



# The impact of engagement in street-based income generation activities on stimulant drug use cessation among people who inject drugs



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## ABSTRACT

**Background:** Despite the growing prevalence of illicit stimulant drug use internationally, and the widespread involvement of people who inject drugs (IDU) within street-based drug markets, little is known about the impact of different types of street-based income generation activities on the cessation of stimulant use among IDU.

**Methods:** Data were derived from an open prospective cohort of IDU in Vancouver, Canada. We used Kaplan–Meier methods and Cox proportional hazards regression to examine the effect of different types of street-based income generation activities (e.g., sex work, drug dealing, and scavenging) on time to cessation of stimulant use.

**Results:** Between December, 2005 and November, 2012, 887 IDU who use stimulant drugs (cocaine, crack cocaine, or crystal methamphetamine) were prospectively followed-up for a median duration of 47 months. In Kaplan–Meier analyses, compared to those who did not engage in street-based income generation activities, participants who reported sex work, drug dealing, scavenging, or more than one of these activities were significantly less likely to report stimulant drug use cessation (all  $p < 0.001$ ). When considered as time-updated variables and adjusted for potential confounders in a multivariable model, each type of street-based income generation activity remained significantly associated with a slower time to stimulant drug cessation (all  $p < 0.005$ ).

**Conclusions:** Our findings highlight the urgent need for strategies to address stimulant dependence, including novel pharmacotherapies. Also important, structural interventions, such as low-threshold employment opportunities, availability of supportive housing, legal reforms regarding drug use, and evidence-based approaches that reduce harm among IDU are urgently required.

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## 1. Introduction

Stimulant misuse has been associated with various health and social harms, including the transmission of infectious diseases and violence. For instance, syringe sharing, a well-known risk for HIV transmission, is common among people who inject cocaine and crystal methamphetamine (Fairbairn et al., 2007; Lloyd-Smith et al., 2009; Tyndall et al., 2003). Crack cocaine smoking has also been

shown to be an independent risk factor for HIV infection (DeBeck et al., 2009; Edlin et al., 1994; Strathdee and Stockman, 2010). Furthermore, prior studies have demonstrated that the relationship between crack cocaine and sex work increases the likelihood of exploitation and violence among sex workers, including being pressured into unprotected sexual intercourse (Shannon and Csete, 2010; Shannon et al., 2009). There is also a growing body of research that has found an interdependent relationship between crack cocaine markets, drug dealing and violent crimes (e.g., homicide) in North American settings (Baumer et al., 1998; Blumstein and Rosenfeld, 1998).

Many individuals who use illicit drugs engage in various street-based income generating activities to support their ongoing drug use and basic living needs (DeBeck et al., 2007). These activities

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often include sex work, drug dealing, street-based scavenging and other activities that carry significant risk for severe violence and other health-related harms (Booth et al., 1993; Braitstein et al., 2003; Parker and Bottomley, 1996; Schneider, 2013; Shannon and Csete, 2010). It is well known that illicit drug dependence plays an important role in contributing to an increased reliance on various street-based income generation activities as a means of generating money to buy drugs (Deering et al., 2013; Maher and Curtis, 1992). However, there is also evidence to suggest that some individuals engaged in the street-based economy become increasingly dependent on illicit drugs as a way to cope with the difficulties and demands of their work (Draus et al., 2010; Erickson et al., 2000; Yahne et al., 2002).

Despite the extensive literature documenting the various harms associated with stimulant drug use among people who inject drugs (IDU) engaged in street-based income generation activities (Baumer et al., 1998; Fairbairn et al., 2008; Maher and Curtis, 1992), and the increasing prevalence of stimulant drug use among these individuals (DeBeck et al., 2011a; Fischer et al., 2006; Werb et al., 2010), the conditions surrounding stimulant drug use cessation are not yet fully understood. Given the growing calls for the identification of social and structural drivers of drug-related harms (Rhodes, 2002, 2009; Strathdee et al., 2010), the present study was conducted to investigate the impact of different types of street-based income generation activities (e.g., sex work, drug dealing, and scavenging) on stimulant drug use cessation in Vancouver, Canada.

## 2. Methods

Data for this study were obtained from the Vancouver Injection Drug Users Study (VIDUS), which is an open prospective cohort that began enrolling IDU through street outreach and self-referral in May, 1996. This study has been described in detail previously (Wood et al., 2001). Briefly, participants are eligible to enroll in the study if they meet the following entry criteria at recruitment: (1) reside in the Greater Vancouver Regional District; (2) have injected illicit drugs in the previous month; and (3) provide written informed consent. At enrollment and on a semi-annual basis, participants complete an interviewer-administered questionnaire and provide a blood sample for serologic testing. Participants received a stipend (\$20 CDN) for each study visit. The study has received ethics approval from St. Paul's Hospital/University of British Columbia's Research Ethics Board. The present study was conducted between December, 2005 and November, 2012.

For the present analysis, we restricted our sample to participants who reported recent injection or non-injection illicit stimulant drugs (in the last six months) at the time of the baseline interview, and who had at least one subsequent study visit to assess for stimulant drug use cessation. Individuals who initiated stimulant drug use during follow-up were included from the point of initiation of stimulant use and followed forward. Only periods of active use were included in the analyses. Illicit stimulant drugs included: cocaine, crack cocaine, and crystal methamphetamine. Individuals who did not use stimulant drugs at baseline but who initiated stimulant drug use during follow-up were included from the next follow-up interview forward. Consistent with previous analyses focused on the cessation of drug use (DeBeck et al., 2011b), the primary outcome of interest was time to first stimulant drug use cessation during the study period, defined as the first instance of a period of at least six months without any episodes of self-reported stimulant drug use administered by either injection or non-injection. The primary independent variable of interest, engagement in street-based income generation activities, was categorically defined as: (1) none; (2) sex work only; (3) drug dealing only; (4) scavenging only; and (5) engagement in more than one of these activities. 'Sex work' was defined as having exchanged sex for any of the following: money, gifts, food, shelter, clothes, drugs, and favors. 'Drug dealing' was defined as having sold illicit drugs. 'Scavenging' was defined as reporting either recycling (i.e., binning or buying/selling recycled products), squeegeeing (i.e., washing car windows), or panhandling (i.e., soliciting donations on the street) as a source of income. These activities all referred to the six-month period prior to the follow-up interview and therefore, income generation categories are dynamic and can change over time. This categorical variable was measured longitudinally at each follow-up and was included in analyses as a time-updated measure. To estimate the independent relationship between engagement in street-based income generation activities and time to first stimulant drug use cessation, we considered secondary explanatory variables that may potentially confound this relationship. Variables included: age (dichotomized at the median) (Evans et al., 2009); gender (female vs. male; Lejuez et al., 2007); White race (yes vs. no; Falck et al., 2007); year of enrolment (per year increase); HCV serostatus (positive vs. negative); homelessness, defined as living on the street or having no fixed address (yes vs. no; Cox et al., 2014; Mehta et al., 2012); binge drug use, defined

as having used injection or non-injection drugs more than usual (yes vs. no; White and Bates, 1995); daily injection or non-injection heroin use (yes vs. no; Werb et al., 2013); daily injection or non-injection prescription opioid use, including Dilaudid (hydromorphone), morphine, oxycodone, illicit methadone (yes vs. no; Evans et al., 2009); incarceration, defined as having been in detention, prison, or jail overnight or longer (yes vs. no; Mehta et al., 2012); drug addiction treatment (detoxification programs and/or behavioral therapies [e.g., a detoxification program, recovery house, residential addiction treatment center, or engaging with an addiction counselor or participating in peer support programs] vs. methadone maintenance therapy (MMT) vs. both vs. none; DeBeck et al., 2011b; Werb et al., 2013). All non-invariant variables are time-updated and refer to the six-month period prior to the follow-up interview unless otherwise indicated.

As an initial step, we compared selected characteristics among participants who reported no engagement in any street-based income generating activity; those who reported one of sex work, drug dealing, or scavenging; and those who reported engaging in more than one of these activities. Using Kaplan–Meier methods, we estimated the cumulative incidence of stimulant drug use cessation separately for each type of street-based income generation activity at baseline. Cumulative incidence of cessation among participants reporting no engagement in street-based income generation activities; those reporting sex work, drug dealing, or scavenging; and those engaging in more than one of these activities were compared using the log-rank test. As a next step, using Cox proportional hazards regression analyses, unadjusted and adjusted hazard ratios were calculated to assess the independent effect of engagement in different types of street-based income generation activities on time to stimulant drug use cessation. To fit the multivariable confounding model, we employed a conservative stepwise variable selection approach (Maldonado and Greenland, 1993). Specifically, we included all variables (where  $p < 0.05$  in bivariable analyses) in a multivariable model and used a stepwise approach to fit a series of reduced models. After comparing the value of the coefficient associated with the main independent variable of interest in the full model to the value of this coefficient in each of the reduced models, we dropped the secondary covariate associated with the smallest relative change in the main independent variable. We continued this iterative process until the minimum change exceeded 5%. Remaining variables were included as confounders in our final model. All statistical analyses were performed using SAS software version 9.2 (SAS Institute, Inc., Cary, NC).

## 3. Results

Of the 887 participants who met the inclusion criteria, 294 (33.1%) were female and the median age at baseline was 41 years (interquartile range [IQR] = 35–47 years). Over the study period, the participants contributed 39,393 person-months of follow-up, and the median duration of follow-up among the study sample was 47 months (IQR = 19–69 months). Over the study period, 377 (42.5%) participants reported a stimulant drug use cessation event. In total, 566 (63.8%) and 810 (91.3%) reported using injection and non-injection stimulant drugs in the 6 months prior to their baseline interview, respectively. Table 1 provides baseline descriptive characteristics stratified by type of street-based income generation activity. Among the study participants at baseline, 75 (8.5%) reported sex work only, 201 (22.7%) reported drug dealing only, 152 (17.1%) reported scavenging only, 136 (15.3%) reported more than one of these activities, and 323 (36.4%) reported none of these activities.

The Kaplan–Meier analysis of time to first stimulant drug use cessation stratified by type of street-based income generation activity at baseline is shown in Fig. 1. By the end of the study period, there was a significant difference in cumulative incidence of first stimulant drug cessation among the different types of street-based income generation activities (log-rank:  $p < 0.001$ ). At four years of follow-up, the cumulative incidence of first stimulant drug cessation was 39.9% among IDU who reported no engagement in street-based income generation activities (95% confidence interval [CI]: 34.5–45.8%), 26.5% among those who reported sex work only (95%CI: 17.1–39.7%), 39.7% among those who reported drug dealing only (95%CI: 32.6–47.7%), 29.9% among those who reported scavenging only (95%CI: 22.8–38.5%), and 19.4% among those who were engaged in more than one activity type (95%CI: 13.2–28.0%).

The results of the Cox proportional hazards regression analyses examining the associations between the various types of street-based income generation activities and time to first stimulant drug use cessation are shown in Table 2. In multivariable Cox

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