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Sex work, injection drug use, and abscesses: associations in women, but not men

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Abstract

Background—Abscesses commonly occur among people who inject drugs (PWID). However, whether the risks are comparable between males and females, and the impact of sex work on abscess risk is unclear. The goal of this study was to examine the contemporary associations of gender and sex work with the risk of abscesses in PWID.

Methods—Combining data from two cross-sectional studies conducted in the Greater Boston Area with people at risk for HIV and hepatitis C virus (HCV), we used the following inclusion criteria: age 18–45 years and report of illicit or non-prescription drug injection within the 30 days prior to the survey. Information on demographics, injection-mediated risks, and sexual behaviors was collected using Audio Computer-Assisted Self-Interview Software. Multivariable logistic regressions were used to model associations.

Results—The study sample included 298 people including 30% were female. Females were more likely than men to report sex work (28% vs. 16%, $p = 0.012$) and abscess during their lifetime

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Contributors

AGW, MS, RH, JBW, KKHC and TJS designed the study. DB and DL performed patient recruitment and data analyses. KKHC provided statistical support. AGW and DB prepared the manuscript with contributions from MS, RH, JBW, KKHC and TJS. All authors contributed to the interpretation of the study's findings as well as reviewed and approved of the manuscript before submission.

Conflict of Interest

AGW has received non-salary support grant funding from Bristol-Myers Squibb and Merck. She is a Principal Investigator on a ViiV study. The other authors have no conflicts of interest to disclose.

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(55% vs. 37% $p=0.004$). Among the females, engaging in sex work increased by >5-fold the odds of reporting abscesses [Adjusted odds ratio 5.42; 95% CI: 1.27, 23.10]. There was no association between sex work and abscesses among men.

Discussion—We found a female-specific association between sex work, injection drug use, and abscesses among PWID. Although the cross-sectional designs precluded causal inferences, longitudinal studies could enhance understanding of gender-associated risks for abscesses and inform the development of harm reduction interventions.

Keywords

Sex Work; Abscess; Skin and Soft Tissue Infection; Injection Drug Use; Heroin; People who Inject Drugs

1. Introduction

Skin and soft tissue infection (SSTI) is one of the most common infectious complications of injection drug use (Ebright and Pieper, 2002). Encompassing the clinical spectrum of cellulitis, abscesses, and deeper, more invasive infections of the fascia and muscle, SSTI in people who inject drugs (PWID) can result from introduction of bacteria on contaminated injection equipment or skin flora into skin and subcutaneous tissue (Kaushik et al., 2011; Louria, 1974). Early identification and treatment of SSTI are crucial to prevent progression of infection to more severe infectious syndromes including endocarditis and osteomyelitis (Cardona and Wilson, 2015). Depending on geographic location, method of abscess evaluation (self-report vs. clinical exam), and period of ascertainment, the prevalence of SSTIs in PWID has ranged from 11% to 70% (Binswanger et al., 2000; Cedarbaum and Banta-Green, 2016; Ciccarone and Harris, 2015; Dahlman et al., 2015; Ebright and Pieper, 2002; Lloyd-Smith et al., 2010; Phillips and Stein, 2010; Summers et al., 2017; Vlahov et al., 1992). Injection of black tar heroin and acid-solubilized free-base cocaine has been linked to increased risk of abscess due to exposure to impurities, caustic solvents, and vasoconstriction, leading to decreased wound healing (Buchanan et al., 2006; Ciccarone and Harris, 2015; Murphy et al., 2001; Passaro et al., 1998; Phillips and Stein, 2010; Summers et al., 2017). Besides immune suppression from HIV, non-vascular injection (i.e., subcutaneous or intramuscular injection) and sharing or re-using needles increases the risk of SSTI (Binswanger et al., 2000; Hope et al., 2014; Phillips and Stein, 2010; Spijkerman et al., 1996).

Females have a higher risk of SSTI—up to five-fold in some studies (Dahlman et al., 2015; Hope et al., 2010; Larney et al., 2017; Lloyd-Smith et al., 2005; Lloyd-Smith et al., 2008). The mechanism for this association remains incompletely understood but may be linked to risky injection-drug use behaviors mediated by sex work. Common in PWID, sex work was associated with increased risk of abscesses in pooled analyses of males and females (Lloyd-Smith et al., 2005; Matusiewicz et al., 2016; Pollini et al., 2010). A survey of young PWID in Denver found that people who shared needles were five times as likely to report a history of “survival sex,” a term inclusive of prostitution and sex work (Walls and Bell, 2011). The authors did not find any differences in the frequency of sex work between males and females, and no information was collected about SSTIs. Over twenty years ago, researchers

in Amsterdam examined risks for abscesses in over 700 PWID and found that females who engaged in sex work had higher incidence rates of skin abscesses compared to females who did not engage in sex work (Spijkerman et al., 1996). The potential interaction of gender and sex work was not analyzed in this study, and one-third of the participants had HIV and given limited treatment options during that era, it is likely that these participants were immunocompromised and at increased risk for infections.

In light of limited data and important unanswered epidemiologic questions, the objective of this study was to examine the association between abscesses in PWID, focusing on sex work and differences between males and females.

2. Methods

2.1. Data collection

The analysis is based on data obtained from the 2016 Tufts REACTS (Responds to the Epidemic of Addiction and Hepatitis C Virus Together; PI: Stopka) study of PWID in Boston, and a subset of respondents from the 2015 HCV and HIV-HCV Hotspots Study (PI: Stopka) of people at risk of or living with HCV/HIV infection in the Boston/Worcester area. Participants for these studies were recruited at needle-exchange programs, through street outreach, and at local clinics and hospitals. Inclusion in our study sample from these two cross-sectional studies required (1) age between 18–45 years and (2) active injection of any non-prescription or illicit drug in the past 30 days. Data were collected using an Audio Computer-Assisted Survey Instrument (ACASI).

2.1.1. Variables—Primary independent variables and covariates used in logistic regression were selected based on the literature and previous research (Hasnain et al., 2007; Morissette et al., 2007; Suryaprasad et al., 2014; Walls and Bell, 2011; Wurcel et al., 2016). We asked participants their gender, and options for answers included male, female, transgender male to female, transgender female to male, or no answer. We calculated age as a continuous variable using the year of birth and the year that the survey was completed. Due to a high percentage of people reporting “other” race, and a low number of black participants, we dichotomized the race/ethnicity variable (White vs. non-White). We dichotomized education for having greater than a high school education (yes/no). Based on self-reported age at initiation of injection drugs, we calculated the approximate number of years of injection drug use by subtracting this number from their current age. We dichotomized both the heroin and the cocaine injection-drug use variables into yes/no to “high use” for each gender based on the median number of times participants reported injections in the past 30 days. If someone did not report the use of the drug in the previous 30 days, then they were classified as “no” to the question of “high use.” We controlled for having obtained needles at Needle Exchange Program. HCV and HIV infection status were self-reported. Homelessness was classified as a binary measure (yes/no) based on participant answer to the question, “Do you consider yourself homeless?”

2.1.2. Exposure—Participants were identified as engaging in sex work if, within the thirty days before taking the survey, they engaged in “prostitution” for income or exchanged sex for money or drugs.

2.1.3. Outcome—The outcome of interest was the dichotomous answer (yes/no) to the question “Has a medical professional ever told you that you had an abscess?” IRB: We received approval from the Tufts University Health Sciences Investigational Review Board to conduct this research. Informed consent was required for participation in both studies and participants were reimbursed for their time.

2.2 Statistical Analysis

2.2.1. Summary Statistics—Continuous variables were summarized using the median and compared between two groups: males and females. Categorical variables were summarized as proportions and compared between two genders using χ^2 test.

2.2.2. Logistic Regression Analyses—Following the original analytical plan, we performed binary analyses to assess crude associations between the outcome of abscess and the exposure of interest and other variables. Because the interaction term between sex work and gender was statistically significant ($p=0.02$) we performed and reported all regression analyses stratified by gender. Independent variables were checked for collinearity, with a variance inflation factor cut-off at 6. All analyses were performed with SAS software 9.3 (SAS Institute Inc., Cary; NC, USA).

3. Results

Table 1 displays demographic data and the frequency of injection-mediated risks and infections. Of the 298 study participants, 30% ($n=88$) were female with more females reporting white race compared to males (86% vs. 62%, $p<0.001$). Despite finding no difference in median age between males and females or age at first injection, males had been injecting for longer (13 years vs. 10 years, $p=0.04$). The vast majority of PWID reported injecting heroin (94%); about half of the participants reported cocaine injection, and about one-third reported speedball injection, which combines heroin and cocaine in a single injection. Females had a significantly higher median number of times injecting heroin in the past 30 days (31 vs. 20, $p<0.001$). Males had a higher median number of times injecting cocaine in the past 30 days (10 vs. 8, $p<0.001$) and were more likely than females to report speedball injection (33% vs. 21%, $p<0.001$).

Females were more likely to engage in sex work (28% vs. 16%, $p=0.012$) and report HCV infection (73% vs. 60%, $p=0.038$). Nearly half of the study participants had been told by a medical professional that they had ever had an abscess with females more likely to report ever having an abscess than males (55% vs. 37%, $p=0.004$). Only 6 individuals reported having an abscess in the previous 30 days. About 33% of the sample reported having a primary care physician although 46% or 126 people (36 females, 90 males) did not answer this question. In females but not males, sex work was associated with ever having an abscess (adjusted odds ratio [AOR] 5.42; 95% confidence interval [CI]: 1.27, 23.10) in the multivariable model. Increased number of years injecting (AOR 1.15; 95% CI: 1.02, 1.29) and HCV infection (AOR 6.91; 95% CI: 1.36, 35.2) were also associated with increased risk of abscess in females, but not males. The type and amount of injection drug were associated with ever having an abscess in males, with a positive association seen for high cocaine use (AOR 2.50; 95% CI: 1.06, 5.91).

4. Discussion

In a sample drawn from two concurrent cross-sectional studies of active PWID, we found that females who reported sex work had 5-fold increased odds of ever having experienced abscesses, while sex work was not associated with abscesses in males. Self-reported HCV infection (7-fold increased odds) and increased years of injecting (15% increased odds of lifetime abscess for every additional year of injecting) were associated with lifetime abscess only in females.

Our findings prompt several explanatory theories about the interaction of gender, sex work, and abscess risk. The differences in some of the infectious complications of injection drug use – SSTIs and HCV, in particular – between females and males may be related to physiological or behavioral factors. Researchers have theorized that females may have smaller, deeper veins that could lead to greater difficulty injecting and the use of non-extremity veins for injection (Hope et al., 2010; Spijkerman et al., 1996; Topp et al., 2008). Supporting this theory, females are more likely than males to inject in large veins, such as the jugular vein in the neck, and these sites are linked to increased risk of infection (Darke et al., 2001; Hoda et al., 2008; Powis et al., 1996). Females are over two times more likely than males to ask for assistance when injecting drugs, and the rationale for their request is often linked to report of small veins (Kral et al., 1999; Lee et al., 2013; Salmon et al., 2009; Tuchman, 2015). Injection by someone else has been linked to a 50 to 100 percent increased odds of abscess in surveys with PWID (E. Lloyd-Smith et al., 2008; Pollini et al., 2010). Dynamics in sexual relationships may also influence injecting practices and subsequent risk of infections. When co-injecting with males, females are more likely to “go second”, thus injecting with previously used or less sharp needles and increased risk for infection (Salmon et al., 2009).

Interestingly, we found that high cocaine injection was associated with increased risk of lifetime abscess in males, but not females. Cocaine injection is a highly-correlated risk factor for abscesses (Lloyd-Smith et al., 2005; E. Lloyd-Smith et al., 2008). The association between cocaine and infection has been attributed to impaired immune response due to vessel vasoconstriction and the need to dissolve crack (aka and “freebase”) cocaine using acids such as vinegar, lemon juice, or solid citric or ascorbic acid (Buchanan et al., 2006; Hope et al., 2014; Waninger et al., 2008). We did not differentiate between cocaine or crack injection. One explanatory theory for our findings is that males who injected cocaine more frequently also reported less frequent heroin injection, which could explain the negative association of heroin use with lifetime abscess report in males. Additionally, speedball injection—a consistent risk factor for abscesses in the literature—was more common in males than females and may have influenced the abscess risk (Barańska-Rybak et al., 2014; Murphy et al., 2001; Phillips and Stein, 2010).

There are several limitations to this study. The large confidence intervals in our primary outcome of interest suggest that further exploration of factors associated with experiencing abscesses using larger cohorts is warranted. For example, the relatively small sample size with limited racial/ethnic diversity precluded examining differences among Whites, Hispanics, and Blacks (Fink et al., 2013). Although our analysis examined the outcome of

self-reported lifetime abscess, we used drug injections in the previous 30 days to derive the frequency of injections. It is possible that the activities during the prior 30 days may not reflect the previous activity level which led to the development of previous abscesses. Participants were also classified as having an abscess based on self-report of diagnosis by a medical provider. Since self-treatment of SSTI by PWID is common, our population may have limited access to health care professionals, and the true frequency of abscesses could be higher (Roose et al., 2009). Additionally, because needle exchange programs represented a recruitment site for the parent studies, there may be an overrepresentation of people who engage in harm reduction, limiting the generalizability of the results.

Despite these limitations, our study is the first in over twenty years to investigate gender-specific differences in associations between sex work and abscesses and paves the way for further research. Recruitment of longitudinal cohorts with increased heterogeneity in harm reduction practices as well as studies that permit linkage to medical-care utilization and mortality databases are necessary to understand risks, outcomes of infection better and develop interventions. Further multi-disciplinary research with public health experts, epidemiologists, social workers and clinicians is necessary to understand better and improve the quality of life for PWID and avert potentially life-threatening infections.

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Highlights

- Abscess and HCV are common in a contemporary sample of people who inject drugs.
- Women who report sex work have increased risk of abscesses, an association not seen in men.
- Physiological and behavioral differences may contribute to gender differences in abscess risk.

Table 1

Demographic, injection-mediated risks, and infections among people who inject drugs by sex, Boston and Worcester Massachusetts, 2015–2016 (n=298)

	All (n=298) n (%)	Female (n=88) n (%)	Male (n=210) n (%)	p- value
Demographics				
Age in year, median [IQR]	33 [30, 39] (n=298)	32 [30, 36]	33 [29, 39]	0.372
White race	206 (69)	76 (86)	130 (62)	<.001
Homeless	255 (86)	72 (82)	183 (87)	0.234
High school education or greater	205 (69)	63 (72)	142 (68)	0.500
Drug Use Behavior past 30 days				
Median age when first injected any drug [IQR] ^{&}	20 [17, 25]	22 [18, 28]	19 [16, 24]	0.296
Median years of injecting drugs [IQR] ^{&}	12 [6, 18]	10 [5, 15]	13 [7, 20]	0.041
Injected in past 30 days				
Heroin	280 (94)	82 (93)	198 (94)	0.199
Cocaine	138 (46)	40 (45)	98 (47)	0.843
Heroin and Cocaine together ("speedball")	91 (31)	21 (24)	70 (33)	0.034
If reported injection of heroin, median # of times injected heroin in last 30 days [IQR]	25 [7, 60]	31 [10, 90]	20 [5, 60]	<.001
If reported injection of cocaine, median # of times injected cocaine in last 30 days [IQR]	10 [4, 25]	8 [3, 23]	10 [4, 25]	<.001
Obtains needles at Needle Exchange Program	128 (62)	61 (69)	125 (60)	0.112
Sex work				
Sex Work for Money or Drugs	58 (19)	25 (28)	33 (16)	0.012
Sex for Drugs Only	36 (12)	7 (8)	29 (14)	0.158
Sex for Money Only	5 (2)	4 (5)	1 (0.5)	0.013
Infections and Health Care Access				
Has a Primary Care Physician (PCP) *	97 (33)	34 (39)	63 (30)	0.147
Saw PCP in previous 6 months *	76 (26)	24 (27)	52 (25)	0.651
HCV Positive	190 (64)	64 (73)	126 (60)	0.038
HIV positive	19 (6)	3 (3)	16 (8)	0.613
Abscess ever	125 (42)	48 (55)	77 (37)	0.004

	All (n=298) n (%)	Female (n=88) n (%)	Male (n=210) n (%)	p- value
Abscess past 30 days	6 (2)	4 (5)	2 (1)	0.044

P-values obtained by Wilcoxon rank sum test, Chi², or T-test. IQR: Interquartile range;

& 1 person did not report age at first use

* 126 people did not answer this question (36 females/90 males).

Table 2

Stratified Analysis: Factors associated with ever having an abscess in male and female people who inject drugs (PWID), Boston and Worcester Massachusetts 2015–2016 (n=298)

Female PWID (n=88)			
	Unadjusted		Multivariable
Predictor	OR (95% CI)	p-value	AOR
Sex work	2.19 (0.83, 5.81)	0.114	5.42 (1.27, 23.10)
Age, years	0.97 (0.90, 1.04)	0.409	0.89 (0.77, 1.02)
Years injecting	1.05 (0.98, 1.12)	0.195	1.15 (1.02, 1.29)
High heroin injection use in the past 30 days	1.50 (0.64, 3.51)	0.349	2.33 (0.70, 7.78)
High cocaine injection use in the past 30 days	0.47 (0.17, 1.29)	0.142	0.27 (0.06, 1.23)
White	1.82 (0.53, 6.27)	0.340	2.04 (0.29, 14.22)
High school education or greater	0.46 (0.17, 1.21)	0.114	0.28 (0.08, 1.08)
Homeless	2.33 (0.77, 7.12)	0.137	1.99 (0.48, 8.27)
HCV positive	4.67 (1.49, 14.59)	0.008	6.91 (1.36, 35.2)
HIV positive	1.73 (0.15, 19.85)	0.659	0.28 (0.01, 7.71)
Obtains needles at Needle Exchange Program	0.48 (0.19, 1.24)	0.132	0.27 (0.07, 1.01)
Male PWID (n=210)			
	Univariate		Multivariable
Predictor	OR (95% CI)	p-value	AOR
Sex work	0.60 (0.26, 1.37)	0.226	0.49 (0.20, 1.21)
Age, years	0.96 (0.92, 1.01)	0.790	0.96 (0.88, 1.04)
Years injecting	0.99 (0.95, 1.02)	0.515	1.01 (0.95, 1.08)
High heroin injection use in the past 30 days	0.85 (0.49, 1.50)	0.579	0.74 (0.37, 1.47)
High cocaine injection use in the past 30 days	1.77 (0.89, 3.51)	0.102	2.50 (1.06, 5.91)
White	1.61 (0.89, 2.90)	0.117	1.35 (0.65, 2.78)
High school education or greater	0.75 (0.42, 1.36)	0.349	0.48 (0.23, 0.99)
Homeless	0.69 (0.30, 1.56)	0.371	0.40 (0.16, 1.00)
HCV positive	1.53 (0.81, 2.89)	0.190	1.53 (0.75, 3.13)
HIV positive	0.54 (0.17, 1.74)	0.301	0.78 (0.21, 2.84)
Obtains needles at Needle Exchange Program	1.43 (0.80, 2.56)	0.230	1.31 (0.65, 2.63)