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Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Neighborhood of residence and risk of initiation into injection drug use among street-involved youth in a Canadian setting

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ARTICLE INFO

Article history:

Received 22 May 2012

Received in revised form 12 March 2013

Accepted 13 March 2013

Available online 12 April 2013

Keywords:

Initiation

Injection drug use

Street-involved youth

At Risk Youth Study

Vancouver

Downtown Eastside

ABSTRACT

Background: While research has suggested that exposure to environments where drug use is prevalent may be a key determinant of drug-related risk, little is known regarding the impact of such exposure on the initiation of illicit injection drug use. We assessed whether neighborhood of residence predicted rates of injecting initiation among a cohort of street-involved youth in Vancouver, British Columbia.

Methods: We followed street-involved injecting naïve youth aged 14–26 and compared rates of injecting initiation between youth residing in Vancouver's Downtown Eastside (DTES) neighborhood (the site of a large street-based illicit drug market) to those living in other parts of the city. Univariate and multivariate Cox regression analyses were employed to determine whether residence in the DTES was independently associated with increased risk of initiation of injection drug use.

Results: Between September, 2005 and November, 2011, 422 injection-naïve individuals were followed, among whom 77 initiated injecting for an incidence density of injecting of 10.3 (95% confidence interval [CI] 5.0–18.8) per 100 person years. In a multivariate model, residence in the DTES was independently associated with initiating injection drug use (adjusted hazard ratio [AHR]=2.16, 95% CI: 1.33–3.52, $p=0.002$).

Conclusions: These results suggest neighborhood of residence affects the risk of initiation into injection drug use among street-involved youth. The development of prevention interventions should target high-risk neighborhoods where risk of initiating into injecting drug use may be greatest.

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1. Introduction

Injection drug use is associated with heightened overdose risk (Coffin et al., 2003; Garfield and Drucker, 2001), and risk of contracting blood-borne infectious diseases such as human immunodeficiency virus (HIV) and hepatitis C (HCV; Garfein et al., 1996; Tyndall et al., 2001), as well as a host of negative social and personal outcomes such as sex trade involvement, drug overdose, and subjective feelings of marginalization (Kerr et al., 2009; Ochoa et al., 2005; Rhodes et al., 2007). Street-involved youth, defined as adolescents and young adults who spend extensive time on the street, are a population at particularly high risk of initiating injection drug use (Clements et al., 1997; Kral et al., 1997; Fuller et al., 2001; Lifson and Halcon, 2001), and preventing this transition to

injecting has recently been identified as a critical public health priority (Robertson et al., 2003; Beyrer et al., 2010).

Vancouver's Downtown Eastside (DTES) neighborhood is the poorest urban neighborhood in Canada and the site of a well described open, street-based illicit drug market (Wood et al., 2004) where powder cocaine injection, crack cocaine smoking, and heroin injection are common (Fast et al., 2010). Previous work has identified residence in the DTES as an independent predictor of HIV infection among a cohort of adult injection drug users (IDU; Maas et al., 2007). However, there is a dearth of quantitative research examining the impact of exposure to specific drug use environments on the initiation of injection drug use. Existing research suggests that exposure to people who inject drugs and environments where injecting is common increases the risk of transition to injecting (Roy et al., 2003, 2011; Abelson et al., 2006; Neaigus et al., 2006; Koram et al., 2011). Research has also found that current IDU who move out of urban areas report less frequent cocaine and heroin injection compared to those who remain in such areas (Rachlis et al., 2010). This study therefore sought to determine whether neighborhood of residence is an

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independent predictor of initiation of injection drug use among a cohort of street-involved youth living in Vancouver, British Columbia.

2. Methods

The present study employed data from the At-Risk Youth Study (ARYS), an open prospective cohort study of street-involved youth aged between 14 and 26 years from Vancouver, Canada (Wood et al., 2006). Street-involved youth were defined as those who spend a large proportion of their time on the street. ARYS participants were recruited through extensive street-based outreach and self-referral, using a combination of snowball and convenience sampling methods. While many of the youth in our sample are homeless, others report living in single room occupancy hotels, hostels, and apartments. To be eligible for inclusion, participants have to be between 14 and 26 years old at the time of enrolment and report using an illicit drug other than or in addition to marijuana in the 30 days prior to recruitment. All study participants provide written consent prior to enrolment.

At baseline and semi-annual follow-up visits participants complete an interviewer-administered questionnaire that solicits detailed demographic data as well as data on housing situations and drug use behaviors. All interviews were conducted by ARYS staff trained in survey administration. Interviewers all receive background training to ensure trust and rapport are developed with participants as well as to ensure confidentiality. At each study visit participants receive a \$20 CAD honorarium. A number of strategies were put in effect to address the health and social needs of youth identified during study visits, including referrals to local health programs, social services, and housing programs. The study has been approved by the University of British Columbia/Providence Health Care Ethics Review Board.

Data were collected from participant interviews conducted between September, 2005 and November, 2011. The sample was restricted to all ARYS participants who reported not ever injecting drugs at baseline and who completed at least one follow-up questionnaire. The outcome of interest was defined as the first report of injection drug use. The primary independent variable of interest was neighborhood of residence (DTES vs. Other). The DTES is a concentrated lower income neighborhood which borders Vancouver's business district and busy tourist areas (Wood et al., 2006). It is characterized by low-income housing, including single room occupancy hotels, and a large subpopulation of highly dependent drug users engaging in both non-injection and injection drug use. The measure of neighborhood of residence for this study was based on self-reported area of residence in the past six months. For participants who were homeless or unstably housed, residence was defined as the area where they reported spending the majority of their time. A time-updated report of residence was used in the survival analysis.

Potential confounders identified in previous research were included in the analysis (Fuller et al., 2001, 2005; Roy et al., 2003, 2011). These included: age, gender, ethnicity (Caucasian vs. others), alcohol use, marijuana use, non-injection powder cocaine use, non-injection crack cocaine use, non-injection crystal methamphetamine use, and non-injection heroin use. Further, we included a variable measuring drug use frequency, defined as daily non-injection use of any cocaine, crack, crystal methamphetamine, or heroin. All behavioral variables refer to behaviors in the previous 6 months, with all time-updated behavioral variables lagged to previously completed questionnaires in order to protect against reverse causality. Incidence of injection drug use was calculated as the total number of subjects who initiated injecting during the study period divided by the total time at risk per 100 person-years.

We investigated the differences in baseline characteristics of street-involved youth in the sample using Pearson's Chi-square test for dichotomous variables and the Wilcoxon rank sum test for continuous variables. Next, Kaplan–Meier methods were used to calculate the cumulative incidence of injection initiation. Univariate Cox regression analyses were then conducted to determine the association between neighborhood of residence and the initiation of injection, along with potential confounders. Subsequently, a multivariate Cox regression model was constructed to explore the independent effect of neighborhood of residence on injection while adjusting for potential confounders.

In determining whether neighborhood of residence was independently associated with injection initiation, we accounted for potential confounding by various sociodemographic and drug use variables, and then fit a series of confounding models based *a priori* on an approach described by Greenland and colleagues (Maldonado and Greenland, 1993; Rothman and Greenland, 1998). First, univariate Cox regression analyses were constructed to determine whether the independent variable of interest (DTES residence) and potential confounders were significant predictors of initiation of injection drug use at the univariate level ($p < 0.05$). Second, a multivariate confounding model was constructed that included all potential confounding variables. Then, in a stepwise manner we removed potential confounders individually to construct a series of reduced models. The relative coefficient change for initiation of injection drug use was calculated among these reduced models, and those variables that changed the model coefficient by more than 5% relative to the full model were included in a final multivariate confounding model. Age, gender and ethnicity were forced into the final model.

All tests of significance were two-sided, with a p value of < 0.05 . All statistical analyses were performed using SAS software version 9.2 (SAS Institute Inc., Cary, NC, USA).

3. Results

In total, between September, 2005 and November, 2011, 991 street-involved youth were recruited, among whom 390 (39.3%) reported injecting at baseline. Those who had injected at baseline were more likely to reside in the DTES (odds ratio 1.73; 95% CI 1.31–2.30). Among the 601 individuals who were injecting naïve at baseline, 179 did not have a follow-up visit, and therefore the study sample included 422 street-involved youth who were eligible for the present study. Among this sample, the median age was 22 (interquartile range [IQR] = 20–23) and the median follow-up time was 20.6 months (IQR = 12.6–26.1). Those participants lost to follow-up were found to be significantly younger (20.7 vs. 21.6 years old, $p = 0.003$), more likely to be Caucasian (70.9% vs. 61.1%, $p = 0.022$), and less likely to use non-injection crack cocaine (40.8% vs. 55.9%, $p = 0.001$) compared with those included in the analysis. No significant differences were detected with respect to gender or neighborhood of residence.

Baseline characteristics of the study population stratified by neighborhood of residence are presented in Table 1. The median age of street-involved youth living in the DTES was 22.7 years (IQR = 21.1–24.1), compared with 21.1 years (IQR = 19.0–22.8) among youth living in other areas of Vancouver ($p < 0.001$). At baseline, 48.0% of street-involved youth living in the DTES were of Caucasian background, compared with 65.1% of youth living in other areas of Vancouver ($p = 0.002$). 84.7% of participants living in the DTES reported marijuana use in the past 6 months, compared to 91.7% of those living in other areas ($p = 0.043$). Additionally, 68.4% of youth living in the DTES reported using non-injection crack cocaine in the past 6 months compared with 52.2% of youth living in other areas ($p = 0.005$). Finally, 28.6% of those youth living in the DTES

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