Correlates of infectious complications of injection drug use among individuals who use drugs in Washington State: An analysis of the 2021 Washington State Syringe Exchange Health Survey

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Abstract

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Abstract

Objectives:

Increased use of injection drugs across the United States has likely increased the burden of complications from abscess or skin infections, blood clots or blood infections, and infectious endocarditis (IE) among people who inject drugs (PWID). Among PWID who attended syringe services programs (SSPs) in Washington State, we assessed the prevalence of complications from injection drug use and examined factors that were associated with these outcomes.

Methods:

In 2021, interviewer-administered surveys were conducted among clients at 21 SSPs in Washington State. Descriptive statistics were used to summarize demographic characteristics and behavioral factors related to IDU. Multivariable logistic regression was used to separately assess the relationship between select demographic and behavioral factors and abscesses or skin infections and blood clots or blood infections.

Results:

Among 955 individuals who participated in the survey, 886 (92.8%) participants reported that they had injected any drug in the last three months. Of those who reported injection drug use in the last three months, 332 (37.5%) reported having abscess or skin infections, 55 (6.2%) reported having blood clots or blood infections, and 19 (2.1%) reported having IE. Factors associated with reporting an abscess or skin infections include: injecting every day of the week, injecting more than three times a day, sharing a syringe, using the same syringe more than once before disposing of it, participating in a methadone program and injecting drugs like goofball, speedball, heroin, and fentanyl. Factors associated with reporting a blood clot or blood infection include: injecting fentanyl, sharing a syringe, and using the same syringe more than once before disposing of it and receiving buprenorphine/suboxone treatment.

Conclusions:

Over one-third of PWID reported an abscess or skin infection in the last year and six percent reported a blood clot or blood infection. Sharing a syringe, injecting fentanyl, and reusing the same syringe in the past three months were the factors most strongly associated with both abscess or skin infections and blood clot or blood infections. Unhygienic injection practices among

participants may have increased the prevalence of infectious complications suggesting the need for expanded syringe coverage and SSPs access to PWID in Washington State.

Introduction

Substance use is a major public health burden in the United States, ranging from tobacco consumption to opioid and illicit drug overdoses.[1,2] Based on data from the Substance Abuse and Mental Health Services Administration (SAMHSA), in 2018 there were approximately 31.9 million individuals who reported use of illegal drugs which included marijuana in the last 30 days.[3] Over the past two decades, with the introduction of substances like heroin and fentanyl, the method of how substances are being used has transitioned from ingesting opioids orally to injection.[4,5] This has led to an increase of blood-related infections and diseases which has resulted in costs of hospitalizations for PWID amounting from 16 million in 2008 to 150 million dollars in 2018.[6] Various social factors can be attributed to the increase of infectious complications among PWID like homelessness, fear of being criminalized, and policy constraints towards syringe service programs (SSPs) such as reduction of syringe distribution.[7,8,9] Discrimination and stigmatization from hospital personnel has also been a major component of an increase in blood-related infections and diseases due to PWID avoiding accessing health services.[10] In 2020, more than 33,000 people were estimated to use injection drugs in Washington State.[11] Injection drug use (IDU) is associated with infectious diseases including human immunodeficiency virus (HIV) and hepatitis C virus (HCV).[9] It is also associated with other infectious complications such as abscess or skin infections like cellulitis, blood clot or blood infections like sepsis and infectious endocarditis (IE).[12,13]

An abscess or skin infections can be defined as an immune system response where an individual experiences symptoms of redness, swelling, and pain like in cellulitis.[14] Abscesses and skin infections primarily occur due to bacteria that are introduced to the body though skin lesions.[14] Blood clot or blood infections are a complication from injection which can often result in deep

venous thrombosis (DVT). An example of a common blood infection is sepsis which is the body's response to a blood infection from bacteremia, bacteria in the blood.[15] Blood clot and blood infections arise from a further complication of bacteremia.[16] Infectious endocarditis (IE) is when the bacteria adhere to parts of the heart which is caused by a complication of bacteremia.[17] IE is a major complication that PWID suffer from due to unhygienic injection practices, such as sharing syringes, which can lead to cardiac injury, primarily on the valves and chambers of the heart.[18,19]

Unlike HIV and HCV which are infections that must be reported to and tracked by local health departments and the US Centers for Disease Control and Prevention (CDC), other infectious complications of injection drug use are not reportable.[12] This lack of reporting makes it more difficult to determine the prevalence of infectious complications attributable to IDU. Based on data from hospital admissions, it is estimated that there are 155,000-540,000 individuals who have both hospitalized and non-hospitalized from infectious complications due to IDU annually in the United States. [12] Hospitalizations from IDU-related infectious complications have increased from 2,900 in 2013 to over 20,000 in 2017.[12] Even though total hospitalizations for infectious complications have increased, it only provides an estimate of the burden of infectious complications serious enough to result in hospitalization. This signifies that the burden of infectious complications may be much greater but is not captured by this data.

Knowing the prevalence of these key infectious complications among PWID will allow for SSPs, public health programs, and harm reduction organizations to develop future preventative measures like increased syringe access, prophylaxis for bacterial infections, and easier access to care at injection sites. To address this gap, we used data from the 2021 Washington State Syringe

Exchange Health Survey to determine the prevalence of select infectious complications of IDU, as well as whether specific factors like demographic characteristics and substance use behaviors are associated with abscesses or skin infections, blood clots or blood infections, and IE in Washington State. We estimated the prevalence and correlates of several infectious consequences of injection drug use among PWID who were seeking services at SSPs in Washington State in the last three months.

Methods:

Study Design and Setting

The data used for this study was from the University of Washington (UW) Alcohol and Drug Institute (ADAI) 2021 Washington State Syringe Exchange Survey. This was a cross-sectional survey that was administered by interviewers from September to October 2021 in SSPs across Washington State. The survey took place at 21 SSPs (Table 1), which served 20 counties across Washington State.

Study Respondents

Any individual who was seeking services at the SSP, even if they were not using drugs or exchanging syringes, was eligible to participate and was asked to complete the survey. If they declined but attended an SSP another time during the time of the survey, they were asked again. An individual could only participate in the survey once and no financial compensation was provided for individuals who participated.

Data Collection

Syringe service programs personnel and volunteers conducted the survey. They were given an interview guide on how to complete the 40-question survey. Individuals who reported injecting drugs were asked additional questions about syringe use and injection patterns as well as their status of infectious complications. All surveys were conducted in person by SSP staff and volunteers in English. The data was collected through REDCap in King County. In other locations outside of King County, surveys were completed on paper due to unreliable internet. They were later mailed and inputted into REDCap by Addictions, Drug & Alcohol Institute (ADAI) personnel.

Measures and Data Analysis

This analysis was restricted to people who reported IDU in the past three months. If a respondent indicated IDU in the past three months, they were asked questions related to IDU and infectious complications. Key exposures included demographic characteristics (gender, age, and race, ethnicity) and injection-related behaviors including the type of substance injected, sharing syringes, and injection patterns.

Our three key outcomes included if, in the past three months, the respondent reported that they had an abscess or skin infection (defined in the survey as "an abscess or skin infection like cellulitis"), blood clot or blood infection (defined in the survey as "a blood clot or blood infection like sepsis; this typically requires 1 week or more of intravenous antibiotics"), and infectious endocarditis (not further defined in the survey).

We evaluated the following demographic characteristics: gender, age, race/ethnicity, housing status, health insurance, and drug treatment (if any) in the past 12 months. Participants were asked about the gender which best describes them and could select more than one from the following list: man, woman, non-binary, trans man, trans woman, and “another not listed”. Gender was recoded into three groups: man, woman, or transgender/non-binary. Participants who identified as non-binary and transgender were grouped into a single category due to the low number of participants who identified with these categories. Age was categorized into five categories: 18-24, 25-29, 30-39, 40-49, and >49. For race/ethnicity, the options included American Indian/Alaskan Native, Asian/South Asian, Black/African American, Latino/Hispanic, Native Hawaiian/Pacific Islander, White, and "another not listed”. Due to participants having the option to choose all categories which applied, we coded each one individually to not exclude those who identified with multiple categories. In regard to housing status, the options were permanent, temporary/unstable, and homeless. Participants were also able to choose from all applicable health insurances listed: Medicaid/Apple Health, Tribal health/Indian Health Service, insurance from job/work, other, or none. Those individuals who selected more than one type of health insurance were combined into a single category. Participants were also asked about the types of drug treatment, if any, that they received in the past 12 months. The options were “detox”, outpatient treatment, inpatient treatment, methadone program, naltrexone/vivitrol, buprenorphine/suboxone, 12-step/recovery support groups, other, and none. Drug treatment was recoded as a categorical variable. People who selected more than one type of treatment were combined into a single category.

In terms of behaviors related to IDU, we captured the following: type of drugs injected in the past three months, number of people that participant shared a syringe with in the past three months,

number of times a syringe was used before disposing of it, number of days which drugs were injected in the past seven days, and the average amount of times injected in a day. Options for the type of drugs injected in the past three months included heroin mixed with methamphetamine (known as goofball), heroin mixed with cocaine (known as speedball), heroin by itself, opiate medications like OxyContin/Vicodin, methadone they did not get from a clinic or health provider, buprenorphine they did not get from a clinic/health provider, fentanyl, powder cocaine by itself, crack cocaine, methamphetamine by itself, and benzos/downers like Valium/Xanax/Klonopin. Since participants had to respond "yes" regarding using the drug before answering if they had injected that specific drug, we recoded those participants who reported not using that specific drug as "not injected". Those participants who shared a syringe in the past three months were recoded from numeric responses (e.g., number of sharing partners) into two categories: those who did not share a syringe and those who shared a syringe. The variable regarding the number of times a syringe was used before disposing of it was recoded into two categories: those who did not share a syringe and those who shared a syringe. The variable regarding the number of days which drugs were injected in the past seven days was recoded from numeric responses into two categories: those who injected less than seven days and those who all seven days. The variable for average times injected in a day was recoded from numeric responses into two categories: those who injected 1-3 times a day and those injected more than three times a day.

Data Analysis:

Descriptive statistics were used to summarize demographic and behavioral characteristics and the prevalence of the three outcomes: abscess or skin infection, blood clot or blood infection, and infectious endocarditis. To identify correlates of each infectious consequence of interest, we

calculated the prevalence of infectious complications by select demographic characteristics and the prevalence of infectious complications by injection behaviors.

The relationship between demographic and behavioral factors and the outcome of interest were assessed using a univariate unadjusted logistic regression models.

For each outcome, we developed a multivariable logistic regression model adjusted for potential confounders. Factors were included in the multivariable model for adjustment if they were identified as potential confounders for infectious complications. Previous literature has demonstrated that gender, age, and housing status have been correlated with the probability of becoming infected with an abscess or skin infection and blood clot or blood infection, thus these three variables were included in all multivariable models. A variable was considered significant and was analyzed in the adjusted model if it had a p-value less than 0.1 in the univariate model. IE was not included in our unadjusted and adjusted models due to the low number of respondents who reported this outcome. All multivariate logistic regression models were also adjusted for study sites using a clustering option to account for SSPs who completed more surveys. Analysis was conducted with R programming version 4.2.0.

Previous versions of this survey were determined to not be human subjects research and exempt from review. The scope and risk associated with this version of the survey were the same, thus a new IRB exemption application was not submitted.

Results:

Among the 955 individuals who participated in the survey, 886 (92.8%) participants reported that they had injected any drug in the last 3 months. The survey consisted of a greater number of male than female participants, and the most common age group was 30-39 years. More than 80% of the participants who injected any drug in the last 3 months identified as White. There was a higher proportion of participants with a blood clot or blood infection and IE who reported having permanent housing status, Medicaid/Apple Health, and participating in a methadone program in the past 12 months compared to those who reported an abscess or skin infection.

Among the participants who injected any drug in the last 3 months, 332 (37.5%) reported having an abscess or skin infection, 55 (6.2%) reported having an infected blood clot or blood infection, and 19 (2.1%) reported having IE.

Tables 2 and 3 include the distribution of demographic and behavioral characteristics of participants. Across the three outcomes, participants with IE included the highest proportion of men, people aged 40-49, and people who reported American Indian/Alaska Native race.

Tables 4 and 5 include the prevalence ratio for each factor for an abscess or skin infection and blood clot or blood infection.

The following variables were found to be significant for an abscess or skin infection: injecting every day in the past seven days (unadjusted prevalence ratio [Unadjusted PR]= 1.46; 95% confidence interval [CI]: 1.22-1.75), injecting more than 3 times in a day (Unadjusted PR= 1.34; 95% CI: 1.09-1.64), sharing a syringe in the past three months (Unadjusted PR= 1.65; 95% CI:

1.24-2.20), using a syringe more than once before disposing of it (Unadjusted PR= 1.30; 95% CI: 1.11-1.53), participating in a methadone program (Unadjusted PR= 0.02; 95% CI: 0.01-0.04), and injecting goofball (Unadjusted PR= 1.38; 95% CI: 1.12-1.69), speedball (Unadjusted PR= 1.47; 95% CI: 1.15-1.89), heroin by itself (Unadjusted PR= 1.66; 95% CI: 1.28-2.16), methamphetamine by itself (Unadjusted PR= 0.78; 95% CI: 0.69-0.92), and fentanyl (Unadjusted PR= 1.35; 95% CI: 1.11-1.66) in the past three months.

The following variables were found to be significant for a blood clot or blood infection: injecting fentanyl (Unadjusted PR= 1.53; 95% CI: 0.96-2.45) in the past three months, sharing a syringe in the past three months (Unadjusted PR= 1.72; 95% CI: 0.95-3.11), using a syringe more than once before disposing of it (Unadjusted PR= 1.67; 95% CI: 1.03-2.71), receiving buprenorphine/suboxone treatment (Unadjusted PR= 0.04; 95% CI: 0.02-0.09) and 12-step/Recovery support group (Unadjusted PR= 0.10; 95% CI: 0.01-0.69). Multiple treatment variables were excluded in the analysis for both abscess or skin infections and blood clot or blood infections even though they were significant due to the low count of participants who choose that option.

Table 6 includes the multivariable model for the two key outcomes – abscess or skin infection and blood clot or blood infection - including the three variables adjusted for a priori (age, gender, and housing status) as well as the factors that we identified as significant in the bivariate models. The factors which remained significant for abscess or skin infection were injecting every day in the past week (adjusted prevalence ratio [APR]= 1.48; 95% confidence interval [CI]: 1.26-1.75), injecting more than three times a day (APR= 1.34; 95% CI: 1.10-1.64), sharing a syringe in the

past three months (APR= 1.68; 95% CI: 1.32-2.14), using a syringe more than once before disposing of it (APR= 1.30; 95% CI: 1.10-1.53), methadone treatment (APR= 0.02; 95% CI: 0.01-0.04), more than one treatment (APR= 0.04; 95% CI: 0.02-0.08) and injecting goofball (APR= 1.39; 95% CI: 1.13-1.70), speedball (APR= 1.48; 95% CI:1.16-1.89), heroin by itself (APR= 1.69; 95% CI: 1.28-2.24), methamphetamine by itself (APR= 0.78; 95% CI: 0.67-0.90), and fentanyl (APR= 1.37; 95% CI: 1.13-1.66) in the past three months. The factors which remained significant for blood clot or blood infection were injecting fentanyl in the past three months (APR= 1.60; 95% CI: 1.02-2.50), sharing a syringe in the past three months (APR= 1.91; 95% CI: 1.06-3.43), using a syringe more than once before disposing of it (APR= 1.76; 95% CI: 1.02-3.04), and receiving buprenorphine/suboxone treatment (APR= 2.00; 95% CI: 1.19-3.36).

Discussion

The primary goal of this study was to develop a better understanding the prevalence of infectious complications of injection drug use among people in Washington State who reported injection drug use in the past three months. Findings from the 2021 Washington State Syringe Exchange Survey demonstrated that specific demographics and injections behaviors increase the prevalence of abscess or skin infections, blood clot or blood infections, and IE. Injecting every day of the week, injecting more than three times a day, sharing a syringe, injecting more than once with the same syringe before disposing of it, and injecting goofball, speedball, heroin, and fentanyl was positively associated with reporting an abscess or skin infection. Injecting methamphetamine and participating in a methadone program was negatively associated with reporting an abscess or skin infection. Sharing a syringe, injecting more than once with the same syringe, and injecting fentanyl in the past three months was positively associated with reporting a blood clot or blood infection.

Having receiving buprenorphine/suboxone was negatively associated with a blood clot or blood infection. This information can be used to develop a better-structured survey for future iterations by elaborating upon specific questions about infectious complications. This will allow to attain a better understanding of participant's practices. It will also provide valuable information to SSPs regarding the types of individuals who are currently using their services and at risk for these health outcomes.

Frequency of injection, specifically injecting every day of the week and multiple times in a single day was positively associated with reporting an abscess or skin infection. This can be attributed to unhygienic injection practices like syringe sharing since using non-sterile equipment increases PWID's susceptibility to infectious complications like an abscess.[20] Previous research has supported this by indicating that injecting with a contaminated syringe can introduce foreign pathogens directly into the bloodstream resulting in multiple health complications.[21,22] The higher the frequency of injection by individuals who use injection drugs, the more susceptible they are to having abscess or skin infections. Even if individuals who use injections drugs have proper hygienic practices, they are still at risk for abscess or skin infections if they are using the same needle multiple times. This can be due to syringes becoming dull, leading to trauma in the area of injection and increasing the susceptibility to abscess or skin infections.[23]

It was also demonstrated that injecting opioids in the last three months, including injecting goofball, speedball, heroin, and fentanyl was positively associated with reporting an abscess or skin infections. This association can be due to these substances being highly addictive and increasing the frequency of injection into the bloodstream resulting in an abscess or skin

infection.[24,25] Previous literature has supported this observation due to the manufacturing of more synthetic opioids being more potent and their duration being less.[26,27] This increases the frequency of IDU resulting in a greater risk of contracting abscess or skin infections.[26,27] The accessibility of these highly addictive substances in Washington State is increasing.[28] As more individuals become dependent on these substances, the risk of abscess or skin infections in Washington State residents will become more prevalent. To mitigate this risk, sterile syringes should become more accessible, and safe hygienic practices should be promoted in the population. In regard to methamphetamine's negative association with reporting an abscess or skin infection, it has been reported that individuals who inject drugs have transitioned to using methamphetamine as a method to reduce opioid use and withdrawal.[29,30] This may not be the case anymore, particularly given the increase in co-injection of methamphetamine with opioids. This finding may also be due to chance alone.

Participating in a methadone program was negatively associated with reporting an abscess or skin infection. Previous literature has demonstrated that methadone treatment may be an effective treatment for opioid use disorder and prevention of future infections related to IDU.[31,32] Participating in a buprenorphine/suboxone program was also negatively associated with reporting a blood clot or blood infection. This can be due to the chemical compound of buprenorphine/suboxone being an opiate antagonist which can reduce withdrawal symptoms and drug usage.[33] By both treatments decreasing the dependence on opioids, symptoms of withdrawal, and reducing an individual's frequency of injection, it decreases an individual's risk of infectious complications caused by IDU.[34]

This analysis is subject to several limitations that are important to consider in interpreting the results. There was potential misclassification bias due to not having access to the participants' medical records to confirm if they had an infectious complication within the last three months. Our second limitation is that the terminology used for some questions like abscess or skin infection and blood clot or blood infection may have been too broad for the participant to interpret. This might have led them to include infectious diseases like HIV and HCV which were diseases that were not analyzed in this study (but included elsewhere in the survey). A third limitation is that we are only analyzing data from SPP participants. The results attained in this analysis may differ from those individuals who do not use SSPs since there may be a probability that these individuals might have a higher incidence of infectious complications compared to SSP participants. We also are unable to determine the frequency that an individual substance was injected on an average day due to the wording of the survey which did not require to specify the drug being used. Also, due to the morbidity and mortality of blood infections and IE, we were unable to analyze a more substantial number of individuals with these conditions to better identify specific correlates to these infectious complications.[35,36] Our last limitation to consider is social desirability bias. Due to the nature of the survey, there were stigmatizing questions that were asked and required sharing the usage of illicit drugs. Also, due to the demography of Washington State, our survey participants were primarily white (82.6%) which prevents us from generalizing the results to other populations and depicting differences between other racial/ethnic groups due to small numbers.

The findings from this exploratory analysis demonstrate that infectious complications of IDU, including abscess or skin infections, blood clot or blood infections, and IE, are prevalent among PWID in Washington State. These are major public health burdens that health departments and

SSPs should address. This paper is one of the few pieces of literature which specifically focuses on these three complications in Washington State. The findings presented should influence strategies for public health practice and future research. Unless we specifically address this circumstance by increasing need-based policies such as syringed access, this health burden will still be prevalent. The implementation and expansion of more harm reduction strategies, like syringe exchange services, can have a positive effect in addressing and reducing infectious complications in the population. Not only will this provide sterile syringes to PWID but also be an environment where they can access other services like peer support groups. This will allow SSPs to increase the knowledge of infectious complications among PWID and an opportunity to develop a better relationship between PWID and SSP personnel. There are still various rural areas within Washington that do not have SSPs with the appropriate infrastructure or funding to be able to provide resources for PWID in their community. Expanding SSPs, especially in remote areas will allow for the implementation of better programs in those communities to reduce infectious complications. This will also allow for better documentation of PWID practices in these areas and provide health departments with valuable information for future programs.

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Tables and Figures

Table 1 Washington State Organizations that administered the survey

Blue Mountain Heart to Heart
Clallam County Health Department
Clark County Public Health
Cowlitz Family Health Center
Dave Purchase Project
Gather Church
Grant County Health District
Island County Human Services
Jefferson County Public Health
Kittitas County Public Health
Manson County Public Health
NE TriCounty Health District
Okanogan County Public Health
Public Health- Seattle & King County
SHARE Vancouver
Skagit County Health Department
Snohomish County Syringe Exchange
Spokane Regional Health District
Thurston County Public Health
Whatcom County Health Department
Yakima Health District

Table 2 Demographics of 2021 Washington State Syringe Exchange Survey participants by self-reported abscess or skin infection, blood clot or blood infection, and/or infectious endocarditis in the past 3 months (n=886)

	Abscess or skin infection		Blood clot or blood infection		Infectious endocarditis (IE)	
	Yes (n=332)[1] n (%)	No (n=554)[1] n (%)	Yes (n=55)[1] n (%)	No (n=831)[1] n (%)	Yes (n=19)[1] n (%)	No (n=867)[1] n (%)
Gender						
Man	185 (55.7%)	323 (58.5%)	34 (61.8%)	473 (57.1%)	13 (68.4%)	493 (57.2%)
Woman	139 (41.9%)	222 (40.2%)	18 (32.7%)	343 (41.4%)	6 (31.6%)	353 (41.0%)
Transgender/Non-binary	7 (2.1%)	7 (1.3%)	3 (5.5%)	12 (1.4%)	0	15 (1.7%)
Age at interview (yr)						
18-24	14 (4.2%)	28 (5.1%)	2 (3.6%)	41 (4.9%)	1 (5.3%)	42 (4.9%)
25-29	45 (13.6%)	67 (12.1%)	7 (12.7%)	105 (12.7%)	4 (21.1%)	107 (12.4%)
30-39	122 (36.7%)	219 (39.7%)	16 (29.1%)	325 (39.2%)	4 (21.1%)	335 (38.9%)
40-49	87 (26.2%)	120 (21.7%)	17 (30.9%)	190 (22.9%)	7 (36.8%)	200 (23.2%)
>49	63 (19.0%)	118 (21.4%)	12 (21.8%)	168 (20.3%)	2 (10.5%)	178 (20.6%)
Race/Ethnicity*						
American Indian/Alaska Native	38 (11.4%)	51 (9.2%)	6 (10.9%)	83 (10.0%)	3 (15.8%)	85 (9.9%)
Asian/South Asian	2 (.6%)	6 (1.1%)	0	8 (1.0%)	0	8 (.9%)
Black/African American	12 (3.6%)	21 (3.8%)	0	33 (4.0%)	0	33 (3.8%)
Latino/Hispanic	23 (6.9%)	38 (6.9%)	6 (10.9%)	55 (6.6%)	0	61 (7.1%)
Native Hawaiian/Pacific Islander	10 (3.0%)	8 (1.4%)	2 (3.6%)	16 (1.9%)	1 (5.3%)	17 (2.0%)
White	282 (84.9%)	457 (82.9%)	46 (83.6%)	693 (83.6%)	12 (63.2%)	725 (84.1%)
Other	9 (2.7%)	7 (1.3%)	2 (3.6%)	14 (1.7%)	3 (15.8%)	13 (1.5%)
Housing Status						
Homeless	134 (40.4%)	210 (38.0%)	23 (41.8%)	321 (38.7%)	6 (31.6%)	337 (39.1%)
Permanent	108 (32.5%)	186 (33.7%)	19 (34.5%)	274 (33.1%)	10 (52.6%)	281 (32.6%)
Temporary/Unstable	90 (27.1%)	155 (28.1%)	13 (23.6%)	233 (28.1%)	3 (15.8%)	243 (28.2%)
Health Insurance*						
None	24 (7.2%)	43 (7.8%)	1 (1.8%)	66 (8.0%)	0	67 (7.8%)
Insurance from job/work	6 (1.8%)	13 (2.4%)	2 (3.6%)	17 (2.1%)	0	19 (2.2%)
Medicaid/Apple Health	263 (79.2%)	451 (81.7%)	44 (80.0%)	671 (80.9%)	18 (94.7%)	695 (80.6%)

Tribal health/ Indian Health Service	5 (1.5%)	7 (1.3%)	1 (1.8%)	11 (1.3%)	1 (5.3%)	11 (1.3%)
>1 Health Insurance	9 (2.7%)	12 (2.2%)	1 (1.8%)	20 (2.4%)	0	21 (2.4%)
Other	21 (6.3%)	21 (3.4%)	4 (7.7%)	35 (4.2%)	0	38 (4.4%)
Type of drug treatment (if any), past 12 months*						
None	205 (61.7%)	368 (66.7%)	25 (45.5%)	548 (66.0%)	10 (52.6%)	559 (64.8%)
Buprenorphine/Suboxone	25 (7.5%)	43 (7.8%)	5 (9.1%)	63 (7.6%)	3 (15.79%)	65 (7.5%)
Detox	8 (2.4%)	10 (1.8%)	1 (1.8%)	17 (2.1%)	0	18 (2.1%)
Inpatient treatment	5 (1.5%)	4 (0.7%)	1 (1.8%)	8 (1.0%)	0	9 (1.0%)
Methadone program	32 (9.6%)	40 (7.3%)	6 (10.9%)	67 (8.1%)	1 (15.8%)	72 (8.4%)
Naltrexone/Vivitrol	0	1 (0.2%)	0	1 (0.1%)	0	1 (0.1%)
Outpatient treatment	7 (2.1%)	15 (2.7%)	2 (3.6%)	20 (2.4%)	0	22 (2.6%)
12-step/Recovery support groups	3 (0.9%)	7 (1.3%)	0	10 (1.2%)	0	10 (1.2%)
> 1 treatment	39 (11.8%)	56 (10.1%)	11 (20.00%)	84 (10.1%)	3 (15.79%)	92(10.7%)
Other	2 (0.6%)	1 (0.2%)	2 (3.6%)	1 (0.1%)	1 (5.3%)	2 (0.2%)

*Participants were able to choose more than one option
[1]Results do not add to n=total (%) due to there being instances where results were NA (not applicable)

Table 3 Injection behaviors reported by 2021 Washington State Syringe Exchange Survey participants stratified by self-reported abscess or skin infection, blood clot or blood infection, and/or infectious endocarditis in the past 3 months (n=886)

	Abscess or skin infection		Blood clot or blood infection		Infectious endocarditis (IE)	
	Yes (n=332)[1]	No (n=554)[1]	Yes (n=55)[1]	No (n=831)[1]	Yes (n=19)[1]	No (n=867)[1]
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Types of drugs injected, past 3 months*						
Benzos/downers like Valium, Xanax, Klonopin	8 (2.4%)	9 (1.6%)	2 (3.6%)	15 (1.8%)	0	17 (2.0%)
Buprenorphine you did Not get from a clinic/health provider	0	4 (.7%)	0	4 (.5%)	0	4 (.5%)
Crack cocaine by itself	5 (1.5%)	8 (1.4%)	1 (1.8%)	12 (1.4%)	0	13 (1.5%)
Fentanyl	88 (26.5%)	98 (17.8%)	16 (29.1%)	171 (20.6%)	6 (31.6%)	181 (21.0%)
Heroin by itself	259 (78.0%)	343 (62.1%)	41 (74.5%)	561 (67.7%)	14 (73.7%)	585 (67.9%)
Heroin mixed with cocaine as a speedball	56 (16.9%)	51 (9.2%)	9 (16.4%)	98 (11.8%)	3 (15.8%)	103 (11.9%)
Heroin mixed with meth as a goofball	192 (57.8%)	249 (45.1%)	32 (58.2%)	409 (49.3%)	10 (52.6%)	430 (49.9%)
Methadone you did not get from a clinic or health provider	2 (0.6%)	4 (0.7%)	0	6 (0.7%)	1 (5.3%)	5 (0.6%)
Methamphetamine by itself	194 (58.4%)	374 (67.8%)	40 (72.7%)	527 (63.6%)	15 (78.9%)	552 (64.0%)
Opiate medications like OxyContin, Vicodin	14 (4.2%)	14 (2.5%)	2 (3.6%)	26 (3.1%)	1 (5.3%)	26 (3.0%)
Powder cocaine by itself	29 (8.7%)	37 (6.7%)	8 (14.5%)	58 (7.0%)	1 (5.3%)	65 (7.5%)
Number of people who participant shared a syringe with, past 3 months						
None	267 (80.4%)	504 (91.3%)	44 (80.0%)	727 (87.7%)	15 (78.9%)	753 (87.4%)
>0	64 (19.3%)	48 (8.7%)	11 (20.0%)	101 (12.2%)	3 (15.8%)	109 (12.6%)
Number of times a syringe was used before disposing it						
1	223 (67.2%)	421 (76.3%)	34 (61.8%)	611 (73.7%)	12 (63.2%)	630 (73.1%)

>1	108 (32.5%)	131 (23.7%)	21 (38.2%)	217 (26.2%)	6 (31.6%)	232 (26.9%)
Number of days which drugs were injected, past 7 days						
<7	68 (20.4%)	174 (31.4%)	14 (25.4%)	229 (46.1%)	4 (21.2%)	239 (27.6%)
7	264 (79.5%)	378 (68.5%)	41 (74.5%)	600 (72.4%)	15 (78.9%)	623 (72.3%)
Times injected in a day, average						
1-3	184 (55.4%)	369 (66.8%)	34 (62.0%)	519 (62.6%)	11 (57.9)	540 (62.6%)
>3	146 (43.9%)	182 (33.0%)	21 (38.2)	307 (37.1%)	8 (42.1%)	319 (37.0%)

*Participant were able to choose more than one option
[1]Results do not add to n=total (%) due to there being instances where results were NA (not applicable)

Table 4. Unadjusted prevalence ratios for demographics of 2021 Washington State Syringe Exchange Survey participants stratified by self-reported abscess or skin infection and blood clot or blood infection in the past 3 months

	Abscess or skin infection			Blood clot or blood infection		
	Unadjusted PR	**95% CI**	**P-value**	**Unadjusted PR**	**95% CI**	**P-value**
Gender						
Man	ref	ref		ref	ref	
Woman	1.06	0.85-1.31	0.57	0.74	0.40-1.38	0.31
Transgender/ non-binary	1.37	0.13-14.4	0.61	2.98	0.37-23.9	0.16
Age at interview (yr)						
18-24	ref	ref		ref	ref	
25-29	1.21	0.75-1.93	0.38	1.34	0.15-11.7	0.76
30-39	1.07	0.72-1.61	0.69	1.01	0.13-7.64	0.99
40-49	1.26	0.82-1.95	0.25	1.77	0.22-14.0	0.54
>49	1.04	0.58-1.88	0.87	1.43	0.17-12.4	0.71
Race/Ethnicity*						
American Indian/Alaska Native	1.15	0.83-1.60	0.34	1.09	0.32-3.73	0.87
Asian/South Asian	0.66	0.07-6.52	0.54	-	-	-
Black/African American	0.97	0.60-1.56	0.85	-	-	-
Latino/Hispanic	1	0.76-1.33	0.97	1.65	0.70-3.92	0.21
Native Hawaiian/Pacific Islander	1.49	0.90-2.49	1.00	1.82	0.70-4.93	0.19
White	1.11	0.90-1.36	0.29	1	0.38-2.64	1
Other	1.51	0.71-3.22	0.19	2.05	0.39-10.7	0.27
Housing Status						
Permanent	ref	ref		ref	ref	
Homeless	1.06	0.85-1.32	0.56	1.03	0.59-1.80	0.9
Temporary/Unstable	1	0.75-1.34	1.00	0.82	0.50-1.34	0.38
Health Insurance						
None	ref	ref		ref	ref	
Insurance from job/work	1.42	0.74-2.72	0.25	2.47	0.29-20.8	0.36
Medicaid/Apple Health	1.13	0.74-1.74	0.51	0.52	0.08-3.45	0.45
Tribal health/ Indian Health Service	0.95	0.41-2.19	0.89	2.83	0.34-23.6	0.30
>1 Health Insurance	1.12	0.56-2.22	0.73	0.81	0.12-5.54	0.81
Other	1.01	0.63-1.61	0.98	1.75	0.28-10.9	0.47

Type of drug treatment (if any), past 12 months						
None	ref	ref		ref	ref	
Buprenorphine/Suboxone	0.59	0.17-1.97	0.28	0.04	0.02-0.09	**<.01**
Detox[1]	86.8	25-301	<.01	1307	439-3892	<.01
Inpatient treatment[1]	9.2	3.13-27	<.01	5419	2258-13001	<.01
Methadone program	0.02	0.01-0.04	**<.01**	1.31	0.58-2.96	.47
Naltrexone/Vivitrol	-	-	**-**	-	-	**-**
Outpatient treatment[1]	46.9	25.5-86.1	<.01	0.32	0.07-1.41	0.11
12-step/Recovery support[1] groups	56.7	27.6-117	<.01	0.10	0.01-0.69	**0.03**
>1 treatment	0.04	0.02-0.08	**<.01**	<.01	<.01	<.01
Other[1]	<.01	<.01	<.01	<.01	<.01	<.01

*Reference group are those who did not select that specific race/ethnicity
[1]Unadjusted PR not significant due to low number of participants in these treatment categories

Table 5 Unadjusted prevalence ratios for injection behaviors reported by 2021 Washington State Syringe Exchange Survey participants stratified by self-reported abscess or skin infection and blood clot or blood infection in the past 3 months

	An abscess or skin infections			Blood clot or blood infection		
	Unadjusted PR	**95% CI**	**P-value**	**Unadjusted PR**	**95% CI**	**P-value**
Types of drugs injected, past 3 months*						
Benzos/downers like Valium, Xanax, Klonopin	1.26	0.66-2.42	0.33	1.92	0.33-11.10	0.31
Buprenorphine you did Not get from a clinic/health provider	-	-	-	-	-	-
Crack cocaine by itself	1.02	0.34-3.12	0.94	1.24	0.16-9.68	0.71
Fentanyl	1.35	1.11-1.66	**0.01**	1.53	0.96-2.45	**0.07**
Heroin by itself	1.66	1.28-2.16	**<0.01**	1.37	0.74-2.55	0.28
Heroin mixed with cocaine as a speedball	1.47	1.15-1.89	**0.01**	1.42	0.59-3.42	0.38
Heroin mixed with meth as a goofball	1.38	1.12-1.69	**0.01**	1.40	0.74-2.62	0.26
Methadone you did Not get from a clinic or health provider	0.89	0.23-3.36	0.81	-	-	-
Methamphetamine by itself	0.78	0.69-0.92	**0.01**	1.49	.79-2.80	.18
Opiate medications like OxyContin, Vicodin	1.35	0.79-2.29	0.19	1.15	0.26-5.22	0.80
Powder cocaine by itself	1.19	0.87-1.62	0.24	2.11	1.03-4.34	0.44
Number of people who participant shared a syringe with, past 3 months						
0	ref	ref		ref	ref	
>0	1.65	1.24-2.20	**<0.01**	1.72	0.95-3.11	**0.07**
Number of times a syringe was used before disposing it						
1	ref	ref		ref	ref	
>1	1.30	1.11 -1.53	**<0.01**	1.67	1.03 -2.71	**0.04**
Number of days which drugs were injected, past 7 days						

<7	ref	ref		ref	ref	
7	1.46	1.22 -1.75	**<0.01**	1.11	0.50-2.46	0.77
Times injected in a day, average						
1-3	ref	ref		ref	ref	
>3	1.34	1.09 -1.64	**0.01**	1.04	0.40-2.69	0.93

*Reference group are those who did not inject that specific drug in the past 3 months

Table 6 Adjusted[*] prevalence ratios of 2021 Washington State Syringe Exchange Survey participants self-reported abscess or skin infection and blood clot or blood infection in the past 3 months

	Abscess or skin infection			Blood clot or blood infection		
Characteristics	APR	**95% CI**	**P-value**	**APR**	**95% CI**	**P-value**
Number of days which drugs were injected, past 7 days						
<7	ref	ref		-	-	-
7	1.48	1.26-1.75	**<.01**	-	-	-
Times injected in a day, average						
1-3	ref	ref		-	-	-
>3	1.34	1.10-1.64	**0.01**	-	-	-
Types of drugs injected, past 3 months						
No Goofball	ref	ref		-	-	-
Goofball	1.39	1.13-1.70	**0.01**	-	-	**-**
No Speedball	ref	ref		-	-	-
Speedball	1.48	1.16-1.89	**0.01**	-	-	**-**
No Heroin	ref	ref		-	-	-
Heroin by itself	1.69	1.28-2.24	**<0.01**	-	-	**-**
No Methamphetamine	ref	ref		-	-	-
Methamphetamine by itself	0.78	0.67-0.90	**<0.01**	-	-	**-**
No Fentanyl	ref	ref		ref	ref	
Fentanyl	1.37	1.13-1.66	**0.01**	1.6	1.02-2.50	**0.04**
Number of people who participant shared a syringe with, past 3 months						
0	ref	ref		ref	ref	
>0	1.68	1.32-2.14	**<0.01**	1.91	1.06-3.43	**0.03**
Number of times a syringe was used before disposing it						
1	ref	ref		ref	ref	
>1	1.3	1.10-1.53	**0.01**	1.76	1.02-3.04	**0.04**
Type of drug treatment (if any), past 12 months						
None	ref	ref		ref	ref	
Buprenorphine/Suboxone	0.56	0.16-1.99	0.26	0.04	0.02-0.08	**<.01**
Detox[1]	82.8	21.7-315	<.01	1328	407-4333	<.01

Inpatient treatment[1]	9.03	3.10-26.3	<.01	6259	2470-15860	<.01
Methadone program	0.02	0.01-0.04	**<.01**	1.48	0.69-3.14	0.27
Naltrexone/Vivitrol	-	-	-	-	-	-
Outpatient treatment[1]	47.8	25.1-91.2	<.01	0.31	0.07-1.31	0.10
12-step/Recovery support groups[1]	57.1	26.5-123	<.01	-	-	-
>1 treatment	0.04	0.02-0.08	**<.01**	<.01	<.01	<.01
Other[1]	<.01	<.01	<.01	<.01	<.01	<.01

*Prevalence ratios were adjusted by gender, age and housing status

[1]Unadjusted PR not significant due to low number of participants in these treatment categories