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Homelessness and incarceration associated with relapse into stimulant and opioid use among youth who are street-involved in Vancouver, Canada

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ABSTRACT

Introduction and Aims: While much research has sought to identify the factors associated with initiation and cessation of various forms of drug use among vulnerable youth, little is known about relapse into drug use in this population. We sought to characterize relapse into stimulant and opioid use among street-involved youth in Vancouver, Canada.

Design and Methods: Data were collected between 2005 and 2017 from the At-Risk Youth Study (ARYS), a prospective cohort study of street-involved youth who use illicit drugs in Vancouver. Multivariable extended Cox regression was utilized to identify factors associated with relapse into harder drug use among youth who had previously ceased using stimulants and/or opioids for six months or longer.

Results: Among 246 participants who reported a period of cessation lasting six months or longer, 165 (67.1%) relapsed at some point during study follow-up. Youth who were recently incarcerated (adjusted hazard ratio [AHR]: 1.47), homeless (AHR: 1.40), or had a history of daily stimulant use (AHR: 1.64) were significantly more likely to report relapse, while youth of who identified as white (AHR: 0.78) were significantly less likely to report relapse (all $p < 0.05$).

Discussion: Relapse into harder drug use was common among youth in our setting, and incarceration, homelessness, and daily stimulant use (pre-cessation) were found to be positively associated with relapse among street-involved youth.

Conclusions: Findings suggest that increased access to youth housing supports and alternatives to the criminalization of drug use may help to reduce the rates of relapse into harder drugs in this population.

Introduction

Amid the ongoing opioid epidemic, reducing the harms associated with opioids and other hard drugs has become a major public health priority in North American settings. People who use drugs (PWUD) are vulnerable to a range of health-related harms including overdose, HIV infection, and Hepatitis C virus (HCV) infection [1,2]. Young PWUD who live or work on the street are particularly vulnerable to these harms, as street-involvement often exposes youth to substandard housing conditions [3], sex work [4], incarceration [5,6], and other types of high-risk and traumatic experiences. These risky environments have resulted in mortality rates approximately eleven times higher among street-involved youth relative to youth of the general population [7–9].

Youth substance use trajectories have been described as fluctuating and dynamic processes that typically include multiple periods of cessation and relapse, and transitions between different forms of drug use [10]. One recent study among the same cohort of youth found that cessation of some forms of high intensity drug use (e.g., injection drug use) may occur while youth continue to use other, less harmful, forms of drugs such as cannabis [11]. This finding suggests that non-abstinence models may be suitable for some, and indeed many countries have accepted managed use as a treatment outcome goal in certain cases [12].

However, most treatment models for substance use disorders are currently centered around abstinence, and relapse is extremely common following treatment.

While the benefits of certain forms of evidence-based treatment are well documented, the average rate of sustained abstinence among adolescents following substance use treatment is estimated to be only 32% at 12 months (though these rates vary depending on the type of substance used) [13]. Among adults who relapse, the risk of fatal overdose is high [14–17]. This highlights the importance of better understanding rates of relapse and, if possible, which groups of youth are most vulnerable to relapse and would benefit from increased access to appropriate treatment and harm reduction services.

Previous research has identified factors associated with initiation into and cessation of various forms of substance use (e.g., alcohol, injection drug use) among at-risk youth, though little is known about relapse into stimulant and opioid use in this population. Further, a large proportion of research on relapse in adolescents and young adults has focused on psychological and developmental risk factors, as opposed to substance use-related and socio-environmental factors. The current study therefore aimed to investigate the prevalence and correlates of relapse into stimulant and opioid use following a period of abstinence in a cohort of youth who are street-involved.

Several frameworks for understanding relapse have been proposed in the literature, with some describing relapse as an outcome and others describing it as a process [18]. The present analysis examined factors within the 'risk environment' [19] that may be associated with relapse, and conceptualized relapse as a return to stimulant and/or opioid use following a period of cessation lasting six months or longer.

Methods

The At-Risk Youth Study (ARYS) is an open prospective cohort study of street-involved youth who use illicit drugs based in Vancouver, Canada. Youth aged 14 to 28 who have used any illicit drug (other than or in addition to cannabis) in the preceding 30 days are eligible for study enrollment. Recruited youth are street-involved at baseline, defined as having been without stable housing or having accessed street-based services in the preceding six months [7,20,21]. Street-based outreach is used to enhance study recruitment both during daytime and nighttime hours in a range of neighbourhoods throughout Vancouver where street youth are known to congregate. Snowball sampling is also used to maximize study enrollment. After providing informed consent, participants complete an interviewer-administered questionnaire at baseline and at six-month follow-up visits. The questionnaire includes items regarding sociodemographic and socioeconomic details, engagement with health and social services, interactions with the criminal justice system, substance use patterns, and other behavioural data. All participants are provided with monetary compensation for their time ($30 CAN). The study is approved by the University of British Columbia and Providence Health Care Research Ethics Board. The ARYS cohort has been described in more detail in previous publications [22].

The study period for this analysis was September 2005 to June 2017. To examine

the potential relationship between substance use-related and socio-environmental factors and subsequent relapse into stimulant and/or opioid use, all participants who had reported a cessation event lasting six months or longer after baseline, in addition to completing at least one follow-up visit following the period of cessation, were included in the present analysis. The primary outcome of interest was relapse into stimulant and/or opioid use, which was defined as responding "yes" to use of any crack cocaine, powder cocaine, heroin, crystal methamphetamine/amphetamine, non-medical prescription opioid use, or synthetic illicit opioids following a report of stimulant and/or opioid use cessation (the period of cessation was defined as responding "no" to the use of all of the same listed drugs). The model presented in this paper considered repeated relapse events (participants could experience relapse multiple times, and each relapse event was considered as a unique observation). We also ran separate models considering only the first observed relapse events (data not presented).

To examine demographic and socio-environmental factors associated with relapse into stimulant and/or opioid use, we *a priori* selected a range of explanatory variables we hypothesized might be associated with relapse including : age [per 10 years older]; gender identity (self-identified at last study visit) [female vs. male]; white race (self-identified) [yes vs. no]; high school completion (or currently enrolled) [yes vs. no]; homelessness in the last six months [yes vs. no]; history of mental illness (ever diagnosed with a mental health issue) [yes vs. no]; history of depression (ever diagnosed with

depression either alone or in addition to another mental health issue) [yes vs. no]; incarceration in the last six months (ever in detention, prison, or jail) [yes vs. no]; hospitalization in the last six months (any hospital admission in the last six months) [yes vs. no]; age of first stimulant and/or opioid use [per year older]; engagement with drug or alcohol treatment (any of: detox, daytox, recovery house, treatment centre, counsellor, NA/CA/AA/SMART, methadone/methadose program, suboxone treatment, onsite treatment, residential community, out-patient treatment, drug treatment court, or other) [yes vs. no]; history of daily opioid use (any daily use of non-injection or injection opioids, including non-medical prescription opioids, during the study period prior to the cessation report) [yes vs. no]; history of daily stimulant use (any daily use of injection or non-injection stimulants during the study period prior to the cessation report); history of injection of 'stimulants and/or opioids' prior to the cessation report (yes vs. no); and number of years of stimulant and/or opioid use (per additional year). To protect against reverse causation whereby reported behaviours were a consequence of stimulant and/or opioid use, the homelessness, incarceration, hospitalization, and drug or alcohol treatment variables were lagged to the previous study visit and were treated as time-updated covariates on the basis of semi-annual follow-up data.

Initially, we examined the descriptive characteristics measured at baseline, stratified by whether participants relapsed into stimulant and/or opioid use at some point during the study. Then, using an extended Cox model with time-dependent variables,

we estimated the unadjusted hazard ratios and 95 % confidence intervals for factors associated with relapse into stimulant and/or opioid use [23]. To fit our multivariable Cox model, we ran a fixed multivariable model where all variables with $p<0.1$ in the bivariate analyses were included into a single model. All statistical analyses were performed using R, version 3.2.4 (R Foundation for Statistical Computing, Vienna, Austria). All *p*-values were two-sided and tests were considered significant at $p<0.05$ level. We also calculated incidence of relapse into stimulant and/or opioid use. This was calculated as the total number of participants who relapsed into stimulant and/or opioid use during the study period divided by the time at risk per 100 person-years (only considered first relapse event).

Results

Between December 2005 and June 2017, of 1385 participants in the ARYS cohort, 1268 (91.6%) reported stimulant and/or opioid use in the last 6 months at baseline. Of those, 351 (27.7%) reported at least one cessation event during follow-up, and among those 253 (72.1%) had at least one follow-up subsequent to the cessation event to assess for stimulant and/or opioid use relapse. Among those, 246 (97%) identified themselves as male or female and were therefore included in the present analysis.

Compared to the analytic sample, participants excluded for insufficient follow-up were less likely to have reported a pre-baseline history of daily stimulant use [cocaine,

crack, crystal meth, or speedball] (12% vs. 54%) or daily opioid use [heroin, speedball, prescription opioids, or other opioids] (5% vs. 33%), defined as any daily use in the six months prior to the baseline visit. Otherwise, those excluded for insufficient follow-up reported similar patterns of drug use to those included in the present analysis. Participants excluded due to insufficient follow-up were also slightly less likely to have reported being homeless in the last six months (25% vs. 34%), but did not differ from the sample in terms of other demographic characteristics. In total, the study sample contributed 987 observations. Among the sample of 246 youth, 73 (30%) identified as female, and the median age was 23.5 years (interquartile range [IQR] = 21.7–25.5). The median number of months of study follow-up was 15.5 (IQR = 7.1–39.8). Further, the median number of study visits was 3 (IQR = 2–5) and the median time between study visits was 6.2 (IQR = 5.7–8.1) months. Over the study period 165 (67%) participants reported at least one relapse event and a total of 212 relapse events were observed for an incidence density of 66.8 cases per 100 person years [95% Confidence Interval (CI): 57.0, 77.8]. The median time to relapse following a period of cessation was 10.1 months (IQR: 6.0–16.6).

Baseline characteristics of the study sample stratified by relapse into hard drug are presented in **Table 1**. **Table 2** shows the unadjusted and adjusted hazards ratios of relapse into stimulant and/or opioid use. Homelessness, incarceration, and daily stimulant use were significantly and positively associated with relapse into stimulant

and/or opioid use in the bivariable Cox regression analyses, while white race was significantly and negatively associated with relapse into stimulant and/or opioid use. These remained significant in multivariable analyses: homelessness [adjusted hazard ratio (AHR): 1.40, 95 % CI: 1.07, 1.83], incarceration [AHR: 1.47, 95 % CI: 1.04, 2.09], daily stimulant use [AHR: 1.64, 95% CI: 1.24, 2.17], and white race [AHR: 0.78, 95 % CI: 0.59, 1.03].

We found no significant differences between the analyses examining repeated relapse events (presented) and those considering the first observed event only (data not presented).

Discussion

To our knowledge, this is the first observational study to longitudinally examine predictors of relapse into stimulant and/or opioid use among a population of street-involved youth. We found that incarceration, homelessness, and daily stimulant use (pre-cessation) predicted relapse. We also observed that relapse was common, with approximately two thirds of participants reporting relapse over a 12-year period.

Our results are consistent with prior studies that have identified associations between homelessness and relapse into crystal methamphetamine and into injection drug use among adults [24–26]. Previous studies have also found that substance use precipitates and exacerbates homelessness – and that drugs are frequently used by youth

to escape from the realities of social marginalization and cope with trauma [27] – lending support to the theory that there may be a chronic and cyclical relationship between homelessness, trauma, and substance use. In addition, one qualitative study examining perspectives on substance use relapse among youth found that housing stress, financial responsibilities, and high availability of drugs in the surrounding environment were commonly reported triggers for relapse [28]. Homelessness has also been associated with engagement in higher risk injection behaviours (e.g., unsafe disposal of drug paraphernalia, public injecting), as individuals using drugs in public spaces are frequently in a rush to inject in order to avoid arrest or confiscation by police [29,30]. The findings from the current study suggest that increasing access to youth housing supports can be expected to help to reduce the rates of relapse into stimulant and/or opioid use among this population of street-involved youth. Supportive housing models have been found to reduce the rates of drug relapse among adults [31]; however, further research is warranted to identify housing models that best support youth through their trajectories of substance use, as adolescent and young adult PWUD may have different housing needs than their adult counterparts.

Our finding that incarceration predicts relapse builds upon previous studies that have examined drug relapse and cessation among PWUD following incarceration [6,32,33]. One study in the same setting found incarceration to be negatively associated with cessation of injection drug use among adults [6]. Previous studies have found lack

of social support, inadequate economic resources, high levels of exposure to drug use, stressful life events, and barriers to addiction treatment to be potential pathways between incarceration and relapse [32–35]. There is also evidence that placing at-risk youth in close proximity to each other (e.g., through incarceration) can reinforce problematic behaviour and elevate the risk of adverse health outcomes [36]. Incarceration of PWUD on drug-related charges remains a prevalent law enforcement strategy for deterring drug use and lowering the supply and demand for drugs [6]. This is especially true for youth: in 2013, incarcerated individuals aged 18 to 24 in Canada had double the rate of drug-related offences compared to those aged 25 to 34 [37]. Further, these charges often involve possession and not necessarily trafficking or production, with nearly 80% of completed drug-related cases among youth involving possession charges in 2013 [37]. However, there is little scientific backing for the use of the criminal justice system as a deterrence strategy, and there is mounting evidence of drug-related harms, such as increased risk of overdose and HIV infection, both while incarcerated and post-release [6,33,38,39]. Together, this evidence highlights the harm of criminalizing substance use and the need to reduce the reliance on the criminal justice system to address substance use disorders.

Further, our study found that a history of stimulant use – but not opioid use – predicted relapse, suggesting that those who have previously used stimulants are at increased risk of relapse and should receive additional attention within treatment

settings. It may also suggest the dominance of opioid-related vs. stimulant-related treatment options in this setting. Previous studies using data from the same cohort have found high rates of crystal methamphetamine use [40], and have found crystal methamphetamine to predict initiation into injection drug use [41]. Further, several studies have found crystal methamphetamine and crack cocaine use to be associated with each other [40,42,43]. The cheap and easy access to crystal methamphetamine has been suggested to be a driver in the high rates of usage in this population [44,45].

It is also worth noting that our study did not identify a negative relationship between drug and alcohol treatment and future relapse, highlighting that, as in many other jurisdictions, Vancouver does not have a functioning system of accessible and effective youth substance use treatment services. The current study also found that a number of youth relapsed multiple times, contributing to our understanding of youth substance use trajectories as fluctuating and dynamic processes [10].

Our study has limitations. First, as with other studies of street-involved youth, the ARYS cohort is not a random sample and therefore the findings may not generalize to other street populations. Second, this study included self-reported information that is susceptible to recall bias and socially desirable responding, and drug use behaviours tend to be underreported. However, we have no reason to suspect that any independent variables, including homeless and incarceration, would be reported differentially according to relapse status. Third, as with any non-randomized study, the associations

found between the independent variables and relapse into stimulant and/or opioid use could be influence by unmeasured confounders. Finally, because our definition of 'relapse' included any use of stimulants and/or opioids following a period of cessation, we did not differentiate between those who relapsed into higher intensity stimulant and/or opioid use (e.g., daily use of injection drugs) and those who relapsed into lower intensity stimulant and/or opioid use (e.g., weekly use of cocaine). Therefore, we were unable to determine whether youth were relapsing into more harmful or less harmful forms of substance use.

Our findings highlight the importance of environmental factors in influencing the course of substance use trajectories among youth. In particular, our findings call attention to the urgency of increasing access to appropriate housing models among youth who use illicit drugs, as well the unsuitability of the criminal justice system as a deterrence strategy for substance use. In addition, increasing supports for those who have a history of incarceration may help to reduce the rates of relapse into stimulant and/or opioid use among this population of youth. Further, those who have a history of stimulant use may benefit from additional evidence-based policy and programmatic efforts to reduce the rates of relapse. Future research is needed to examine how socio-environmental factors can be modified to reduce the rates of relapse among those most at risk and promote transitions into less harmful forms of substance use among those who are unable or

unwilling to abstain. Future research is also warranted to examine the factors that contribute to the higher rates of relapse among those who use stimulants.

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TABLE 1. Baseline characteristics of 246 street-involved youth who ceased stimulants and/or opioids for 6 months or longer, stratified by whether or not participants relapsed into stimulant and/or opioid use over study follow-up.

Characteristic[a]	Total (%) (*n* = 246)	Relapsed into stimulants and/or opioids during follow-up		Odds Ratio (95% CI)
		Yes (%) (*n* = 165)	No (%) (*n* = 81)	
Demographic				
Age (median, IQR)[b]	23.5 (21.7-25.5)	23.9 (22.0-25.5)	23.0 (21.3-25.4)	1.05 (0.96 - 1.15)
Female[c]	73 (29.7)	45 (27.3)	28 (34.6)	0.71 (0.40 - 1.26)
White	171 (69.5)	107 (64.8)	64 (79.0)	0.46 (0.24 - 0.87)
High school education	83 (33.7)	57 (34.5)	26 (32.1)	1.12 (0.63 - 1.97)
Homelessness[d]	93 (37.8)	66 (40.0)	27 (33.3)	1.33 (0.76 - 2.33)
Social and environmental				
History of mental illness	154 (62.6)	105 (63.6)	49 (60.5)	1.20 (0.69 - 2.08)
History of depression	90 (36.6)	59 (35.8)	31 (38.3)	0.90 (0.52 - 1.56)
Incarceration[d]	32 (13.0)	23 (13.9)	9 (11.1)	1.30 (0.57 - 2.97)
Substance use-related				
History of daily opioid use[d]	82 (33.3)	52 (31.5)	30 (37.0)	0.78 (0.45 - 1.37)
History of daily stimulant use[d]	132 (53.7)	93 (56.4)	39 (48.1)	1.39 (0.82 - 2.37)
History of hard drug injection	89 (36.2)	58 (35.2)	31 (38.3)	0.87 (0.50 - 1.52)
Number of years of stimulant and/or opioid use[e]	7.3 (5.3-9.7)	7.3 (5.2-9.9)	7.4 (5.5-9.0)	1.03 (0.95 - 1.11)
Age at first stimulant and/or opioid use[e]	16 (14.0-17.5)	16 (14.0-17.3)	16 (14.3-17.5)	1.00 (0.91-1.09)
Drug or alcohol treatment[d]	87 (35.4)	59 (35.8)	28 (34.6)	1.05 (0.6 - 1.84)

CI = Confidence Interval; IQR = Interquartile range

[a]Yes vs. no, except for age-related variables

[b] Odds ratios calculated per ten years older

[c]Self-identified

[d]During the six months preceding study enrollment

[e] Odds ratios calculated per additional year/year older

TABLE 2. Unadjusted and adjusted hazard ratios (HRs) for factors associated with hard drug relapse (repeated events) among street-involved youth (n=246).

Characteristic[a]	Hazard Ratios (HR)		*p*-value
	Unadjusted HR (95% CI)	Adjusted HR[b] (95% CI)	
Demographic			
Age (per 10 years older)	1.21 (0.78-1.86)		
Female[c]	0.83 (0.60-1.14)		
White[c]	0.73 (0.56-0.95)	0.78 (0.59-1.03)	0.082
High school completion	0.93 (0.71-1.22)		
Homelessness[d,e]	1.43 (1.10-1.85)	1.40 (1.07-1.83)	**0.014**
Social and environmental			
History of mental illness	1.11 (0.83-1.49)		
History of depression	0.98 (0.75-1.28)		
Incarceration[d,e]	1.64 (1.16-2.31)	1.47 (1.04-2.09)	**0.030**
Substance use-related			
History of daily opioid use[e,f]	0.76 (0.57-1.01)	0.75 (0.56-1.00)	0.054
History of daily stimulant use[e,f]	1.58 (1.20-2.08)	1.64 (1.24-2.17)	**0.001**
History of hard drug injection	1.04 (0.78-1.39)		
Number years of stimulant and/or opioid use (per additional year)	1.02 (0.98-1.06)		
Age at first stimulant and/or opioid use (per year older)	0.98 (0.94-1.03)		
Drug or alcohol treatment[e,f]	1.21 (0.91-1.62)		

CI = confidence interval; HR = hazard ratio

[a]Yes vs. no, except for age-related variables

[b]Variables with p<0.1 in bivariate model were selected for inclusion in multivariate model

[c]Self-identified (used most recent reported gender identity)

[d]Lagged by one study visit

[e]Refers to exposure in previous 6 months

[f]Any reported use during the study period, pre-cessation