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Drug use patterns predict risk of non-fatal overdose among street-involved youth in a Canadian setting

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ABSTRACT

Background: Non-fatal drug overdose is a major cause of morbidity among people who use drugs, although few studies have examined this risk among street-involved youth. We sought to determine the risk factors associated with non-fatal overdose among Canadian street-involved youth who reported illicit drug use.
Methods: Using data from a prospective cohort of street-involved youth in Vancouver, Canada, we identified youth without a history of overdose and employed Cox regression analyses to determine factors associated with time to non-fatal overdose between September 2005 and May 2012.
Results: Among 615 participants, 98 (15.9%) reported a non-fatal overdose event during follow-up, resulting in an incidence density of 7.67 cases per 100 person-years. In multivariate Cox regression analyses, binge drug use (adjusted hazard ratio [AHR] = 1.85; 95% confidence interval [CI] = 1.20–2.84), non-injection crystal methamphetamine use (AHR = 1.70; 95% CI = 1.12–2.58), non-injection prescription opiate use (AHR = 2.56; 95% CI = 1.36–4.82), injection prescription opiate use (AHR = 2.49; 95% CI = 1.40–4.45) and injection heroin use (AHR = 1.85; 95% CI = 1.14–3.00) were positively associated with time to non-fatal overdose. Social, behavioural and demographic factors were not significantly associated with time to non-fatal overdose event.
Conclusions: Rates of non-fatal overdose were high among street-involved youth. Drug use patterns, in particular prescription opiate use, were associated with overdose. These findings underscore the importance of addiction treatment and prevention efforts aimed at reducing the risk of overdose among youth.

1. Introduction

Individuals who use illicit drugs face considerable risk of accidental overdose, and drug overdose mortality has emerged as a leading cause of accidental death in North America (Kerr et al., 2007; Pollini et al., 2006; Sergeev et al., 2003). Non-fatal drug overdose is also associated with significant morbidity related to physical injuries, aspiration pneumonia, renal failure, and hypoxic brain injury (Warner-Smith et al., 2002).

Among adults, drug use characteristics such as heroin injecting (Fairbairn et al., 2008) and polysubstance use (Davidson et al., 2003) have been found to be important predictors of non-fatal overdose. Concurrent use of sedatives such as alcohol and benzodiazepines are also associated with increased likelihood of overdose (Darke et al., 1996; Dietze et al., 2005), and heavy alcohol use has been linked to an increased risk of mortality in this context (Hser et al., 2001).

Unfortunately, much of the research focused on identifying risk factors for non-fatal drug overdose has examined adult populations (Fairbairn et al., 2008; Kerr et al., 2007; Seal et al., 2001), and risk factors for non-fatal overdose among street-involved youth have not been as well described. This is despite an association between younger age and increased risk of overdose (Coffin et al., 2007; Fairbairn et al., 2008; Seal et al., 2001). The majority of research studies concerning youth drug overdose have examined heroin use (Sergeev et al., 2003; Sherman et al., 2007), and few longitudinal studies have investigated the influence of prescription drug misuse (Silva et al., 2013). This gap in research is of concern, since drug overdoses have been identified as an important cause of

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preventable death among street-involved youth (Roy et al., 2004) and are increasing in prevalence (White et al., 2011; Fischer et al., 2014).

Although drug overdose among street-involved youth is a growing epidemic in North America (Boivin et al., 2005), few prospective studies have examined risk factors for overdose among this population. Therefore, the present longitudinal study was conducted to characterize the risk factors associated with non-fatal overdose among a cohort of street-involved youth in a Canadian setting where a range of different illicit drugs are commonly used.

2. Material and methods

The present study employed data from the At-Risk Youth Study (ARYS), a prospective cohort study of street-involved youth aged 14 and 26 years living in Vancouver, Canada (Wood et al., 2006). Cohort participants are recruited through extensive street-based outreach, various community services, and self-referral, using a combination of snowball and convenience sampling. Efforts to ensure a representative sample included outreach in a range of neighbourhoods, during the day and night-time, with attempts also made to have participants recruit their peers.

To be eligible for inclusion, participants need to be between 14 and 26 years old at the time of enrollment, report using an illicit drug other than or in addition to marijuana in the 30 days prior to enrollment, and be 'street-involved' defined as having been temporarily or absolutely without housing in the preceding six months, or having accessed street-based youth services during that time. All participants provide written informed consent prior to joining the study.

At baseline and semi-annual follow-up visits, participants complete an interviewer–administered questionnaire that inquires about demographic and socio-economic information, and drug use behaviours. At each study visit participants receive a $20 CAD (Canadian Dollars) honorarium. The study has had ethics approval by the University of British Columbia/Providence Health Care Ethics Review Board.

Data were collected from participant interviews conducted between September 2005 and May 2012. The outcome of interest was defined as the self-report of at least one incident of non-fatal drug overdose in the past six month period. Specifically, we asked participants "In the last six months, have you ever overdosed by accident (i.e. where you had a negative reaction from using too much drugs)?"

A number of variables were explored as potential predictors of non-fatal overdose in our study. Demographic variables included: age (per year older), gender (male vs. female), and ethnicity (Caucasian vs. other). Behavioural variables included: assisted injection, defined as having received manual assistance with the injection process from another individual (yes vs. no); public injection, defined as injecting in city streets, parks and alleys (yes vs. no); rushed public injection, defined as feeling rushed when injecting drugs in public areas (yes vs. no). Given that safer injection education may involve overdose prevention messaging and information about reversal methods, we considered whether participants had ever been taught safer injection techniques by a health care provider (yes vs. no). Social variables included: engagement in sex work, defined as having exchanged money, gifts, drugs or something else of value for sex (yes vs. no); police encounters, defined as recently having been stopped, searched or questioned by police (yes vs. no); homelessness, defined as having no fixed address, sleeping on the street, couch surfing, or staying in a shelter or hostel (yes vs. no); and residence in the 'Downtown Eastside' (DTES), which is Vancouver's drug use epicenter (yes vs. no) (Kerr et al., 2003). Drug use variables that were explored included: heavy alcohol use (based on National Institute on Alcohol Abuse and Alcoholism definitions for males [more than 4 drinks per day or more than 14 drinks per week] and females [more than 3 drinks per day or more than 7 drinks per week]) (yes vs. no) (National Institute on Alcohol Abuse and Alcoholism (NIAAA), 2015); non-injection crystal methamphetamine use (yes vs. no); crystal methamphetamine injection (yes vs. no); non-injection heroin use (yes vs. no); heroin injection (yes vs. no); non-injection prescription opiate use (yes vs. no); prescription opiate injection (both prescription opiate use variables included illicit methadone, morphine, oxycodone, Dilaudid [hydromorphone], Percocet [acetaminophen and oxycodone], Demerol [meperidine], fentanyl, Vicodin [hydrocodone] Talwin (pentazocine), and Tylenol 3 [codeine]) (yes vs. no); crack cocaine smoking (yes vs. no); non-injection cocaine use, defined as any intranasal use (yes vs. no); and cocaine injection (yes vs. no). We also included a measure of binge drug use; specifically, we asked participants, "In the past six months, did you go on runs or binges (that is, when you used non-injection/injection drugs more than usual)?" (yes vs. no).

All behavioural, social and drug use variables refer to activities in the previous six months, with the exception of being taught safer injection practices, which referred to education occurring "ever".

To assess factors associated with time to first overdose event during the study period, all ARYS participants who had completed at least one follow-up questionnaire and had not reported an overdose incident in the past six months at baseline were included in the analysis. The time to first overdose event was defined as the time interval between recruitment into the cohort and estimated date of this non-fatal overdose. Persons who never reported an overdose during follow-up were right-censored at the interview date of their last study visit.

Baseline characteristics of study participants were stratified according to gender, given past studies have shown gender differences in overdose patterns (Coffin et al., 2007; Werb et al., 2008). The counting process framework was used for applying the bivariate and multivariate Cox regression in this analysis. For the multivariate Cox analyses, variables being significant at $p < 0.05$ in the bivariate Cox analyses were considered. The Akaike Information Criterion (AIC) model building approach for variable selection was used to select the best multivariate model, as indicated by the lowest AIC value (Shtatland et al., 2001).

All statistical analyses were performed using the SAS software version 9.3 (SAS Institute Inc., Cary, NC). All p values are two-sided.

3. Results

Between September, 2005 and May, 2012, 1019 street-involved youth were recruited into the ARYS cohort. Of the 1019 street youths recruited, 615 (60.4%) did not report a recent non-fatal overdose event at enrollment and had returned for at least one follow-up visit. Of the 615 participants, 421 (68.5%) were male, 403 (65.5%) reported being Caucasian, and the median age was 21 years (interquartile range [IQR] = 20–23). Compared to the 404 individuals who were not eligible for the primary analysis, the study sample of 615 participants were less likely to be Caucasian (65.5% vs. 72.3%, $p = 0.026$). There were no significant differences in age and gender.

Table 1 presents baseline characteristics stratified by gender. Over study follow-up, a total of 98 (15.9%) of these participants reported at least one incident of non-fatal overdose, resulting in an incidence density of 7.67 cases (95% confidence interval [CI] = 6.15–9.19) per 100 person-years.

Table 2 presents the results of the bivariate and multivariate Cox regression analyses. In multivariate analysis, factors that were significantly associated with time to non-fatal overdose during the study period included: binge drug use (adjusted hazard ratio