37 (0.87 – 2.14)	0.172
2-3 times per day	1.73 (1.19 – 2.52)	0.004*
≥ 3 times per day	1.86 (1.23 – 2.82)	0.003*
Distance to nearest SSP		
Walk there	Reference	---
≤ 30 minute drive	1.53 (1.10 – 2.12)	0.011*
> 30 minute drive	2.35 (1.43 – 3.87)	0.001*
Street price per syringe		
<\$3 USD	Reference	---
\$3 - \$5 USD	1.34 (0.80 – 2.24)	0.264
≥\$5 USD	2.33 (1.51 – 3.59)	<0.001*

<sup>1</sup>Past 30 days; ARR: Adjusted risk ratio

## Conclusions

- Rural PWID are re-using syringes nine times on average, conferring extensive risk for contamination between injections and thereby heightening risk of injection-related infections.
- Syringe re-use was higher among those engaging in receptive syringe sharing, indicating that syringes might be reused more times than reported and could carry risk for hepatitis C as well.
- Ensuring that SSPs are easily accessible to rural PWID who may lack transportation might reduce syringe reuse.
- Harm reduction interventions that encourage syringe cleaning may be warranted as a stop-gap measure while SSP reach is expanded.

## Limitations

- We used interviewer-based questionnaires to collect the data for this analysis and data may be prone to recall bias and social desirability bias.
- Local PWID use “syringe” and “needle” synonymously, but it is possible that participants interpreted the question to refer to syringes rather than needles. This creates a challenge in interpretation because these may confer different risks for infection.
- The analyses were not adjusted for the design effect potentially introduced by the respondent-driven sampling chains.



<sup>1</sup> Van Handel MM, Rose CE, Hallisey EJ, et al. (2016) County-Level Vulnerability Assessment for Rapid Dissemination of HIV or HCV Infections Among Persons Who Inject Drugs, United States. *J Acquir Immune Defic Syndr* ;73(3):323-331

<sup>2</sup> Siddiqi K, Freeman PR, Fanucchi LC, Slavova S. (2021) Rural-urban differences in hospitalizations for opioid use-associated infective endocarditis in Kentucky, 2016-2019. *J Rural Health*.