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Violence, trauma and living with HIV: Longitudinal predictors of initiating crystal methamphetamine injection among sex workers

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ABSTRACT

Background: Despite rapid increases in crystal methamphetamine (CM) use worldwide and established gendered patterns of use, empirical research on CM injection initiation among sex workers is limited. Given the wide range of harms associated with CM, alongside stimulant effects including sexual dis-inhibition and prolonged awakeness, this study aimed to longitudinally investigate socio-structural predictors of initiating CM injection among sex workers in Vancouver, Canada.

Methods: Data (2010–2014) were drawn from a community-based cohort of women sex workers: AESHA (An Evaluation of Sex Workers Health Access). Participants completed bi-annual interviewer-administered questionnaires and HIV/STI testing. Kaplan Meier methods and Cox proportional hazards regression were used to model predictors of CM injection initiation among CM injection-naïve participants.

Results: Of 455 participants eligible at baseline, 14.3% (n = 65) injected CM for the first time over follow-up, with an incidence density of 6.79 per 100 person-years (95% Confidence Interval [CI] 5.30–8.69). In multivariable analysis, injection heroin use (Adjusted Hazard Ratio [AHR] 6.11; 95%CI 3.24–11.52), having an intimate partner who injects drugs (AHR 2.93; 95%CI 1.57–5.46), workplace violence (AHR 2.85; 95%CI 1.74–4.67), HIV seropositivity (AHR 2.69; 95%CI 1.45–5.00), and childhood abuse (AHR 1.86; 95%CI 0.99–3.49) were independently associated with initiating CM injection.

Conclusions: Findings underscore the gendered and social risk environment of CM injection initiation among sex workers. The strong influences of historical/workplace violence, coupled with heroin injection (known to be self-medicating for post-traumatic stress) as a primary risk pathway, emphasize the urgency of increasing access to integrated, trauma-informed addiction treatment and HIV care for marginalized women.

1. Introduction

In recent years, crystal methamphetamine (CM) has become one of the world's most commonly used illicit drugs; global use of amphetamine-type stimulants (ATS), which includes CM, is now second only to cannabis, with growing concern over the impacts of the increasing accessibility and availability of CM in North America and Europe (UNODC, 2015). CM is a potent and more commonly injected form of methamphetamine, and for many, a cheaper alternative to heroin with significant potential for addiction and transmission of HIV and other blood-borne infections (Boddiger, 2005; Mathers et al., 2008). Injection of CM appears to be more common in countries with the crystalline form of the drug (Strathdee and Stockman, 2010), such as Canada, the United States, Australia, New Zealand, Mexico, and a number of countries in Europe and East and South-East Asia (e.g., Germany, Greece, Cambodia, Japan, and Thailand, among others) (Degenhardt et al., 2010; UNODC, 2015).

The evidence remains equivocal regarding elevated risk for HIV among those who inject CM compared to other drugs, with limited evidence documenting rates of HIV among CM injectors from only a few countries (Degenhardt et al., 2010; Marshall and Werb, 2010). CM use has been associated with risky sexual (Rusch et al., 2009; Schwarcz

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et al., 2007) and drug-related behaviors, such as transition from non-injection (e.g., inhalation) to injection drug use (Ahamad et al., 2014; Werb et al., 2013), and increased odds of HIV among key populations, primarily street-involved youth and men who have sex with men (MSM) (Boddiger, 2005; Fairbairn et al., 2007; Strathdee and Stockman, 2010; Uhlmann et al., 2014a,b). A wide range of other health and social harms have been linked to using CM, including homelessness (Feng et al., 2013; Rusch et al., 2009; Shannon et al., 2011; Uhlmann et al., 2014a,b), early age of incarceration (Milloy et al., 2009), and mental health problems (e.g., psychosis, suicide ideation, depression) (Cohen et al., 2007; Marshall and Werb, 2010; Semple et al., 2004).

Unlike other drugs, women may use CM at rates equal to those of men (Cohen et al., 2007), and women who use CM report high levels of social disadvantage, comorbid psychiatric problems (e.g., depression/anxiety), and sexual risk behaviors (Cohen et al., 2007; Lorvick et al., 2006; Semple et al., 2004). Women entering treatment for CM dependence are more likely than men to suffer from depression/anxiety, post-traumatic stress disorder (PTSD) and other psychological effects related to trauma from physical, sexual or emotional abuse (Cohen et al., 2007).

Among the limited available data, there is evidence to suggest that harms associated with CM use are increasing in marginalized street-involved populations (e.g., youth) in Western Canada (Degenhardt et al., 2010; Fast et al., 2014; Wood et al., 2006). In Vancouver, Canada, the use of CM has risen among various injection and non-injection drug-using populations (Wood et al., 2006) and recently, the prevalence of CM injection among adults in Vancouver doubled from 4.9% to 10.5% between 2010 and 2011 (UHRI, 2013). Among street-involved youth, a significant association between smoking crack and subsequent initiation of CM was demonstrated (Uhlmann et al., 2014a,b). Research from Vancouver has estimated that one-quarter (24%) of street-based sex workers used CM in the last six months over a two-year follow-up period (Shannon et al., 2011).

Despite high and increasing levels of CM use in many settings worldwide, there remains a dearth of research on the initiation patterns of CM injection among sex workers. Compared to other drugs, CM is most often linked to sexual motivations for use and may be more prevalent among individuals in the sex industry (Chettiar et al., 2010; Meade et al., 2012; Rusch et al., 2009; Weiser et al., 2006). Qualitative research has elucidated the ways in which CM is used to stay awake and enhance sexual performance and pleasure (Maher et al., 2011) and is perceived by some sex workers as a superior and more modern alternative to heroin (Ho et al., 2013). While CM has been found to have direct effects on sexual desire, it may also lead to impaired judgment and increased likelihood of unprotected sex and syringe-sharing (Fairbairn et al., 2007; Lorvick et al., 2006; Strathdee and Stockman, 2010; Volkow et al., 2007).

Given the wide range of social and health-related harms associated with CM use, alongside stimulant effects including sexual dis-inhibition and prolonged awake-ness, this study aimed to investigate socio-structural predictors of initiating CM injection among women sex workers in Vancouver, Canada. We postulated that experiences of violence would be associated with a higher incidence of CM injection.

2. Methods

2.1. Design and sample

Data were drawn from a community-based, prospective cohort of women sex workers known as AESHA (An Evaluation of Sex Workers Health Access). AESHA was initiated in 2010 and consists of over 900 street and off-street sex workers across Metro Vancouver. A Community Advisory Board of over 15 women's health, sex work and HIV agencies, as well as representatives from health authorities and policy experts, continuously monitors the study.

Participants were recruited using time-location sampling (Stueve et al., 2001), with day and late-night outreach to outdoor sex work locations (i.e., streets, alleyways), indoor sex work venues (i.e., massage parlors, micro-brothels, in-call locations), and online. Working venues were identified and updated through participatory mapping strategies conducted with current and former sex workers. Outreach/nursing teams operating a mobile van reach over 100 sex work venues weekly. Regular contact and encouragement of drop-in to women-only spaces at the research office contributes to an annual retention rate of > 90% for AESHA participants.

Eligibility criteria for participants included cis or trans women, 14 years of age or older, who exchanged sex for money within the last 30 days. Participants completed interviewer-administered questionnaires and voluntary HIV/STI/HCV serology testing by a project nurse at enrollment and biannually. Biolytical INSTI rapid tests were used for HIV screening, with reactive tests confirmed by blood draw for western blot. Urine samples were collected for gonorrhea and chlamydia, and blood was drawn for syphilis, HSV-2 antibody, and HCV. The questionnaires and clinical components were completed at one of two study offices or at a safe location identified by participants. The main interview questionnaire elicits responses related to socio-demographics (e.g., sexual identity, ethnicity, housing), the work environment (e.g., access to services, safety, policing, incarceration), client characteristics (e.g., types/fees of services, condom use), intimate partners (e.g., cohabitation, financial support), experiences of violence (e.g., childhood abuse, exposure to intimate partner and workplace violence), and drug use patterns. The clinical questionnaire relates to overall physical, mental, and emotional health, and HIV testing and treatment experiences to support education, referral, and linkages with care. The study holds ethical approval through Providence Health Care/University of British Columbia Research Ethics Board. All participants receive an honorarium of $40 CAD at each bi-annual visit for their time, expertise and travel.

2.2. Measures

Analyses were restricted to CM injection-naïve participants who completed at least one follow-up visit between January 2010 and February 2014. The outcome of interest was time to initiation of CM injection (i.e., participants who responded 'yes' to a first event of injection CM use in the last six months). Time-fixed variables examined included age (continuous), gender/sexual minority (lesbian, gay, bisexual, trans, or two-spirit), Indigenous ancestry (inclusive of First Nations, Metis, and Inuit), being a migrant/new immigrant worker (versus Canadian born), education (high school or greater), and physical and/or sexual childhood abuse (before age 18). HIV/STI serostatus, homelessness, physical and/or sexual workplace violence (i.e., responded 'yes' to any of 'abducted/kidnapped,' 'forced to have sex without a condom,' 'attempted sexual assault,' 'raped,' 'strangled,' 'physically assaulted/beaten,' 'locked/trapped in a car,' 'thrown out of moving car,' 'assaulted with weapon' by clients; responded 'yes' to 'physically assaulted' or 'coerced into providing sexual favors' by police), primary place to solicit and service clients (e.g., outdoor/public spaces, informal indoor venues, brothels/quasi-brothels), having a male intimate (non-paying) partner who injects drugs, and any injection and non-injection drug use (heroin, crack, cocaine, marijuana, alcohol) were considered time-varying and were updated to reflect their occurrence within the last six months.

2.3. Kaplan-Meier analyses

The cumulative incidence of CM injection was calculated using Kaplan-Meier methods stratified by workplace violence and by participants with or without a history of childhood abuse at baseline. Survival curves were compared using the log-rank test. The date of CM injection initiation was estimated to be the midpoint between the last interview and interview date when CM injection initiation was reported.

Participants who did not initiate CM injection were right-censored at the time of their most recent follow-up visit. Time zero was considered the date of recruitment into the cohort.

2.4. Cox proportional hazards regression analyses

Unadjusted and adjusted hazard ratios (HR and AHR) and 95% confidence intervals (95%CI) for factors associated with CM injection initiation were calculated using Cox proportional hazards regression. All time-updated covariates were based on bi-annual follow-up data. For the final multivariable Cox analysis, a fixed model was built to adjust for all variables significantly correlated with CM injection initiation at $p < 0.05$ in bivariate analyses. Backward model selection was used to determine the final multivariable model with the best overall fit, as indicated by the lowest Akaike information criterion (AIC) value. All statistical analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC, USA), and all p-values are two-sided.

3. Results

CM use was highly prevalent, with 42% (n = 309/744) of the total AESHA cohort reporting ever using non-injection CM and 18% (n = 132/744) reporting ever injecting CM who were thus excluded from this analysis. A total of 455 CM injection-naïve sex workers who completed at least one follow-up visit were eligible for inclusion in the present analysis. Baseline characteristics of participants who initiated CM injection during the study compared to those who did not are displayed in Table 1. Overall, 14% (n = 65) injected CM for the first time over the follow-up period, corresponding to an incidence density of 6.79 (95%CI: 5.30–8.69) per 100 person-years. The median age was 36 years old (interquartile range [IQR] = 29–43) and those who initiated CM injection were a median age 5 years younger (32, IQR = 28–39) than those who did not inject CM (37, IQR = 29–43) (p = 0.013). One quarter (24%; n = 107) of participants identified as a gender or sexual minority and 39% (n = 177) as Indigenous. Overall HIV prevalence was 12% (n = 54), and those who initiated CM injection had a higher prevalence of HIV than those who did not initiate CM injection (25% vs. 10%, $p < 0.001$).

At baseline, 32% (n = 147) of participants had ever used non-injection CM, the majority (64%; n = 291) reported non-injection crack use, and 28% (n = 126) reported injecting heroin in the last six months. More than half (61%; n = 276) of participants reported experiencing physical and/or sexual abuse before the age of 18, and among those who initiated CM injection, 75% experienced childhood abuse compared to 58% among those who did not inject CM (p = 0.006). Overall, 21% (n = 94) experienced recent physical and/or sexual violence from clients and 37% (n = 168) experienced recent police harassment or arrest. Nearly one third (29%; n = 131) were homeless in the last six months and more than half (55%; n = 252) solicited for clients on the streets, with 43% (n = 196) providing services to clients in outdoor/public spaces.

Among those who initiated CM injection during the study period (n = 65), 20% (n = 13) reported first-time use to be via injection, of which 85% (n = 11/13) injected themselves. One third (31%; n = 20) reported using CM for the first time with a friend/acquaintance, and 14% (n = 9) with a boyfriend. The most frequently reported location for using CM in the last six months was the participant's own place (65%; n = 42), followed by outdoors (35%; n = 23), a friend's place (32%; n = 21), a boyfriend's place (20%; n = 13), a client's place (18%; n = 12), and Vancouver's supervised injection site, Insite (18%; n = 12). Approximately 40% (n = 26) reported using CM while working, either indoors (n = 18/26; 69%) or outdoors (n = 15/26; 58%).

After 48 months, the cumulative incidence of CM injection was higher among participants who reported physical and/or sexual workplace violence than those who did not (25.6% vs. 14.1%; $p < 0.01$) (Fig. 1). Similarly, the cumulative incidence of CM injection after follow-up was 21.9% among those who experienced childhood abuse compared with 16.3% among those who did not (p = 0.014) (Fig. 2).

Table 1
Baseline characteristics of sex workers in Vancouver who reported first time injection crystal methamphetamine use over follow-up compared to those who did not (N = 455).

Characteristic	Initiated Crystal Methamphetamine Injection		P value
	Yes (%) (*n* = 65)	No (%) (*n* = 390)	
Age (*med, IQR*)	32 (28–39)	37 (29–43)	0.013
HIV seropositivity†	16 (24.6)	38 (9.7)	< 0.001
STI seropositivity†	13 (20.0)	43 (11.0)	0.063
Canadian-born	62 (95.4)	270 (69.2)	< 0.001
Indigenous ancestry	32 (49.2)	145 (37.2)	0.065
Sexual minority	21 (32.3)	86 (22.1)	0.071
Education, high school or greater	26 (40.0)	205 (52.6)	0.061
Homelessness†	30 (46.2)	101 (25.9)	< 0.001
Coerced into sex work	7 (10.8)	35 (9.0)	0.644
Childhood abuse	49 (75.4)	227 (58.2)	0.006
Physical/sexual violence by clients†	23 (35.4)	71 (18.2)	0.002
Physical/sexual violence by police†	7 (10.8)	15 (3.9)	0.026
Police harassment/arrest†	36 (55.4)	132 (33.9)	< 0.001
Primary place to service clients			
Outdoor/public space†	41 (63.1)	155 (39.7)	
Informal indoor†	19 (29.2)	105 (26.9)	
Formal/managed indoor space†	5 (7.7)	130 (33.3)	< 0.001
Primary place to solicit clients			
Indoor establishment†	2 (3.1)	129 (33.1)	
Street/public†	53 (81.5)	199 (51.0)	
Independent†	10 (15.4)	62 (15.9)	< 0.001
Drug use variables			
Intimate partner injects drugs†	10 (15.4)	26 (6.7)	0.013
Non-injection heroin use†	23 (35.4)	55 (14.1)	< 0.001
Injection heroin use†	36 (55.4)	90 (23.1)	< 0.001
Cocaine use (non-injection)†	17 (26.2)	64 (16.4)	0.057
Cocaine use (injection)†	24 (36.9)	32 (8.2)	< 0.001
Crack use (non-injection)†	60 (92.3)	231 (59.2)	< 0.001
Crack use (injection)†	3 (4.6)	6 (1.5)	0.124
Marijuana use†	31 (47.7)	132 (33.9)	0.031

†Last six months.

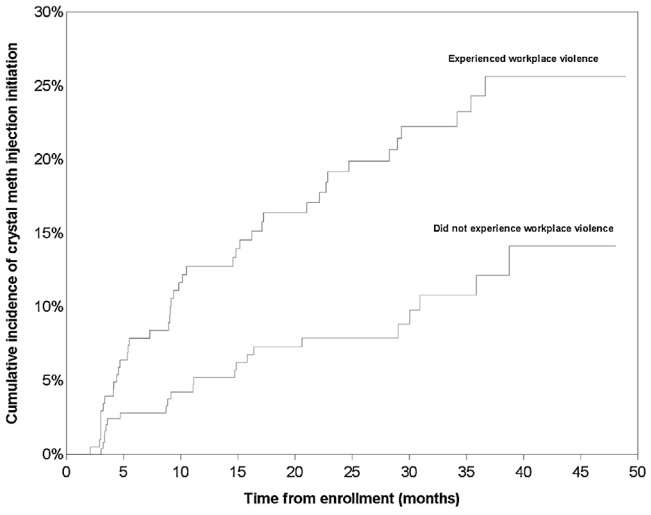

Fig. 1. Time to initiation of crystal methamphetamine (CM) injection by workplace violence experiences.

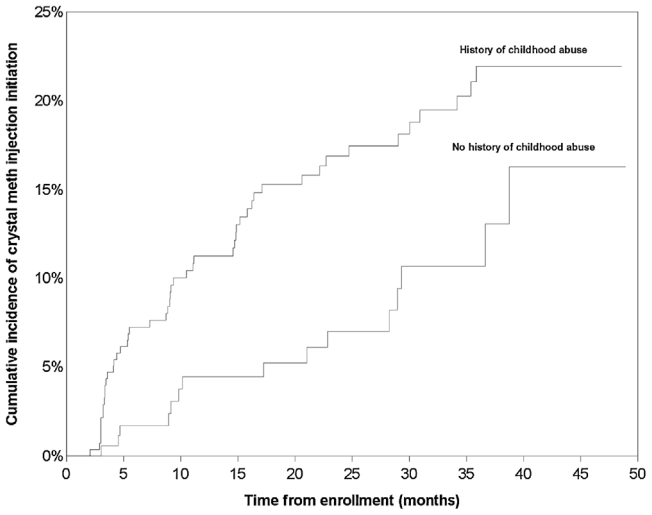

Fig. 2. Time to initiation of crystal methamphetamine (CM) injection by childhood abuse.

Unadjusted and adjusted hazard ratios for factors associated with initiating CM injection over follow-up are reported in Table 2. In the final multivariable model, injection heroin use (AHR 6.11; 95%CI 3.24–11.52), having an intimate partner who injects drugs (AHR 2.93; 95%CI 1.57–5.46), workplace violence (AHR 2.85; 95%CI 1.74–4.67), HIV seropositivity (AHR 2.69; 95%CI 1.45–5.00), and a history of physical and/or sexual childhood abuse (AHR 1.86; 95%CI 0.99–3.49) remained independently associated with time to CM injection initiation. For each year increase in age, the hazard of initiating CM injection decreased by 5% (AHR 0.95; 95%CI 0.92–0.98). In a sub-analysis where non-injection CM use was included, the hazard associated with childhood abuse was smaller and less significant (AHR 1.68; 95%CI 0.89–3.17).

4. Discussion

This prospective study reports on the incidence of and characteristics associated with first-time CM injection among a community-based cohort of women sex workers. Findings demonstrate that injection heroin use, having an intimate partner who injects drugs, HIV seropositivity, workplace and historical physical/sexual violence, and younger age are independently associated with initiating CM injection in this setting.

Current evidence demonstrates that sex workers who inject drugs are at elevated risk for HIV and other blood-borne infections, shaped by dual drug and sexual-risk pathways (Argento et al., 2015; Kerr et al., 2016; Shannon et al., 2011; Strathdee and Stockman, 2010). It has been hypothesized that CM use increases risk for HIV due to a reduced likelihood of using condoms and increased likelihood of engaging in riskier sexual behaviors (Meade et al., 2012; Patterson et al., 2008; Volkow et al., 2007; Zule et al., 2007). Among sex workers in northern Mexico, snorting or smoking CM was associated with three-fold increased odds of HIV infection (Patterson et al., 2008). Multivariable analyses among women who use CM in California found that injecting CM was independently associated with anal sex, > 5 sexual partners, and syringe-sharing (Lorvick et al., 2006). Similar findings were observed among sex workers in Cambodia, with the use of CM/ATS being significantly associated with having more partners and STI infection (Couture et al., 2012). Conversely, previous research did not find significant associations between CM use and enhanced sexual risks (i.e., number of clients, unprotected sex) among sex workers in Vancouver (Shannon et al., 2011).

Global and systematic reviews recite insufficient evidence of elevated risk for HIV among those who inject CM compared to those who inject other drugs (Degenhardt et al., 2010; Marshall and Werb, 2010). Importantly, the present study suggests that the associations between CM injection and HIV infection may be bi-directional. While injecting CM has been linked to heightened risk for HIV and other

Table 2
Unadjusted and adjusted hazard ratios (AHR) for predictors of time to initiating crystal methamphetamine injection among sex workers in Metro Vancouver, 2010–2014 (N = 455).

Characteristic	Unadjusted Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI)	AHR P value
Age (per year older)	0.96 (0.93–0.98)*	0.95 (0.92–0.98)	0.001
HIV seropositivity†	2.49 (1.42–4.37)*	2.69 (1.45–5.00)	0.002
STI seropositivity†	2.38 (1.32–4.31)*		
Canadian-born	6.83 (2.13–21.89)*		
Indigenous ancestry	1.41 (0.86–2.31)		
Sexual minority	1.62 (0.96–2.73)		
Education, high school or greater	0.69 (0.42–1.14)		
Homelessness†	1.86 (1.08–3.22)**	–	
Coerced into sex work	1.08 (0.49–2.36)		
Childhood abuse	2.05 (1.15–3.65)**	1.86 (0.99–3.49)	0.054
Physical/sexual violence by clients†	4.25 (2.56–7.06)*		
Physical/sexual violence by police†	1.50 (0.20–11.44)		
Police harassment/arrest†	2.76 (1.65–4.62)*		
Workplace violence (police, clients)†		2.85 (1.74–4.67)	< 0.001
Primary place to service clients			
Informal indoor (vs. outdoor)†	0.82 (0.49–1.36)		
Brothel (vs. outdoor)†	0.14 (0.04–0.48)*		
Primary place to solicit clients			
Indoor establishment (vs. street)†	0.22 (0.09–0.57)*		
Independent (vs. street)†	0.68 (0.39–1.18)		
Drug use variables			
Intimate partner injects drugs†	5.17 (2.92–9.14)*	2.93 (1.57–5.46)	0.001
Non-injection heroin use†	1.72 (0.90–3.26)		
Injection heroin use†	10.13 (5.59–18.34)*	6.11 (3.24–11.52)	< 0.001
Cocaine use (non-injection)†	2.45 (1.37–4.39)*	–	
Cocaine use (injection)†	10.68 (6.55–17.42)*	–	
Crack use (non-injection)†	5.64 (2.56–12.42)*	–	
Crack use (injection)†	9.15 (4.17–20.07)*	–	
Marijuana use†	2.47 (1.51–4.05)*		

*$p < 0.01$, **$p \leq 0.05$, †Last six months.

blood-borne infections via risky sex (Patterson et al., 2008) and syringe-sharing (Fairbairn et al., 2007; Lorvick et al., 2006; Rusch et al., 2009), our study found an almost three-fold increased hazard of initiating CM injection among sex workers living with HIV, after adjusting for potential confounders. CM use may be a coping mechanism for psychosocial stressors, as using CM (via injection or non-injection routes) can help to alleviate the emotional and psychological stress associated with living with HIV (Boddiger, 2005). This study underscores the complex and potentially bi-directional associations between HIV and CM injection among sex workers, compounded by psychosocial distress, and the critical need to integrate trauma-informed addiction treatment within HIV care.

Sex workers in North America report high levels of violence and childhood abuse, and while data on mental illness were not directly captured in the present analysis, mental illness may be mediating the association between experiences of traumatic events and drug use-related risk behaviors (Argento et al., 2014; Surratt et al., 2012). Historical experiences of violence, as well as indirect violence (i.e., witnessing violence), can contribute to risk by shaping the propensity to use drugs to escape emotional trauma (Romero-Daza et al., 2005). Among female CM users (of whom 22% were sex workers) surveyed in San Diego, 38% reported having a psychiatric disorder, with only 15% reporting current use of psychiatric medication (Semple et al., 2004). A US-based review of women with CM dependence underscores the high prevalence of comorbid mental disorders and history of violence and abuse (Cohen et al., 2007). This study provides temporal evidence for the relationship between sex workers' experiences of violence/abuse and initiation of CM injection. In multivariable analyses, physical/sexual violence independently predicted time to initiation of CM injection, which may imply that sex workers are self-medicating with CM for trauma or mental illness. Ethnographic research among street-involved youth in Vancouver supports this hypothesis, where narratives describe using CM as treatment for both professionally and self-diagnosed mental illness (Fast et al., 2014). A systematic review demonstrated consistent associations between CM use and psychosis and depression among youth (Marshall and Werb, 2010). The association of CM injection initiation with younger age in the present study highlights the vulnerability faced by younger sex workers to HIV and drug-related harms, amplified by the criminalized and stigmatized nature of sex work (Shannon et al., 2015; Uhlmann et al., 2014a,b).

Our findings extend upon prior research demonstrating a significant association between CM use and heroin injection (Shannon et al., 2011), and reveal that recent heroin injection is a strong predictor of subsequent CM injection. Given that heroin is known to be self-medicating for those suffering from PTSD (Tull et al., 2010), sex workers who have experienced violence and other traumatic life events may be self-medicating with injection CM. Higher rates of CM use have been observed among individuals with PTSD than without (Smith et al., 2010), and PTSD has been associated with poorer CM treatment outcomes (Glasner-Edwards et al., 2013).

For sex workers in this setting, injection heroin use preceding CM injection could be attributable to the availability or purity of heroin in Vancouver, or the perception that CM is a better alternative. The global literature highlights sexual motivations for CM use among women, including elevated energy and mood, weight loss, and enhanced sexual desire (Semple et al., 2004; Volkow et al., 2007). Qualitative work in southeast Asia explicates the varied motivations for using CM among women sex worker populations who described increased feelings of confidence, happiness, and euphoria, highlighting the effect of enhanced sexual pleasure and performance (Ho et al., 2013; Maher et al., 2011). CM has been described as a highly functional "power drug" that facilitates a sense of agency and increases strength and endurance, allowing sex workers to see more clients and for longer hours (Maher et al., 2011). Sex workers in this region also report replacing heroin with CM, which they perceive as a more fashionable, less addictive alternative that enables them to perform better at work (Ho et al., 2013).

The present analysis highlights the critical role of having an intimate partner who injects drugs and identifies important, gendered risk factors for injecting CM among sex workers, as well as a key area for intervention. Previous studies indicate that CM use may be closely connected to use with regular clients and non-commercial partners. More than half of women interviewed in northern Mexico reported injecting drugs exclusively with their intimate sexual partners, and when sharing syringes with their male partners women often assume the more subordinate role, injecting after their partner (Firestone Cruz et al., 2007). Research has identified the pervasiveness of male psychological dominance and gender inequality among drug-using couples in the US and its association with increased violence (El-Bassel et al., 2005). Sex workers who used CM in Vancouver have been shown to be more likely to have an intimate partner procure drugs for them (Shannon et al., 2011), and earlier ethnographic work has highlighted the physical and emotional vulnerability of women in unequal power relations, often relying on pimps to obtain drugs (Maher, 1997; Shannon et al., 2008). In Cape Town, South Africa, CM users were more likely than non-users to have experienced various forms of interpersonal violence: close to 50% experienced violence from intimate partners and nearly a quarter experienced childhood abuse (Meade et al., 2012). These findings evidence more nuanced gendered risk for injecting CM, tied closely to psychosocial relationships with sexual partners and experiences of violence and abuse. Given that injection drug use by intimate partners alongside recent heroin injection exemplify key risk pathways to CM injection, future research should seek to include male intimate partners and inform evidence-based interventions that actively involve couples within the context of understanding drug-related risks and harms.

The research and policy implications of our findings point to the critical need for evidence-based interventions that incorporate gender- and couple-focused strategies, integrating harm reduction, violence prevention, and mental health supports within HIV prevention and care for sex workers. Given the role of socio-structural factors in shaping CM injection initiation patterns, future research should address the broader risk environment for sex workers, including the physical and emotional aspects of the work environment, violence and abuse, as well as drug use patterns within sex workers' intimate sexual partnerships. Prior qualitative work has elucidated the importance of increasing access to safer indoor sex work environments, which offer critical protections against victimization and violence by increasing sex workers' capacity to control and negotiate safer transactions (Krüsi et al., 2012). In light of disproportionate trauma and mental health burden (primarily depression, anxiety, and PTSD) experienced by sex workers, alongside the potential for self-medicating with CM or other drugs, insufficient access to mental health and addiction services remains a critical concern. Trauma-informed mental health interventions and integrated HIV and addictions services tailored to sex workers are urgently needed.

4.1. Limitations

Data used in this study were largely self-reported, and the variables examined included sensitive topics such as childhood abuse and highly stigmatized illicit drug use, which introduces the potential for social desirability and reporting bias. However, interviews were conducted in safe and comfortable spaces by experienced interviewers (including current/former sex workers) with strong rapport, and the community-based nature of the study reduces the likelihood of these biases. Questions pertaining to events that occurred within the past six months of the interview may be subject to recall bias. Initiation of CM injection among sex workers may be influenced by complex individual, interpersonal and structural variables not measured in our study (e.g., psychiatric disorders). The study population included women from wide-ranging sex work environments, yet findings may not be fully

generalizable to sex workers in other settings. Although eligibility criteria for participants included sex workers 14 years of age or older, our sample had few participants < 18; therefore, younger sex workers may be underrepresented.

5. Conclusions

This study underscores the gendered and social risk environment of first-time CM injection experiences among women sex workers. Drug use patterns within intimate sexual partners were evidenced to shape initiation of CM injection. The critical roles of workplace and historical violence, coupled with heroin injection (known to be self-medicating for PTSD) as the strongest predictor of initiating CM injection, emphasize the importance of increasing access to evidence-based addiction treatment for key populations both living with and affected by HIV. This study elucidates the urgent need for gender-sensitive and integrated, trauma-informed HIV and addiction services for marginalized women.

Conflict of interest

None.

Role of funding source

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Contributors

Conceived and designed the experiments: EA SAS KS. Performed the experiments and analyzed the data: EA MB KS. Wrote the first draft and integrated suggestions from all authors: EA. Made significant contributions to the interpretation of the data, drafting of the manuscript and approved the final manuscript: EA SAS SG MB JM KS.

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