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## Childhood Sexual Abuse and Risk for Initiating Injection Drug Use: A Prospective Cohort Study

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### Abstract

**Objective**—This study examined whether childhood sexual abuse predicts initiation of injection drug use in a prospective cohort of youth.

**Method**—From October 2005 to November 2010, data were collected from the At Risk Youth Study (ARYS), a prospective cohort study of street-involved youth in Vancouver, Canada. Inclusion criteria were age 14–26 years, no lifetime drug injection, and non-injection drug use in the month preceding enrollment. Participants were interviewed at baseline and semiannually thereafter. Cox regression was employed to identify risk factors for initiating injection.

**Results**—Among 395 injection-naïve youth, 81 (20.5%) reported childhood sexual abuse. During a median follow-up of 15.9 months (total follow-up 606.6 person-years), 45 (11.4%) youth initiated injection drug use, resulting in an incidence density of 7.4 per 100 person-years. In univariate analyses, childhood sexual abuse was associated with increased risk of initiating injection (unadjusted hazard ratio [HR], 2.38; 95% confidence interval [CI], 1.29–4.38;  $p=0.006$ ),

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**Contributors:** Drs. Hadland, Werb, Kerr, Montaner and Wood designed the study. Drs Hadland and Wood wrote the protocol. Dr. Hadland conducted the literature review and wrote the first draft of the manuscript. Mr. Fu and Ms. Wang undertook statistical analyses with additional input from Dr. Hadland. All authors contributed to and have approved the final manuscript.

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an effect that persisted in multivariate analysis despite adjustment for gender, age, Aboriginal ancestry and recent non-injection drug use (adjusted HR, 2.71; 95% CI, 1.42–5.20;  $p=0.003$ ).

**Conclusion**—Childhood sexual abuse places drug users at risk for initiating injection. Addiction treatment programs should incorporate services for survivors of childhood maltreatment.

### MeSH terms

child abuse; sexual; drug abuse; adolescent; cohort studies

## 1. Introduction

Injection drug use clearly places individuals at high risk of acquiring potentially fatal blood-borne pathogens such as human immunodeficiency virus (HIV) and hepatitis C virus (HCV), and of experiencing other harms such as overdose (US Public Health Service, 1997; Des Jarlais and Friedman, 1987). The risk for becoming infected is especially high during the period immediately following the initiation of injection (Garfein et al., 1996; Roy et al., 2009). Survey-based studies of drug users have inquired retrospectively about individual and environmental factors associated with injection, revealing a number of factors more common among those who have ever injected compared to those who have not. Such factors include parental substance use (Martinez et al., 1998), familial dysfunction (Martinez et al., 1998), early onset of drug use (Sherman et al., 2005) and other early misconduct (Fuller et al., 2002; Tomas et al., 1990), forced institutionalization (Martinez et al., 1998; Roy et al., 2003), prior use of non-injection crack/cocaine, heroin or methamphetamine (Fuller et al., 2001; Hadland et al., 2010; Irwin et al., 1996; Sherman et al., 2005; Wood et al., 2008), homelessness (Martinez et al., 1998), violent victimization (Fuller et al., 2002), survival sex (Martinez et al., 1998), and high-risk peer networks and neighborhoods (Fuller et al., 2001).

With rare exception (Roy et al., 2003), however, these studies have tended to be limited by cross-sectional design, having recruited participants after they had already initiated injection drug use. Additionally, most of these studies recruited samples consisting predominantly of adult injection drug users (IDU), rather than young people. Conducting large, prospective cohort studies examining injection initiation among adolescents and young adults has proven difficult in many settings due to ethical concerns and difficulty locating and following at-risk youth populations, which in general are ‘hidden’ from traditional population-based sampling methods due to homelessness and extensive street involvement (Farrow et al., 1992). As a result, risk factors for transitioning to injection drug use among young people remain poorly elucidated.

One putative risk factor for initiating drug injection among youth is childhood sexual abuse, which is retrospectively reported by a large proportion of adult IDU (Ompad et al., 2005; Walton et al., 2011) and a well-established correlate of adult substance use in general (Molnar et al., 2001; Rounsaville et al., 1982). Cross-sectional studies of adult drug users suggest an association between lifetime sexual abuse and injection drug use (Cheng et al., 2006), with perhaps greater likelihood of early transition to drug injection during adolescence among those with a history of childhood sexual abuse (Holmes, 1997; Ompad et al., 2005). Prospective data of young adults following into middle adulthood demonstrate that those with a history of childhood maltreatment are more likely to use illicit drugs, to engage in polysubstance use, and to report substance use-related problems (Widom et al., 2006). Still, high quality studies drawing on prospective data from samples of youth are scarce (Roy et al., 2003), and the excess risk for initiating injection drug use conferred by childhood sexual abuse, if any, remains poorly quantified.

Reported prevalence of childhood sexual abuse among drug-using adolescents and young adults is high, with approximately one-third of youth disclosing prior abuse in several samples (Markowitz et al., 2011; Roy et al., 2004; Stoltz et al., 2007). The long-term mental health consequences of childhood sexual abuse are diverse and include depression, anxiety, and post-traumatic stress disorder, some or all of which might in turn predispose to initiating drug injection (Browne and Finkelhor, 1986; Farrugia et al., 2011; Plotzker et al., 2007). Understanding which youth are at risk for transitioning to injection could help inform the allocation of already scarce public health efforts that seek to prevent the harms of injection drug use. In the present study, we hypothesize that history of childhood sexual abuse independently predisposes to initiating injection drug use among youth.

## 2. Methods

### 2.1. Sample

The At Risk Youth Study (ARYS) followed a cohort of street-involved youth in Vancouver, Canada. Inclusion criteria for ARYS included: (1) aged 14 to 26 at the time of enrollment, and (2) use of an illicit drug other than or in addition to marijuana during the 30-day period prior to enrollment. The ARYS cohort relied on snowball sampling, with recruitment conducted in multiple neighborhoods in downtown Vancouver, including at night (Wood et al., 2006).

Following informed consent, all participants completed an extensive baseline interviewer-administered questionnaire pertaining to sociodemographic data, drug use behaviors, and lifetime history of childhood sexual abuse. They were then surveyed and examined for stigmata of injection drug use semiannually thereafter, with youth reporting on drug use patterns and other risk behaviors in the preceding six months. Participants were provided \$20 CAN per visit as remuneration. ARYS was approved by the University of British Columbia/Providence Health Care Research Ethics Board.

From October 2005 to November 2010, 984 participants were recruited into the ARYS cohort, among whom 389 (39.5%) reported a prior history of injection. Those who had previously injected were more likely to be older and to have experienced childhood sexual abuse (both  $p < 0.05$ ), but otherwise did not differ according to gender or Aboriginal ancestry. Of the 595 youth who had not previously injected drugs at baseline, 395 (66.4%) returned for 1 follow-up visit and are included in the incidence analysis of injection drug use. Among the 395 youth included in the incidence analysis, the mean age of participants was 22.2 years (standard deviation [SD] = 2.7 years), and 269 (68.1%) youth were male and 105 (26.6%) were of Aboriginal ancestry. 81 (20.5%) youth reported childhood sexual abuse.

### 2.2. Dependent and independent variables

The primary outcome, or dependent variable, was self-reported initiation of injection drug use in the preceding six months. Participants were asked, "In the last six months have you used a needle to chip, fix or muscle even once? (Yes / No)" The sample in the present analysis was limited to all participants with no prior history of injection drug use at the time of enrollment. The primary independent variable of interest was self-reported history of childhood sexual abuse, based on earlier evidence from a study of street youth conducted elsewhere (Roy et al., 2003). At the baseline interview, participants were asked by a nurse in a separate, private interview in which confidentiality was assured, "Before age 19, how many times were you sexually abused", and participants were grouped into those with and without a prior history of abuse. An array of covariates was also examined, including gender, age (as a continuous variable), Aboriginal ancestry, high school education, self-reported sexual orientation, lifetime homelessness, lifetime incarceration, non-injection drug use in the

preceding six months (including heroin, cocaine, crack, and crystal methamphetamine use), and sex work in the preceding six months.

### 2.3. Statistical analyses

Each of the variables listed above was initially examined in a series of bivariate associations with history of childhood sexual abuse. Next, applying Cox proportional hazards modeling, unadjusted hazard ratios for initiating injection drug use were computed for history of childhood sexual abuse and the other covariates. In addition, an interaction term examining prior sexual abuse according to gender as a risk factor for initiating drug injection was tested, which was not significant (data not shown); therefore, subsequent analyses were not stratified by gender. The final multivariate Cox regression model adjusted for gender, age, Aboriginal ancestry and recent drug use (*i.e.*, non-injection use of heroin, cocaine or crystal methamphetamine in the preceding six months). Recent non-injection drug use was combined into a single variable to ensure parsimony, and a sensitivity analysis was conducted to determine whether this resulted in a different adjusted hazard ratio for the childhood sexual abuse, and it did not. Covariates included in the multivariate model were selected based on results of prior studies (Cheng et al., 2006; Fuller et al., 2001; Hadland et al., 2010; Irwin et al., 1996; Ompad et al., 2005; Sherman et al., 2005; Wood et al., 2008).

We performed all statistical analyses using SAS version 9.1 (SAS Institute, Inc, Cary, North Carolina). Reported *p* values are two-sided and considered significant at  $p < 0.05$ .

## 3. Results

Baseline characteristics of the 395 youth included in the incidence analysis of injection drug use are reported in Table 1 and compared with regard to history of childhood sexual abuse. Those with a history of childhood sexual abuse were more likely to be female (58.0% were female among those with history of childhood sexual abuse *vs.* 25.2% were female among those without history of childhood sexual abuse;  $p < 0.001$ ), to be of Aboriginal ancestry (37.0% *vs.* 23.9%;  $p = 0.017$ ), to identify as gay/lesbian/bisexual (34.6% *vs.* 10.5%;  $p < 0.001$ ), and to have been recently involved in the sex trade (12.4% *vs.* 5.1%;  $p = 0.019$ ). Of note, baseline rates of non-injection drug use did not differ between groups; the prevalence of non-injection heroin use among those with and without a history of childhood sexual abuse were, respectively, 14.8% *vs.* 13.4% ( $p = 0.737$ ); of cocaine, 34.6% *vs.* 36.6% ( $p = 0.731$ ); of crack, 48.2% *vs.* 45.5% ( $p = 0.675$ ); and of crystal methamphetamine, 29.6% *vs.* 29.3% ( $p = 0.954$ ).

During a median follow-up of 15.9 months per participant and a total study follow-up of 606.6 person-years, 45 (11.4%) of the 395 youth initiated injection, resulting in an incidence density of 7.4 per 100 person-years. Table 2 demonstrates crude incidence rates and unadjusted hazard ratios (HR) for select variables with regard to initiation of drug use. Table 3 demonstrates unadjusted and adjusted HR for these same variables, which were included in the multivariate Cox proportional hazards regression model. Of note, the adjusted hazard ratio for childhood sexual abuse was not substantially affected by the combining together of recent non-injection drug use into a single variable; in a sensitivity analysis, when drugs were included as separate variables, the adjusted hazard ratio for childhood sexual abuse was 2.65 (95% CI, 1.37– 5.11;  $p = 0.004$ ).

Figure 1 shows the cumulative incidence of initiating injection drug use according to history of childhood sexual abuse during follow-up (log-rank test,  $p < 0.001$ ).

## 4. Discussion

In this large, prospective cohort of adolescents and young adults, we observed that childhood sexual abuse placed youth at two to three times greater risk of initiating injection drug use. Notably, history of childhood sexual abuse was highly prevalent in our sample, with more than one-fifth of all participants reporting having been abused. We did not, however, observe any difference in risk for initiating drug injection between males and females according to history of childhood sexual abuse, a finding consistent with prior evidence that abuse may have equally damaging long-term effects for both genders (Dube et al., 2005).

Our results are consistent with prior cross-sectional data highlighting an association between prior sexual abuse and injection drug use among adults (Cheng et al., 2006). Indeed, adult IDU with a history of childhood sexual abuse frequently report transitioning to injection earlier (including during adolescence) than those without such a history (Holmes, 1997; Ompad et al., 2005). However, one of the only other prospective studies of youth injection initiation to date did not demonstrate increased risk for injection drug use among survivors of sexual abuse, although this study did not differentiate abuse during childhood from abuse later in life (Roy et al., 2003).

The pathways leading from childhood sexual abuse to risky drug use behaviors are likely to include a complex series of intermediate and more proximal factors (Ompad et al., 2005). Indeed, the factors may even differ among youth subpopulations, with heavily street-involved youth like those sampled in this study initiating injection drug use within an environment of homelessness, poverty, heavy non-injection drug use, and other important factors that may differ substantially from the environment in which other youth initiate injection drug use. Considered together, adverse childhood experiences – including sexual abuse, in addition to physical and emotional abuse/neglect, parental drug or alcohol abuse, parental incarceration, parental mental illness, domestic violence, or absence of one or both parents – have been correlated with a number of negative long-term outcomes, including subsequent alcohol use (Dube et al., 2006), illicit drug use (Dube et al., 2003), teen pregnancy (Hillis et al., 2004), and attempted suicide (Dube et al., 2001; Hadland et al., 2011), with depressive symptoms mediating many of these relationships. It is therefore possible that mental illness may indeed be a crucial intermediate in the pathway leading from childhood sexual abuse to later initiation of injection drug use. Complicating matters, childhood sexual abuse is often experienced as part of a ‘cluster’ of adverse childhood experiences, such as physical or emotional abuse/neglect, witnessing domestic violence, parental marital discord, or having a parent who is substance abusing, mentally ill, or criminally involved (Dong et al., 2003), all of which may have various contributions to risk. Future studies should therefore carefully examine the contribution of these various factors to initiating drug injection.

There are some limitations to the present study. First, our study recruitment employed extensive street-based outreach with snowball sampling. This method does not produce a truly random sample (Wood et al., 2006). However, the characteristics of our cohort are similar to those of other at-risk youth in western Canada (Miller et al., 2006; Ochnio et al., 2001). Also, because the sample was street-involved, they may not be fully representative of the general adolescent population at large. Second, our study relied heavily on self-report. Given that questions probed highly sensitive personal data, our results may have been affected by social desirability bias despite efforts to assure confidentiality (Briere, 1992). Recall bias may have also affected our results, particularly if those with heavier drug use patterns were more likely to recall a history of childhood sexual abuse (Widom et al., 1999). Finally, as outlined earlier, although our results show a strong relationship between

childhood sexual abuse and initiating drug injection, our findings do not indicate which factors might be intermediates in this pathway.

## 5. Conclusion

In summary, we conclude that childhood sexual abuse is associated with substantially increased risk of initiating injection drug use among at-risk youth. These results highlight the dual need for programs that seek to prevent childhood maltreatment as well as those that mitigate the downstream consequences of sexual abuse during adolescence and young adulthood (Kerr et al., 2009). Indeed, adverse childhood experiences such as sexual abuse are likely to predispose to a range of risk behaviors and adverse health outcomes in adolescence and early adulthood that extend well beyond injection drug use (Anda et al., 2008; Chapman et al., 2004; Dube et al., 2005; Dube et al., 2003), and survivors of childhood abuse should remain a focus of research, policy and advocacy. A small body of evidence shows promise for home visit programs as well as population-level parenting education for preventing childhood abuse and neglect, while a reduction in adverse mental health outcomes has been demonstrated for sexually abused children with symptoms of post-traumatic stress disorder (MacMillan et al., 2009). Further developing these programs and ensuring wider implementation among at-risk youth may serve an important role in reducing injection drug use and its associated harms.

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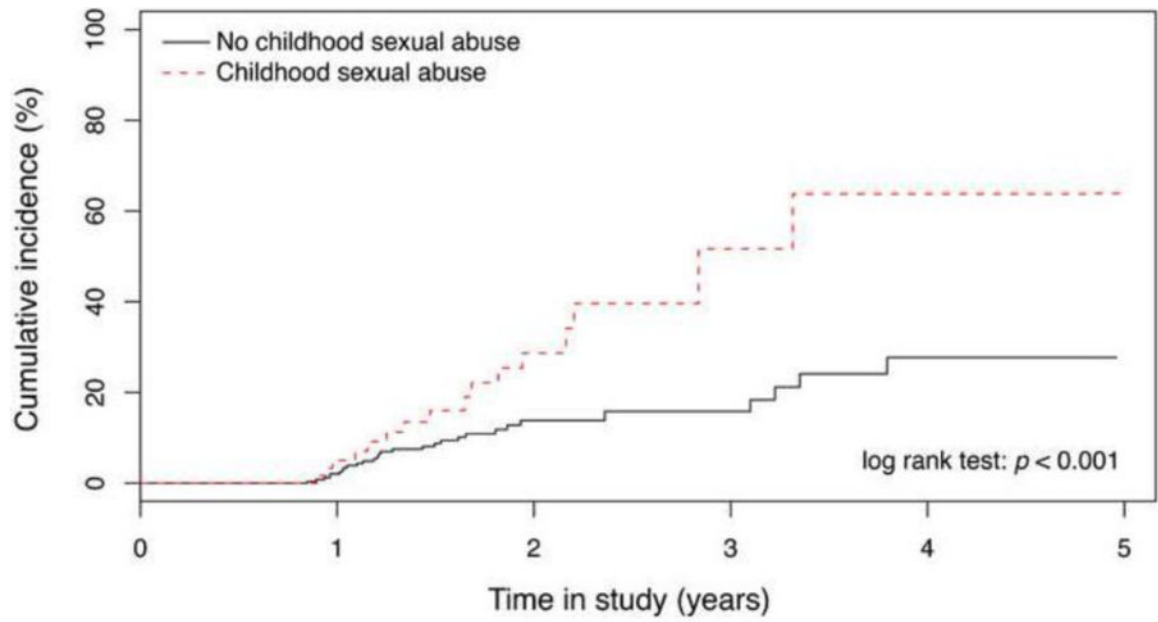
### Highlights

- We examine whether childhood sexual abuse predicts injection drug use
- We follow a prospective cohort of youth in Vancouver, Canada
- More than one-fifth of youth report childhood sexual abuse
- Abuse independently predicts risk for initiation of injection drug use
- Addiction treatment should incorporate services for survivors of childhood abuse

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**Figure 1.** Cumulative incidence of initiation of injection drug among youth in Vancouver, Canada, 2005-2010 ( $n = 395$ ).

**Table 1**

Baseline characteristics of injection-naïve youth according to history of childhood sexual abuse in Vancouver, Canada, 2005-2010 ( $n = 395$ ).

Characteristic	Total (%) ( $n = 395$ )	Childhood Sexual Abuse		<i>p</i> Value
		No (%) ( $n = 314$ )	Yes (%) ( $n = 81$ )	
<b>Sociodemographic factors</b>				
Female gender	126 (31.9)	79 (25.2)	47 (58.0)	<0.001
Mean age (SD)	22.2 (2.7)	22.2 (2.8)	22.4 (2.8)	0.415
Aboriginal ancestry	105 (26.6)	75 (23.9)	30 (37.0)	0.017
High school education <sup>a</sup>	194 (49.1)	160 (51.0)	34 (42.0)	0.150
Gay/lesbian/bisexual	61 (15.4)	33 (10.5)	28 (34.6)	<0.001
Ever homeless	231 (58.5)	179 (57.0)	52 (64.2)	0.242
Ever incarcerated	295 (74.7)	241 (76.6)	54 (66.7)	0.063
<b>Drug use-related behaviors</b>				
Non-injection heroin use <sup>b</sup>	54 (13.7)	42 (13.4)	12 (14.8)	0.737
Non-injection cocaine use <sup>b</sup>	143 (36.2)	115 (36.6)	28 (34.6)	0.731
Non-injection crack use <sup>b</sup>	182 (46.1)	143 (45.5)	39 (48.2)	0.675
Non-injection crystal methamphetamine use <sup>b</sup>	116 (29.4)	92 (29.3)	24 (29.6)	0.954
Mean age first drug use (SD)	14.3 (2.6)	14.4 (2.4)	13.9 (3.3)	0.898
<b>Sexual abuse history</b>				
Sex work <sup>b</sup>	26 (6.6)	16 (5.1)	10 (12.4)	0.019

<sup>a</sup>Prior completion of or current enrollment in high school

<sup>b</sup>Denotes behavior in the preceding six months

**Table 2**

Crude incidence densities and unadjusted hazard ratios (HR) for factors related to initiation of injection drug use among youth in Vancouver, Canada, 2005-2010 ( $n = 395$ ).

Characteristic	Number of new injectors	Rate, per 100 person-years	HR (95% CI)	<i>p</i> Value
<b>Gender</b>				
Female	14	2.4	1.03 (0.55 – 1.92)	0.930
Male	31	2.4	<i>Reference</i>	
<b>Age<sup>a</sup></b>				
< 22 years	24	5.9	1.96 (1.09 – 3.52)	0.025
≥ 22 years	21	3.0	<i>Reference</i>	
<b>Aboriginal ancestry</b>				
Yes	14	2.9	1.16 (0.62 – 2.19)	0.637
No	31	2.3	<i>Reference</i>	
<b>Recent non-injection drug use<sup>b</sup></b>				
Yes	41	6.2	2.63 (0.92 – 7.47)	0.023
No	4	2.3	<i>Reference</i>	
<b>Childhood sexual abuse</b>				
Yes	16	4.4	2.38 (1.29 – 4.38)	0.006
No	29	1.9	<i>Reference</i>	

<sup>a</sup>Included as dichotomous variable with median split for ease of interpretation (though treated as continuous variable in final multivariate model)

<sup>b</sup>Denotes non-injection use of heroin, cocaine or crystal methamphetamine in the preceding six months

**Table 3**

Unadjusted and adjusted hazard ratios (HR) for factors related to initiation of injection drug use among youth in Vancouver, Canada, 2005-2010 ( $n = 395$ ).

Characteristic	Unadjusted HR (95% CI)	<i>p</i> Value	Adjusted HR (95% CI)	<i>p</i> Value
Female gender	1.03 (0.55 – 1.92)	0.764	0.66 (0.32 – 1.35)	0.256
Age (per year younger)	1.14 (1.03 – 1.26)	0.010	1.11 (0.98 – 1.25)	0.088
Aboriginal ancestry	1.16 (0.62 – 2.19)	0.382	1.32 (0.67 – 2.59)	0.424
Recent non-injection drug use <sup>a</sup>	2.63 (0.92 – 7.47)	0.070	2.67 (0.92 – 7.70)	0.070
Childhood sexual abuse	2.38 (1.29 – 4.38)	0.006	2.71 (1.42 – 5.20)	0.003

<sup>a</sup>Denotes non-injection use of heroin, cocaine or crystal methamphetamine in the preceding six months