Police-related barriers to harm reduction and poor health access linked to alarmingly high rates of non-fatal overdose among sex workers who use drugs: results of a community-based cohort in Metro Vancouver, Canada

by

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INTRODUCTION

The dramatic and sustained increase in rates of opioid-related overdose deaths seen in recent years across North America has been recognized as a pressing public health concern requiring an urgent response (Fairbairn, Coffin, & Walley, 2017; "Provincial health officer declares public health emergency," 2016). Between 2012 and 2018 the rate of drug overdose deaths in British Columbia, Canada increased from 5.9 to 31.3 per 100,000 (BC Coroners Service, 2018), prompting the provincial health officer to declare a public health emergency ("Provincial health officer declares public health emergency," 2016). The city of Vancouver, Canada has been particularly heavily impacted by the current overdose crisis, prompting the expansion and intensification of overdose prevention efforts (BC Coroners Service, 2018; Government of British Columbia, n.d.). Despite this, the rate of drug overdose in Vancouver - as elsewhere in North America – remains exceedingly high (BC Coroners Service, 2018). More robust evidence is needed to better inform this response, yet information regarding how the current crisis differentially impacts marginalized populations is limited, with particular gaps in our understanding of the uniquely gendered needs and experiences of marginalized women in the context of the current overdose crisis. Although men comprise a greater proportion of fatal drug overdoses in British Columbia (BC Coroners Service, 2018), among women between 30 and 64 years old in the United States, rates of drug overdose death increased 260% between 1999 and 2017 (VanHouten, Rudd, Ballesteros, & Mack, 2019). During this time period rates of opioid-related drug overdose deaths among women increased 492% (VanHouten et al., 2019), indicating that women are heavily impacted by the overdose crisis in North America. Previous research has indicated that, amongst people who use drugs, non-fatal overdose is associated with a 1.95-fold increased odds of subsequent fatal overdose (Caudarella et al., 2016). An improved understanding of non-fatal overdose patterns can therefore help to inform a more efficient and effective approach to reducing drug-related harms amongst women who use drugs.

Previous studies exploring the intersection of sex work and substance use have described a high degree of overlap between the two, with sex workers being overrepresented amongst people who use drugs (Chettiar, Shannon, Wood, Zhang, & Kerr, 2010; Kerr et al., 2009) and a high prevalence of drug use amongst sex workers globally (Argento, Chettiar, Nguyen, Montaner, & Shannon, 2015; Azim, Bontell, & Strathdee, 2015; Odinokova, Rusakova, Urada, Silverman, & Raj, 2014; Shannon, Bright, Duddy, & Tyndall, 2005; Shannon et al., 2011). For example, amongst a sample of sex workers in Vancouver, Canada, 69.4% reported having used non-injection drugs and 40.0% reported having used injection drugs within the last six months (Argento et al., 2015). The exceptionally high prevalence of substance use amongst sex workers suggests that this population may be disproportionately burdened by the current overdose crisis, yet there is a dearth of evidence addressing this. Further, sex workers who use drugs may face increased health inequities (Eiroá-Orosa et al., 2010), including an increased risk of sexually transmitted and blood borne infections (STBBIs) such as HIV (Azim et al., 2015; Shannon et al., 2018; World Health Organization, 2016), poorer psychological health, more intensive patterns of substance use (Kerr et al., 2009; Marchand et al., 2012), decreased survival time (Gjersing & Bretteville-Jensen, 2014; Spittal et al., 2010), and increased odds of non-fatal overdose (Fairbairn, et al., 2008). Others have described the ways in which gender-based inequities shape safety amongst women who use drugs (Argento et al., 2014); for example, the threat of gender-based violence in drug use environments may discourage women from utilizing harm reduction services or strategies (Boyd et al., 2018; Shannon et al., 2008).

Despite previous evidence illustrating enhanced health and social inequities for sex workers who use illicit drugs (Azim et al., 2015; Gjersing & Bretteville-Jensen, 2014; Spittal et al., 2006), and growing concern regarding the health and social harms of North America's current overdose crisis, few studies have explored the gendered social and structural factors shaping overdose amongst sex workers. Drawing on previous descriptions of the 'risk environment' in the context of harm reduction (Rhodes, 2002, 2009), this study explores the interacting structural and individual factors that shape vulnerability to overdose amongst women sex workers who

use drugs (Shannon et al., 2015; Shannon, Goldenberg, Deering, & Strathdee, 2014). For example, criminalization and marginalization have been shown to threaten the health and safety of sex workers by constraining their ability to utilize harm reduction services and strategies (Baratosy & Wendt, 2017; Blankenship & Koester, 2002; Landsberg et al., 2017; Shannon et al., 2009), thereby; enhancing vulnerability to physical and sexual violence (Baratosy & Wendt, 2017; Blankenship & Koester, 2002; Krüsi et al., 2014); and increasing the risk of STBBI such as HIV by reducing sex workers' ability to negotiate condoms and safer sexual practices (Azim et al., 2015; Shannon et al., 2009). However, there is a notable lack of evidence describing how these structural factors influence sex workers' engagement in drug-related harm reduction strategies (e.g. use of clean equipment and safer drug consumption practices). Additionally, it is well documented that stigmatization and other barriers to health services faced by sex workers exacerbate existing health inequities (Bodkin, Delahunty-Pike, & O'Shea, 2015; King, Maman, Bowling, Moracco, & Dudina, 2013; Lazarus et al., 2012; Shannon et al., 2005; Socías et al., 2016). Amongst sex workers in Vancouver, Canada, over 70% experienced institutional barriers to health services (e.g. long wait times, limited service hours, and poor treatment from health care providers) (Socías et al., 2016). Additional vulnerabilities relating to experiences of violence, mental health, gender identity, and sexual orientation were found to be associated with increased odds of reduced health service access (Socías et al., 2016), highlighting the relationship between marginalization and access to care. Although barriers to health services and harm reduction strategies amongst sex workers have been widely documented (Bodkin et al., 2015; King et al., 2013; Lazarus et al., 2012; Socías et al., 2016), there is a scarcity of research exploring the relationship between drug-related harm reduction strategies, health services access, and vulnerability to overdose amongst sex workers.

Given the dearth of evidence regarding patterns and determinants of overdose amongst sex workers, including the ways in which policing and health services access shape vulnerability to overdose in the context of British Columbia's current overdose crisis, this study aimed to describe the prevalence of non-fatal overdose in a cohort of sex workers, and to explore the

independent effect of (1) experiencing police-related barriers to harm reduction strategies, and (2) experiencing unmet needs for health services on non-fatal overdose experiences amongst women sex workers who use drugs in Metro Vancouver, Canada over a 7.5-year period.

METHODS

Study Design

Longitudinal data for this study were drawn from an open prospective cohort, *An Evaluation of Sex Workers Health Access* (AESHA), from January 2010 - August 2017. This study was developed based on substantial community collaborations with sex work agencies since 2005 and continues to be monitored by a Community Advisory Board of representatives comprised of more than 15 community agencies. Current eligibility includes identifying as a woman (trans- and cis-gender identifying women), having exchanged sex for money within the last 30 days, and providing written informed consent. Given the challenges of recruiting sex workers in isolated and hidden locations, time-location sampling is used to recruit youth and adult women sex workers through day and late-night outreach to outdoor/public sex work locations (i.e. streets, alleys) and indoor sex work venues (i.e. massage parlours, micro-brothels, and out-call locations) across Metro Vancouver, BC. In addition, online recruitment is used to reach sex workers working through online solicitation spaces. Indoor sex work venues and outdoor solicitation spaces ('strolls') are identified through community mapping conducted together with current/former sex workers and are updated regularly by the outreach team.

At enrolment and on a bi-annual basis, participants complete a questionnaire with a trained interviewer (both sex workers and non-sex workers), which elicits responses related to individual socio-demographic characteristics (e.g. age, sexual identity, ethnicity, physical and mental health, patterns of substance use), social and interpersonal environmental factors (e.g. experiences of physical and sexual violence, social cohesion amongst sex workers), and structural factors (e.g. sex work patterns and environment, experiences of criminalization). In addition, HIV/STI/HCV serology testing and treatment for STIs is provided by a project nurse.

All participants provide informed consent and receive an honorarium of $40 CAD at each bi-annual visit for their time, expertise and travel. The study holds ethical approval through the Providence Health Care/University of British Columbia and Simon Fraser University Research Ethics Boards.

Study Variables

Primary exposure and outcome variables were time-updated variables measured as occurrences within the last six months at each bi-annual study visit. Additional variables of interest and potential confounders included in analysis were also time-updated, with the exception of age and Indigenous ancestry, which were considered time-fixed variables.

Outcome variable: The outcome variable used in this analysis was "non-fatal overdose", which was defined as responding "yes" to the question "In the last 6 months, have you overdosed by accident?"

Primary exposure variables of interest: (1) Police-related barriers to harm reduction strategies was defined as having experienced any of the following as a result of police presence within the last six months: difficulty accessing drugs, syringes, or other drug equipment, rushed smoke or injection, having new or used equipment taken away or broken by police, having money or drugs taken away by police (without arrest), or being "jacked up" by police, and (2), Unmet needs for health services was defined as responding "sometimes", "occasionally", or "never" to the question "How often can you get health care services when you need it?".

Other exposure variables of interest: Other hypothesized individual and structural confounders were identified *a priori* based on previous literature and informed by explanatory analyses. These included the demographic variables age (continuous), income (monthly income per $1,000 CAD), Indigenous ancestry (including First Nations, Metis, or Inuit), lifetime occurrence of mental health diagnosis (e.g. anxiety, depression, post-traumatic stress disorder), minority gender identity (e.g. transgender, intersex, transsexual, two spirit, or genderqueer), and minority sexual orientation (gay, lesbian, bisexual, two spirit, queer, or asexual).

Variables related to patterns of substance use included use of injection opioids (e.g. street methadone, diverted/nonmedical use of prescription opioids), non-injection opioids (e.g. street methadone, diverted/nonmedical use of prescriptions opioids), injection stimulants (e.g. crystal meth, crack cocaine, diverted/nonmedical use of prescription stimulants), and non-injection stimulants (e.g. cocaine, crystal meth, crack cocaine, diverted/nonmedical use of prescription stimulants). Factors related to substance use within intimate partnerships included use of drugs with intimate partner and obtaining drugs for intimate partner. Utilization of community-based (e.g. InSite), women-specific (e.g. SisterSpace), and any overdose prevention services was also examined descriptively, as well as possession of take-home naloxone kit.

Structural variables included unstable housing (e.g. single room occupancy housing, living with family or friends); primary place of service (outdoor/public spaces (e.g. street, public washroom, car, tent), informal indoor space (e.g. crack/drug house, sauna/steam bath, bar/nightclub, own or client's place of residence), or formal in-call space) (e.g. massage/beauty parlor, micro-brothel); police encounters while working (e.g. arrest, police inspection or raid, detainment, physical assault, property searched or taken away, propositioned or coerced into providing sexual favours); physical and/or sexual workplace violence (e.g. abduction, sexual assault, attempted sexual assault, rape, physical assault, trapped in car or room/hotel by aggressor posing as client); and rushed drug use in an outdoor space ('always', 'usually', 'sometimes' or 'occasionally' rushing drug use).

Statistical Analyses

Analyses were restricted to study visits where participants reported using non-injection (excluding alcohol and cannabis) or injection drugs within the last six months. For each model, baseline individual and structural characteristics were stratified by the outcome variable and compared using Pearson's chi-squared test for categorical variables (in the case of small cell counts, Fisher's exact test was used in place of Pearson's chi-squared test) and the Wilcoxon rank-sum test for continuous variables. We began with bivariate logistic regression using generalized

estimating equations (GEE) with an exchangeable correlation matrix (Diggle, Heagerty, Liang, & Zeger, 2013) was used to examine associations between independent variables of interest, hypothesized confounders and non-fatal overdose. GEE was used to account for repeated measurements amongst participants over time.

Next, we developed two separate multivariate confounder models using logistic regression with GEE to identify the independent effects of experiencing (1) *police-related barriers to harm reduction strategies* and (2) *unmet needs for health services* on the odds of non-fatal overdose. Hypothesized confounders significantly associated with the outcome at $p<0.10$ in bivariate analysis were included in both full models. For each model, using the process described by Maldonado and Greenland (Maldonado & Greenland, 1993), potential confounders were removed in a stepwise manner, and variables that altered the association of interest by <5% were systematically removed from the model. All statistical analyses were performed in SAS version 9.4 (SAS, Cary, NC) and all p-values are two-sided.

RESULTS

Analyses were restricted to 624 participants who reported using injection or non-injection drugs during the study, who contributed 3703 observations and a median of 5 study visits (IQR 2 – 9) where they used drugs in the last six months. Amongst this sample, 7.7% reported non-fatal overdose within the last six months at baseline and over one-quarter (27.6%) experienced at least one non-fatal overdose over the 7.5-year study period, contributing a total of 287 overdose events. Over the course of the study, 60.6% (n = 378) reported using non-injection opioids, 96.3% (n = 601) reported using non-injection stimulants, 63.1% (n = 394) reported using injection opioids, and 54.3% (n = 339) reported using injection stimulants. Among participants who reported police-related barriers to harm reduction, the most common barriers included police confiscation of used (40.2%) or new (27.6%) (n=118) harm reduction equipment, being 'jacked up' by police (38.1%) or policing activity resulting in difficulty accessing harm reduction supplies (22.2%).

At baseline (Table 1), participants' median age was 34 (IQR 27-42) and 52.7% were of Indigenous ancestry. 7.9% of participants identified as a gender minority and 43.4% identified as a minority sexual orientation. Almost two-thirds (62.3%) had previously been diagnosed with a mental health issue.

Over the 7.5-year study period, over two-thirds (68.6%) of participants reported police-related barriers to harm reduction strategies (e.g., syringe confiscation) and one-third (33.0%) reported having unmet needs for health services. In a sub-analysis of descriptive data amongst participants who responded to questions on new/emerging overdose prevention services between March and August 2017 (n=217), 129 (58.5)% had used any overdose prevention services in the last 6 months over the 6-month follow-up period (e.g., supervised injection, naloxone); nearly half had accessed community-based overdose prevention services (e.g. InSite) and 80.2% (*n*=174) reported possession of take-home naloxone.

In bivariate GEE analysis (Table 2), experiencing unmet needs for health services (OR: 1.66; CI: 1.18 – 2.34) and police-related barriers to harm reduction strategies (OR: 1.72; CI: 1.34 – 2.20) were both significantly associated with increased odds of non-fatal overdose. Other variables associated with increased odds of non-fatal overdose included having a mental health diagnosis (OR: 2.39; CI: 1.63 – 3.51), identifying as a minority gender/sexual orientation (OR: 1.36; CI: 0.98 – 1.89), and patterns of drug use including use of injection opioids (OR: 2.87; CI: 2.13 – 3.88), injection stimulants (OR: 2.26; CI: 1.69 – 3.02), non-injection opioids (OR: 1.54; CI: 1.17 – 2.02), and providing drugs for an intimate partner (OR: 1.39; CI: 1.03 – 1.87); use of non-injection stimulants was associated with lower odds of non-fatal overdose (OR: 0.73; CI: 0.51 – 1.06). Structural variables associated with elevated odds of non-fatal overdose in bivariate analysis included physical and/or sexual workplace violence (OR: 2.08; CI: 1.47 – 2.94), and having to rush one's drug use in an outdoor space (OR: 1.29; CI: 1.01 – 1.64).

In two separate multivariate GEE confounder models (Table 3), exposure to police-related barriers to harm reduction strategies (AOR: 1.41; CI: 1.06 – 1.87) and experiencing unmet needs for health services (AOR: 1.56; CI: 1.09 – 2.24) were both independently associated with increased

odds of non-fatal overdose, after adjustment for key individual and structural confounders (eg. physical and/or sexual workplace violence, mental health diagnosis, use of injection opioids, use of non-injection opioids, place of service, and use of injection stimulants).

DISCUSSION

Amidst the growing overdose crisis in North America, sex workers in Metro Vancouver, Canada face an alarmingly high prevalence of non-fatal overdose, with almost one in three sex workers who use drugs in this study experiencing at least one non-fatal overdose over a 7.5-year period. Experiencing unmet needs for health services and police-related barriers to harm reduction strategies were both independently associated with increased odds of non-fatal overdose amongst sex workers who use drugs, after adjustment for confounders, suggesting that criminalization, adversarial relations with police, and exclusion from health services may undermine access to appropriate harm reduction paraphernalia and services (e.g., supervised injection) and exacerbate vulnerability to overdose amongst an already highly-marginalized population.

Previous literature has documented deleterious effects of criminalization and policing on HIV/STI risk, violence, and ability to engage in harm reduction strategies (e.g. client screening and condom negotiation) amongst sex workers, resulting in pronounced health inequities (Baratosy & Wendt, 2017; Blankenship & Koester, 2002; Krüsi et al., 2014; Landsberg et al., 2017; Shannon et al., 2009). The threat of criminalization may leave sex workers unable to adequately screen clients, negotiate safer sex practices, or protect themselves from violence (Baratosy & Wendt, 2017; Blankenship & Koester, 2002; Krüsi et al., 2014; Landsberg et al., 2017; Shannon et al., 2009). Our findings build on this, by elucidating the ways in which the policing of sex work and substance use interact to undermine use of drug-related harm reduction strategies, exacerbate risk, and further marginalize sex workers who use drugs, resulting in an increased burden of overdose within this population.

Barriers to health and other services faced by sex workers have been widely documented (Bodkin et al., 2015; King et al., 2013; Lazarus et al., 2012; Shannon et al., 2005; E. M. Socías et al., 2016); stigma may impede access to health and addictions services amongst marginalized women (Azim et al., 2015; Bodkin et al., 2015; King et al., 2013; Vancouver Coastal Health, 2016), highlighting the need for non-stigmatizing, sex worker-friendly supports. A 2016 report exploring the unique gendered barriers to health services faced by marginalized women in Vancouver identified a critical need for women-centered services, particularly in the area of harm reduction (Vancouver Coastal Health, 2016), given that men tend to be better represented and more visible within traditional harm reduction and overdose prevention services. Women may retreat from some drug use environments due to elevated risks of violence (Boyd et al., 2018); this marginalization within communities of people who use drugs may elevate women's risk of overdose. Our findings expand upon this, by drawing direct associations between health services barriers and elevated non-fatal overdose risk amongst sex workers who use drugs, thereby helping to situate vulnerability to overdose within broader structural determinants of health and patterns of marginalization.

In light of pronounced inequities in access to health, harm reduction, and overdose prevention services and the alarmingly high prevalence of non-fatal overdose amongst our sample, targeted interventions informed by gender and sex work-specific research are needed to prevent further drug-related harm amongst sex workers who use drugs. The unique interplay of social and structural vulnerabilities faced by sex workers who use drugs suggests a need for sex work-specific addiction services and harm reduction strategies that are women-centered and trauma-informed (Schmidt, Poole, Greaves, & Hemsing, 2018; Vancouver Coastal Health, 2016). In particular, given that unmet health needs were a key independent predictor of overdose, scale-up of women and sex worker-friendly, low-threshold, community-based services that incorporate anti-stigma and peer-led approaches, drop-in hours, mobile service delivery, harm reduction, and violence supports are potential strategies for overcoming barriers to health access and increasing women's health and safety (Bodkin et al., 2015; Janssen et al., 2009; Kim et al., 2015;

The Women's Coalition, 2014). Promising models of community-based, sex work-specific mobile services include mobile outreach services including harm reduction supplies (e.g. condoms and clean syringes), first-aid services, information, and referrals, as well as sex work-specific drop-in centres (Kim et al., 2015). In addition to reducing immediate harms associated with substance use, including overdose risk, accessible harm reduction services can provide sanctuary from the violence that women often face within street-based drug use environments (Boyd et al., 2018; Fairbairn, Small, Shannon, Wood, & Kerr, 2008). However, in the context of British Columbia's persistent overdose crisis, further overdose-related supports are needed to address the overdose crisis among sex workers who use drugs. In the face of a growing overdose epidemic, there is a critical need to expand women-centered, sex work-specific health and harm reduction supports in an effort to fill gaps in service and overcome structural barriers to safety. Over half of participants in our sub-analysis accessed overdose prevention services and over three-quarters possessed take-home naloxone. In Vancouver, a unique women-only overdose prevention site opened in 2017 and represents the first facility of its kind in Vancouver and one of few worldwide (Centre for Excellence in Women's Health, n.d.); future evaluation efforts are needed to evaluate access and impacts for this population. In addition, initiatives that offer safe, non-judgmental, destigmatizing, peer-based supports have proven successful at improving service access and safety amongst sex workers and people who use drugs (Argento et al., 2016; Bardwell, Kerr, Boyd, & McNeil, 2018; Febres-Cordero et al., 2018; Kerrigan et al., 2015; St. James Infirmary, 2017). While the expansion of timely, sex work-friendly health services may provide a crucial linkage to needed harm reduction strategies and overdose prevention supports, shifts in policing practices and criminalization are also needed to meaningfully address the broader structural barriers to sex workers' health and safety. Given that sex workers across Metro Vancouver continue to report high rates of police harassment and surveillance, and in this study, police barriers to harm reduction and overdose prevention, efforts to decriminalize sex work and implement more progressive, harm-reduction oriented policing practices across Metro Vancouver are urgently needed.

Strengths/Limitations

Several potential limitations should be noted when interpreting results of this study. Although observational research designs do not permit causal inferences, this study provides unique data from a prospective, 7.5-year cohort to shed light on the overdose experiences of women sex workers who use drugs – a population at high risk of overdose, yet frequently overlooked in research on drug use, largely due to the lower visibility of women within substance use scenes. Future mixed-methods studies on this topic are recommended. In light of the stigma associated with sex work and with drug use, it is possible that findings could be influenced by social desirability bias. Our community-based research approach, including trained experiential (sex workers) and community-based interviewers with experience with building rapport and asking questions in a non-judgmental fashion, and ongoing outreach and semi-annual follow-up with participants, is designed to maintain community connections and rapport, address stigma, and ensure that research topics and questions are reflective of sex workers' needs and priorities.

CONCLUSION

The current findings suggest that sex workers in Metro Vancouver are heavily impacted by the persistent overdose crisis in North America; nearly a third of sex workers who use drugs experienced a non-fatal overdose over the study period. This emphasizes the urgent need to better address structural factors shaping the health and safety of marginalized women, particularly within the context of North America's current overdose crisis. Our findings suggest that criminalization, adversarial police relations, and exclusion from health services impede access to harm reduction strategies and services for marginalized women, thereby exacerbating overdose risk within a population facing both drug use and sex work-related marginalization. This underscores the need for expanded gender and sex work-specific community-based services

and highlights the value of using a gendered lens to understand the unique experiences of marginalized women who use drugs.

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TABLE 1. Baseline demographic and structural characteristics amongst women sex workers who use drugs in Metro Vancouver, Canada between 2010 and 2017 (*n* = 624)

Characteristic	Total (%) (*n* = 624)	Non-Fatal Overdose*		*p* - value
		Yes (%) (*n* = 48)	No (%) (*n* = 576)	
Primary exposures of interest				
Police-related barriers to harm reduction strategies*	294 (47.1)	26 (54.2)	268 (46.5)	0.269
Unmet needs for health services*	67 (10.7)	8 (16.7)	59 (10.2)	0.172
Other individual and structural confounders				
Demographics				
Age (med, IQR)	34 (27 – 42)	31 (23 – 40)	34 (28 – 42)	0.029
Average monthly income per $1000 CAD (med, IQR)*‡	2.9 (1.7 – 5.5)	4.9 (2.3 – 8.8)	2.8 (1.7 – 5.1)	0.005
Indigenous ancestry	329 (52.7)	29 (60.4)	300 (52.1)	0.267
Minority gender identity	49 (7.9)	7 (14.6)	42 (7.3)	0.089
Minority sexual orientation	271 (43.4)	22 (45.8)	249 (43.2)	0.734
Mental Health Diagnosis†	389 (62.3)	38 (79.2)	351 (60.9)	0.012
Substance use patterns				
Injection opioid use*	309 (49.5)	29 (60.4)	280 (48.6)	0.119
Non-injection opioid use*	250 (40.1)	30 (62.5)	220 (38.2)	>0.001
Injection stimulant use*	226 (36.2)	26 (54.2)	200 (34.7)	0.005
Non-injection stimulant use*	588 (94.2)	42 (87.5)	546 (94.8)	0.174
Provide drugs for intimate partner*	147 (23.6)	12 (25.0)	135 (23.4)	0.586
Use drugs with intimate partner*	256 (41.0)	20 (41.7)	236 (41.0)	0.909
Structural factors				
*Primary place of service**				
Outdoor/public space	328 (52.6)	27 (56.3)	301 (52.3)	
Informal indoor	238 (38.1)	18 (37.5)	220 (38.2)	
Brothel/quasi-brothel	36 (5.8)	1 (2.1)	35 (6.1)	
N/A no recent sex work	7 (1.1)	0 (0.0)	7 (1.2)	0.580
Police encounters while working*	277 (44.4)	24 (50.0)	253 (43.9)	0.416
Physical and/or sexual workplace violence*	141 (22.6)	20 (41.7)	121 (21.0)	<0.001
Rushed drug use in outdoor space*	321 (51.4)	30 (62.5)	291 (50.5)	0.201
Housing				
Current unstable housing	446 (71.5)	38 (79.2)	408 (70.8)	0.219

All data refer to *n* (%) of participants unless otherwise specified
* In the last 6 months
† In lifetime
‡ Income from all sources, including government allowances

Table 2. Bivariate logistic regression analysis using generalized estimating equations (GEE) for associations between individual and structural factors and non-fatal overdose amongst women sex workers who use drugs in Metro Vancouver, Canada between 2010 and 2017 (*n* = 624)

Characteristic	Odds Ratio (95% CI)	*p* - value
Primary exposures of interest		
Police-related barriers to harm reduction strategies*	1.72 (1.34 – 2.20)	<0.001
Unmet needs for health services*	1.66 (1.18 – 2.34)	0.004
Other individual and structural variables		
Demographics		
Age, per year older	0.99 (0.97 – 1.01)	0.375
Average monthly income, per $1000 CAD*‡	1.02 (1.00 – 1.05)	0.066
Indigenous ancestry	1.22 (0.87 – 1.70)	0.256
Minority gender/sexual orientation†	1.36 (0.98 – 1.89)	0.068
Mental Health Diagnosis°	2.39 (1.63 – 3.51)	<0.001
Substance Use Patterns		
Injection opioid use*	2.87 (2.13 – 3.88)	<0.001
Non-injection opioid use*	1.54 (1.17 – 2.02)	0.002
Injection stimulant use*	2.26 (1.69 – 3.02)	<0.001
Non-injection stimulant use*	0.73 (0.51 – 1.06)	0.095
Provide drugs for intimate partner*	1.39 (1.03 – 1.87)	0.030
Use drugs with intimate partner*	1.13 (0.87 – 1.47)	0.350
Sex work & drug use environment		
*Primary place of service**		
Outdoor/public space (ref)	-	-
Informal indoor	0.94 (0.73 – 1.22)	0.653
Brothel/quasi-brothel	0.17 (0.03 – 1.13)	0.067
N/A no recent sex work	0.87 (0.59 – 1.27)	0.470
Police encounters while working*	1.16 (0.87 – 1.56)	0.312
Physical and/or sexual workplace violence*	2.08 (1.47 – 2.94)	<0.001
Rushed drug use in outdoor space*	1.29 (1.01 – 1.64)	0.040
Housing		
Current unstable housing	1.24 (0.93 – 1.65)	0.140

* Time updated measure using the last six months as a reference
† Combined variable capturing minority gender identity and sexual orientation
° Time updated lifetime measure
‡ Income from all sources, including government allowances

Table 3. Multivariate logistic regression analysis using generalized estimating equation (GEE) for the independent association between *i.* experiencing police-related barriers to harm reduction strategies and *ii*. experiences unmet needs for health services and non-fatal overdose amongst women sex workers who use drugs in Metro Vancouver, Canada between 2010 and 2017 (N=624)

	Adjusted Odds Ratio (95% CI)	*p* - value
Police-related barriers to harm reduction strategies*†*	1.41 (1.06 – 1.87)	0.018
Unmet needs for health services*‡*	1.56 (1.09 – 2.24)	0.016

* Time updated measure using the last six months as a reference
† Adjusted for place of service*, physical/sexual workplace violence*, lifetime mental health diagnosis, use of injection opioids*, use of non-injection opioids*, and use of injection stimulants*
‡ Adjusted for lifetime mental health diagnosis, physical/sexual workplace violence*, and injection opioid use*

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