ABSTRACT

Research Problem: Young injection drug users (IDUs) may be at elevated risk for blood-borne infection, however there is a dearth of longitudinal data regarding factors that influence drug-related harms in this population.

Methods: This study was an interdisciplinary exploration of drug-related harm among young (≤29 years) IDUs in Vancouver, BC, undertaken through the VIDUS, a prospective cohort that began in 1996. Over 1500 participants have been enrolled and followed, among whom over 550 were aged ≤29 years. Participants were eligible for an interview semiannually and have undergone serologic testing for HIV and HCV antibodies. In addition to the longitudinal survey data, 28 participants (aged ≤29 years) consented to an in-depth interview.

Results: Cumulative incidence rates for HIV and HCV among young participants were 11.1% and 52.1% respectively at 36 months after enrollment in the study. In total, 38% of the young IDUs initiated injection drug use in early adolescence (≤16 years) and those who did were more likely to be: HIV and HCV-seropositive, female, sex workers, binge drug users and incarcerated. Younger (≤29 years [N=582]) and older (≥30 years [N=1016]) IDUs were compared in multivariable analyses and younger age was associated with: female sex, homelessness, incarceration, sex work, borrowing syringes, ≥ 1 daily injection of heroin, cocaine, and speedballs and being less likely to access drug treatment or MMT. In quantitative and qualitative analyses examining associations between younger age and frequent heroin injection, data revealed numerous sex and drug-related vulnerabilities among younger IDUs associated with heroin dependency, initiation and withdrawal. 22 young IDUs died during the study period for a crude mortality rate of 1,368 per 100,000 person-years. Young female IDUs
were 54.1 times (95% CI; 29.6-90.8) and young male IDUs 12.9 times (95% CI; 5.5, 25.3) more likely to die compared to the Canadian non-IDU population of the same age.

Findings: Younger IDUs demonstrated unique and elevated risk patterns as compared to older IDUs, including elevated use of injection heroin and lower uptake of available treatment. Young IDUs, particularly females, require targeted and 'youth-friendly' interventions including the development of substitution therapies, drug treatment, injection initiation prevention and harm reduction education services.
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**CHAPTER 4**

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I would sincerely like to acknowledge and thank the VIDUS participants who have come to share parts of their lives and stories with the study staff and me. I truly hope the information compiled in this study contributes positively to their lives. I also want to acknowledge the hard work, dedication and deep level of empathy of the VIDUS staff for the participants with whom they work with. In particular, thank you, Caitlin, for answering questions and helping me organize my data collection. I am honoured and extremely fortunate to have had the opportunity to undertake this project with the VIDUS participants, researchers, staff and community advisory board.

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I would also like to gratefully acknowledge the financial support of the Canadian Institutes of Health Research, the Michael Smith Foundation for Health Research and the BC Centre for Excellence in HIV/AIDS.
CO-AUTHORSHIP STATEMENT

Chapter two consists of summaries of several manuscripts that have been published in international, peer-reviewed journals. The candidate is the lead author on all of the summaries regarding younger injection drug users in the VIDUS cohort included in chapter two.

Chapters three to six are stand-alone manuscripts that have either been published or submitted or will be submitted shortly to peer-reviewed journals. The candidate is the lead author on all these manuscripts.

This statement is to certify that the candidate was the major contributor to all of the studies inception, design and interpretation. The candidate also wrote the manuscripts and conducted revisions as requested by peer-reviewers.

The primary co-authors of these manuscripts include committee members (Drs. Evan Wood, Patricia Spittal, and Jim Frankish) as well as work supervisor and the principal investigator of the VIDUS project Dr. Thomas Kerr. VIDUS statistician, Kathy Li provided statistical analyses and expertise and international collaborator Dr. Steffanie Strathdee provided her expertise in the area of drug use research.
CHAPTER 1

GENERAL INTRODUCTION AND THESIS OBJECTIVES

1.0 Thesis format

In order to share this information broadly and to ensure the quality of the substudies comprising this thesis, it has been prepared according to a manuscript-based format. Thus, the literature review in Chapter Two is partially comprised of summaries of six separate published manuscripts regarding blood-borne infection transmission among younger IDUs in this setting, three of which contributed to the candidate’s MSc thesis and three having been done during work towards the candidate’s PhD. These manuscripts have all been published in peer-reviewed journals including Hepatology, AIDS and Journal of Acquired Immuno-Deficiency Syndromes (JAIDS). Chapter Three, regarding initiation into injection drug use, has been published as a brief report in the Journal of Adolescent Health. Chapters Four and Six are undergoing peer review and Chapter Five will be sent out for peer review over the summer of 2006. The candidate is the lead author on all of the above-mentioned manuscripts.

The thesis format conforms with the requirements for a manuscript-based thesis as outlined by the University of British Columbia. As stated in the guidelines, Chapter Two is a relevant literature review. Chapters Three through Six each represent stand-alone manuscripts that have either been published (Chapter Three), are under peer-review (Chapters Four and Six) or are in the final stages of submission (Chapter Five). As requested in the guidelines, the stand-alone manuscripts are put into the chapters without abstracts. The final chapter
discusses and summarizes the overall study results, comments on the implications of the findings, suggests directions for future research and summarizes the limitations. In accordance with the manuscript-based guidelines, references, tables and figures are all at the end of each chapter.

1.1 Project background

This dissertation project comprises an interdisciplinary exploration of injection drug use risk among young (<29 years) people who use injection drugs in Vancouver, BC, Canada. Vancouver is a city where one of the first HIV outbreaks in Canada was documented among injection drug users (IDUs) during the 1990's. Since that time, researchers, people who use injection drugs, activists, lawyers, police, politicians and local health authorities have challenged themselves to respond innovatively to both this incredibly dynamic disease and population. Despite a challenging political environment, influenced to some extent by our neighbour, the United States, Vancouver has implemented some innovative, albeit controversial, measures to help reduce the harms associated with injection drug use. Vancouver is now the first, and only, North American city to have a supervised safe injection facility (SIF) as well as an ongoing heroin maintenance trial that is part of a three-city Canadian trial. These newer initiatives are part of a multifaceted drug strategy that includes the expansion of one of North America's largest needle exchange programs (NEPs), an increase in the distribution of methadone maintenance therapy (MMT) and other drug treatment programs.
1.2 The Vancouver Injection Drug Users Study (VIDUS)

The implementation of these groundbreaking strategies can be attributed to the availability of scientific evidence from around the world, particularly from Vancouver\(^4\), Switzerland\(^7,8\) and Australia\(^9,10\), the tenacity and activism of local injection drug user and community groups\(^11\), the bravery of local politicians and health policy administrators, support from some members of the Vancouver Police Department and the collaboration of these individuals and groups with local researchers and academicians. Contributing to the evidence and supporting the movement has been VIDUS, initiated by Dr. Steffanie Strathdee in 1996 to understand and respond to the HIV outbreak among the city’s IDUs. Since that time, VIDUS researchers have generated some of the world’s leading research on injection drug use and contributed to the development of evidence-based policies towards the improvement in the health of IDUs in Vancouver and worldwide\(^12-16\).

VIDUS has been a leader in research design since it began in 1996. With the active participation of many local community groups from the beginning, the employment of interviewers and nurses with many years experience in working within the IDU community, (including youth workers) and the importance placed on employing staff who were philosophically empathetic to the unique environmental challenges posed by injection drug use. This study has collectively responded, in a cutting-edge fashion, to emerging epidemics and policy and programmatic needs of the local IDU population. In addition, and important to this project has been the ability of the study staff to recruit and follow this dynamic population and specifically their ability to recruit younger IDUs. Early on, in recognition of the importance of the young IDU population, the VIDUS was granted ethical approval to interview emancipated minors (\(\leq 14\) years) (*please see appendix 1). These youth are often hidden and hard to reach due to fear of discovery by parents, extended family, pimps, peers,
social workers and/or police\textsuperscript{17-20}. However, VIDUS staff and the overall study design have taken care to protect the confidentiality of the participants and retention rates are high, VIDUS participants represent approximately one third of the estimated number of IDUs living in Vancouver, Canada. VIDUS staff have conducted interviews, not only at the study site located conveniently in the hub of Vancouver's IDU community, but also in jails, participants' homes and treatment centres when requested. The VIDUS is a well-known and respected resource in the community where young and older participants often drop by for coffee, conversation or to share news.

From an operational perspective, VIDUS is a prospective cohort study of IDUs who have been recruited through self-referral and street outreach from Vancouver's Downtown Eastside (DTES) since May 1996. The Downtown Eastside is Vancouver's poorest urban neighborhood in which an estimated 4,700 IDUs and 1,000 street youth reside in an area of approximately ten city blocks, and where inexpensive housing in the form of single room hotel occupancies (SROs) are abundant\textsuperscript{21}. Persons were eligible for this study if they were aged 14 years and older, had injected illicit drugs at least once in the previous month confirmed by inspection of track marks, and resided in the Greater Vancouver region\textsuperscript{22}. At baseline and semi-annually, subjects provided venous blood samples and completed an interviewer-administered questionnaire. All participants provided informed consent and were given a stipend ($20 CDN) at each study visit as compensation for their time. The study has been approved by the University of British Columbia's Research Ethics Board (*please see appendix 1).
1.3 The study site setting

Vancouver, BC has been the site of explosive HCV and HIV epidemics among IDUs, particularly those living or working in the Downtown Eastside (DTES). To give a sense of what the DTES community composition is, in 1991 the median household income was $8,748 compared to $34,174 for Greater Vancouver; the population was estimated to be 4,956; and in 1999 the injection drug-using population was estimated to be approximately 4700. Numerical accuracy aside, clearly the proportion of the DTES population that uses injection drugs is high. Youth living in the DTES are exposed to high rates of poverty, injection drug use and HCV and HIV infection.

To give a broader sense of the setting and some relevant situational factors about where this study takes place, Vancouver, Canada, differs from many American and other Canadian cities in terms of local drug policy. As noted above, Vancouver is the only Canadian city to have a safe injection facility (SIF), a testimony to the collective activity of local community members, researchers and politicians. Vancouver also has a highly concentrated visible population of IDUs in one central location known as the DTES. The DTES is an area in which a combination of historical and situational factors such as close proximity to a major international port, a long history of drug and sex work availability, the concentration of bars and strip clubs, low income housing and resource allocation have concentrated many of the city’s IDUs into one small area.

1.4 The instrument

VIDUS is in its 10th year of collecting data, and thus a vast data set has been compiled since May of 1996. The majority of participants (over 1100 [approximately 73%]) were
enrolled during the years 1996 and 1997, the rest were enrolled from 1998 to 2005. Retention rates are high, with approximately 87% returning for at least one follow-up visit. During the study period, over 300 (approximately 20%) VIDUS participants have died. VIDUS is an open cohort and as such, individuals have been enrolled and followed over time, allowing the continuous collection of data. Therefore, the substudies comprising this thesis may vary in terms of cohort composition and the differences in numbers reflect the available longitudinal data where appropriate. Cohort composition and available data are detailed in each substudy chapter.

Questionnaires elicit sociodemographic and drug and sexual information, as well as information pertaining to addiction treatment access. All participants have completed the baseline questionnaire and data from this is presented in all substudies. Typical sociodemographic variables included in analyses were gender, ethnicity (Aboriginal vs. other), HIV and HCV-positivity, incarceration and homelessness. Aboriginal ethnicity is self-reported and includes First Nations people, Inuit and Métis. Homelessness was defined as sleeping in the street, shelter or squat and incarceration was defined as being in jail or youth detention in the six months previous to the interview. Typical drug and sexual risk variables included in analyses were: history of sexual abuse, sex work, unprotected sexual intercourse, borrowing used syringes, finding it hard to find new syringes, experiencing a non-fatal overdose, binge drug use, greater than once daily crack smoking, greater than once daily injection of heroin, cocaine and/or speedball (a mixture of heroin and cocaine), requiring help to inject, access to methadone maintenance therapy (MMT) and drug treatment (excluding MMT) and having been denied treatment. Sex-work involvement was defined as exchanging sex for money, goods, drugs, or shelter and unprotected sex was defined as vaginal and/or anal intercourse without a condom with regular, casual and/or client partners. Sexual abuse was
defined as ever being forced to have sex against one's will and included childhood sexual abuse. Binge drug use is a common local term referring to an increase in regular use or going on a drug run usually accompanied by several 24-hour periods of heavy drug use\textsuperscript{25}. Help injecting is defined as requiring someone else to inject drugs for the participant. Drug treatment refers to entering treatment other than MMT either in the previous six months at the time of interview or ever and MMT is defined similarly. Deny treatment refers to trying to access any kind of drug treatment but being unable to.

\subsection*{1.5 Qualitative component}

As part of the candidate's commitment to gaining experience with mixed methods research and due to the dearth of information qualifying and exploring drug related harm among young IDUs in this setting, a qualitative component was completed in 2006\textsuperscript{26-28}. Chapter five consists of a mixed methods substudy using the longitudinal data collected through VIDUS and the qualitative data collected by the candidate. Complementary quantitative and qualitative methods were used iteratively in chapter 5 to contribute dual forms of evidence to develop a more detailed understanding of how contextual factors impact on the overall risk environment among young IDUs. Interviews were conducted in the VIDUS office. The majority of interviews were conducted on a drop-in basis during the study sites drop-in hours, however a few were scheduled at the participants' convenience. Participants' identity, including age was checked by the study co-ordinator and anonymity was assured as the interviewer (C. Miller) had access to only the participants' unique identifier code. Participants were approached by the interviewer, provided with detailed information about the study and asked if they would like to participate. Interviews were conducted following
obtaining both oral and written informed consent. An initial interview guide was pilot tested with four young people and modified prior to proceeding with the remaining interviews. Study participants were provided with an honorarium of $20 CDN as compensation for their time. Ethical approval was granted by the ethics boards of both Providence Health Care and the University of British Columbia (*see appendix 2).

Twenty-eight open-ended semi-structured qualitative interviews were conducted with young (≤29 years) VIDUS participants, 13 with male and 15 with female participants who were actively using injection drugs. Efforts were made to ensure that the sample represented young people who were either living in or regularly using injection drugs in Vancouver's Downtown Eastside. The interviews explored four main areas of experience: initiation into injection drug use, sterile syringe acquisition, drug use patterns following initiation and needle sharing vulnerabilities. The interview guide was informed by the survey data and was modified as the interviewing progressed to reflect new topics, investigation of emerging themes and to ensuring the data was triangulated on an ongoing basis. All interviews were tape recorded (permission was gained from the interview subjects prior to recording) and subsequently transcribed verbatim.

1.6 Brief introduction to mixed methods research

During the past 10 to 20 years, we have come to understand prevention and treatment of HIV infection in injection drug using populations as a human rights movement that extends far beyond the prevention of a single disease²⁹,³⁰. In turn the focus on prevention of disease has shifted from behaviour change on an individual level to a more complex and critical analysis of the ways in which social and environmental structures facilitate disease
transmission among marginalized populations\textsuperscript{31,32}. Thus, injection drug use researchers are increasingly expected to take a more ecological approach to understanding disease prevention and treatment\textsuperscript{31,33,34}. More recently innovative research methods are being used to understand individual behaviour across populations from the standpoint of its interconnection with existing social and environmental structures that impact on disease prevention and treatment\textsuperscript{34,35}. Through this more critical understanding we have greatly increased our capacity to work together to use our collective strengths and to provide interdisciplinary evidence to develop, support and implement programs and policies that contribute to the overall health of people who use injection drugs\textsuperscript{36}. Increasingly, injection drug use research projects have employed researchers with interdisciplinary backgrounds. However, experienced researchers in the field have suggested that there is a need for individuals with interdisciplinary skills and knowledge of mixed methods to further advance injection drug use research\textsuperscript{34}. This project aims to draw from interdisciplinary theories and employ mixed methods to provide evidence for policies, programs and community groups working towards improving the health and social environment for young people who are at risk for, or who use injection drugs.

\textit{1.7 Exploratory / descriptive research}

This research is both exploratory and descriptive. While there is evidence to demonstrate that young IDUs are at increased risk for blood-borne infection transmission, the reasons for this phenomenon are poorly understood. This project is a continuation of the work that comprised the candidate's MSc dissertation work (graduation 2002) which explored HIV and hepatitis C (HCV) prevalence and incidence among young people who use injection drugs.
This current dissertation project adds new information regarding individual, social and environmental factors that facilitate vulnerability to drug related harms among young IDUs and contributes new evidence to support existing and new social and structural level interventions towards improving the overall risk environment. This project diverges from the candidate’s MSc dissertation by using an innovative design whereby both epidemiologic and qualitative research methods were used to maximize the opportunities available through the longitudinal VIDUS data and include the voices of experiential young people. By using combined methods, this project contributes new evidence to better understand the relationships between social and environmental context and individual behaviour.

Prior to the research undertaken towards the candidate’s MSc thesis, there was very little research on this population locally or nationally and there was no research on similar populations in Canada that had as large a sample size. This under researched population represents an important age group with respect to blood-borne infections in North America and worldwide\(^{37-40}\). The goal of this work is not to be generalizable to all young IDUs worldwide, but to have relevance for other major urban centres coping with injection drug related harms among their young people. The information in this study is intended to provide evidence for informing current and future public health interventions in order to help reduce drug-related harms among young people.

1.8 The research problem

Youth are of particular importance with respect to HIV and hepatitis C (HCV)\(^{40,41}\), not only because they are at risk for infection but also because it is during this period of life when many behaviour patterns are established that will affect their risk of infection throughout their
adult years\textsuperscript{42-44}. Young people under the age of 30 years comprise the fastest growing population at risk for and living with HIV\textsuperscript{45-47}. Worldwide, young people (≤30 years) account for over half the number of people living with HIV\textsuperscript{38} and in Canada they represent approximately one third overall and over one half among females\textsuperscript{40}. Young people account for the majority of new HCV infections in developed nations\textsuperscript{24,37,48}. In these nations, approximately one quarter of HIV infections and the majority of new HCV infections are directly attributable to injection drug use\textsuperscript{48}. In addition, the indirect transmission of HIV from people who use injection drugs to non-IDUs via sexual contact, is higher among young people, particularly young women as they are biologically more susceptible to becoming HIV infected through sexual contact\textsuperscript{38,44,49}. Among high risk young IDUs, time to HIV infection from the onset of injection drug use is estimated to be between three and five years\textsuperscript{37,50,51} while time to HCV infection is between one and two years\textsuperscript{24,43,32,53}.

Emerging drug patterns have implications for blood-borne disease transmission and prevention among young people, particularly among young IDUs\textsuperscript{23,54,55}. For example, the use of crack cocaine has greatly increased across North America over the past decade and youth who smoke crack cocaine have been shown to be at elevated risk for HCV and HIV\textsuperscript{56-58}. HCV can be transmitted through the equipment used to smoke crack (such as pipes), and also because of problems associated with crack smoking, such as cracked lips\textsuperscript{59,60}. Studies have also shown a relationship between crack use and high-risk sexual behaviour among young people and street youth\textsuperscript{61-64}. There is scant longitudinal information regarding injection and non-injection drug use patterns of high-risk groups such as young IDUs. Specifically very little is known about the particular drugs, poly-drug use and emerging patterns of drug use occurring among young IDUs. Understanding drug use patterns and associated risks is important for the development of appropriate and effective public health interventions.
Blood-borne infections, particularly HIV and HCV are systemically patterned so as to render some young people more likely to become infected than others. Gender, ethnicity, socio-economic status and sexuality have been found to be important factors in structuring vulnerability to infection\textsuperscript{65-67}. Vulnerability to infection is often mediated by complex social factors directly impacting on drug use behaviours and the overall risk environment in which they occur\textsuperscript{68}. Developing effective prevention, treatment and intervention strategies to reduce the risk of infection among vulnerable young people requires a coordinated effort between experiential young people, community, researchers, law enforcement practitioners, and policy makers\textsuperscript{69,70}. It is critical to the success of public health interventions that there is the availability of interdisciplinary evidence that elucidates populations and subpopulations at highest risk, risk factors and information regarding the type of risks occurring and the context in which they occur.

1.9 Thesis objectives

This thesis is divided into seven chapters. The first chapter provides a general introduction to the setting, study project and relevance as well as the objectives of the thesis research. Chapter two is a detailed literature review outlining risk factors for HIV and HCV and other drug related harms among young IDUs and an overview of issues relating to mixed methods approaches. Chapters three to six address the main thesis objectives as outlined below. The final chapter provides a discussion, summary of the research findings and comments on the implications of this thesis work.

The general aim of this thesis is to provide new evidence to inform public health interventions regarding longitudinal risk behaviours and socio-environmental factors
that contribute to drug-related harm among young (<29 years) IDUs. To meet this aim, this thesis consists of a series of substudies regarding target subpopulations of young IDUs at higher risk for drug related harm (Chapters 2 and 3), the examination of longitudinal risk behaviour differences between younger and older IDUs (Chapter 4), a combined quantitative and qualitative exploration of socioenvironmental factors contributing to elevated risk behaviours among injection heroin dependent young people (Chapter 5) and a longitudinal examination of mortality among young IDUs (Chapter 6).

1.9.1 Specific objective one

The first objective of this thesis project was to establish what is known about HIV and HCV infection transmission among young IDUs in Vancouver, BC. To meet this objective, chapter two will summarize the main findings in the candidate's contributions to date, as well as other available information, on blood-borne infection transmission among young IDUs as part of the literature review. Chapter two will also review the literature on other populations of young IDUs in North America and other developed nations. This objective will describe:

1. What subpopulations of young IDUs are at highest risk for blood-borne infection.

2. What sociodemographic, sexual and drug-related factors increase vulnerability to blood-borne infection transmission among young IDUs.
1.9.2 Specific objective two

The second objective is to examine risk factors for initiation into injection drug use and factors relating to initiation and increased risk for blood-borne infection transmission. This second objective will provide the following evidence:

1. What age(s) is important to be targeted by public health interventions to reduce initiation of injection drug use and subsequent harms.

2. What factors are associated with drug related harm following initiation of injection drug use during early adolescence (≤16 years).

1.9.3 Specific objective three

The third objective is to examine longitudinal factors associated with drug-related harm between younger (≤ 29 years) and older (≥ 30 years) IDUs. Objective three will provide the following evidence:

1. Establish if younger IDUs are at increased risk for drug related harm and if this remains true over time.

2. Provide information regarding injection and non-injection drug use patterns over a nine-year period between younger and older IDUs.

3. Provide information regarding drug treatment and substitution therapy access among younger IDUs as it relates to drug use behavior over time.
1.9.4 Specific objective four

The fourth objective uses iterative quantitative and qualitative methods to explore the relationship between injection heroin dependency and the social context in which this behaviour occurs. Objective four will contribute new evidence regarding:

1. The role of injection heroin dependency on drug related harms among young IDUs.

2. Access to drug treatment and substitution therapies among young injection heroin-dependent IDUs.

3. Experiences surrounding the initiation of heroin injection among young female and male IDUs.

4. Experiences of coping with “dopesickness” (heroin withdrawal) as it pertains to increased risk for drug-related harms including needle sharing, sex work and criminal activity.

1.9.5 Specific objective five

The fifth objective was to determine mortality rates and causes among young IDUs. Objective 5 will contribute new evidence regarding:

1. Causes and factors associated with premature mortality among younger female and male IDUs.

2. Mortality rates among younger female and male IDUs compared to the Canadian population of the same age.
1.10 References


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CHAPTER 2

LITERATURE REVIEW

Risk Factors for HIV, Hepatitis C, and Co-infection Among Young Injection Drug Users and Subpopulations at Elevated Risk for Infection

*FOOTNOTE

In addition to reviewing the broader literature on risk factors for HIV, HCV and co-infection among young injection drug users, included in this chapter are brief summaries of the following manuscripts:


Miller CL, Spittal P, Laliberte N, Li K, Tyndall M, O’Shaughnessy MV, Schechter MT Females experiencing sexual and drug vulnerabilities are at elevated risk among youth who use injection drugs. JAIDS 2002, 30 (3) 335-41

Miller CL, Wood E, Spittal PM, Frankish JC, Li K, Braitstein P, Montaner JSG, Schechter MT


Contributions of the candidate:

The candidate initiated exploration and data analyses for these manuscripts, conducted the literature review and wrote the manuscripts.
2.1 Introduction

In Canada, an estimated 2.5% of all high school students have used injection drugs. Although these drug use estimates declined in the 1970's, they have been rising in more recent years\(^1\). Among out-of-school and vulnerable youth, such as street youth, injection drug use is more common. In Montreal, an estimated one-half of street youth have ever used injection drugs; the incidence for initiation into injection drug use was estimated to be approximately 8.2 per 100 person years and was associated with younger age\(^2,3\). While the overall prevalence of injection drug use among the general youth population is low, injection drug use accounts for an increasing proportion of the burden on the health care and criminal justice systems, particularly since the number of injection drug users (IDUs) living with AIDS is increasing\(^4\). In addition to blood-borne infection risk, injection drug use also contributes substantially to health care resource utilization for other health related issues such as abscesses, endocarditis, cellulitis, pneumonias, TB and other infections\(^5\). Injection drug use also contributes to the burden on criminal justice systems, whereby policing, courts and jails are often the mechanisms used to cope with criminal behaviours such as sex work, drug dealing and robberies associated with injection drug dependency\(^6\). Thus, exploring and understanding the dynamics of injection drug use among young people through research is important so that public health policy makers have access to evidence to inform the development and implementation of evidence-based intervention programs to reduce the harms associated with injection drug use.

In Canada, injection drug use directly accounts for approximately one-third of all HIV infections among young people aged \(\leq 29\) years and indirectly accounts for up to one-half of heterosexually transmitted HIV infections\(^7\). Injection drug use accounts for approximately 35% - 40% of young people living with AIDS\(^8\). In addition, injection drug use is estimated to
account for well over half of all Hepatitis C (HCV) infections and the majority of HIV/HCV co-infections\textsuperscript{9-11}.

While injection drug use affects young people from all socioeconomic, educational, ethnic and racial backgrounds, its effects are felt disproportionately\textsuperscript{12}. Young people particularly vulnerable to injection drug use and related health and incarceration rates tend to live in neighbourhoods that are socially and economically disadvantaged and in which illegal drug markets thrive\textsuperscript{13}. In the United States (US), African-American and Latino/Latina people are disproportionately affected by injection drug use, whereas in Canada, particularly in the western provinces, Aboriginal people have been disproportionately affected\textsuperscript{14,15}. Among young people in the US and Canada, HIV infections attributable to injection drug use among young African-Americans and Aboriginal Canadians are almost double those seen among young Caucasian people\textsuperscript{14,16,17}. It has been suggested by Aboriginal service providers that the higher rates of injection drug use among young Aboriginal people may be a coping mechanism for the complex effects of discrimination, poverty and cultural dislocation, including the multigenerational effects of the residential school system\textsuperscript{18}.

Prior to the candidate’s MSc thesis work (2000 – 2002) examining risk factors for HIV and HCV prevalence and incidence among young IDUs in Vancouver, British Columbia, Canada, very little was known about blood-borne infection transmission in this population in Canada. This literature review will summarize the candidate’s contribution to date regarding HCV and HCV transmission among young IDUs, the broader literature in this area and directions for further research.
2.2 HCV prevalence and incidence among young people who use injection drugs

The leading cause of HCV infection in Canada and other developed nations is the sharing of contaminated equipment between IDUs. The incidence of HCV infections among IDUs is estimated to range between 4.2 and 22.0 per 100 person-years and prevalence estimates fall between 30% and 90%\(^1{9-22}\). Time to HCV infection among young (≤ 30 years) IDUs typically ranges between 8 months and 2 years, thus young IDUs are an important group with respect to HCV prevention\(^10,21,23-25\).

There are approximately 5,000 new HCV infections occurring yearly in Canada, the majority occurring among young people and those who use injection drugs\(^9,26\). The viral transmissibility of HCV through injecting is far greater than that of HIV\(^27,28\). HCV is most commonly associated with sharing needles\(^29\), but unlike HIV it has also been associated with sharing ancillary equipment such as crack cocaine pipes and cookers (used in the preparation of injection heroin and cocaine)\(^30\). However, younger IDUs have been found to share needles and ancillary equipment more so than older IDUs\(^29-31\). Due to the rapid acquisition of HCV infection following initiation into injection drug use, young IDUs represent an important group for HCV prevention and intervention. This may be particularly important in urban areas experiencing high prevalence of blood-borne infections among IDUs such as Vancouver, Canada\(^10,19,23\).

In Vancouver, HCV prevalence had reached a point of saturation among IDUs following the initial outbreak during the early to mid-1990's in which HCV reached close to 90%\(^32\). However, when the candidate looked at HCV prevalence among younger IDUs in Vancouver in 2002, HCV prevalence was 43% at baseline\(^10\). In the Vancouver study as well as studies among young IDUs in San Francisco\(^33\) and Baltimore\(^19\), a greater number of years
injecting was associated with HCV prevalence suggesting that there is a window of opportunity for prevention of HCV among younger IDUs.

Hahn et al. identified an HCV incidence rate of 11 per 100 person years in San Francisco, while in Baltimore, two separate studies found incidence rates of 16 and 23 per 100 person years and in New York incidence rates were 18 per 100 person-years. Among young IDUs in Vancouver, BC, the HCV incidence rate was 37.3 per person years. Half of the young people who became HCV positive did so within the 2 years following injection drug initiation. In a study among street youth in Montreal, Quebec, Canada, the prevalence of HCV infection was strongly associated with injection drug use. These findings underscore the need for targeted interventions, particularly among new initiates and street youth. Areas for further research include investigations of factors surrounding initiation into injection drug use, including age and sociodemographic characteristics of youth most likely to initiate. Increasing our understanding of drug injection initiation among youth in Canada will increase our capacity to target subpopulations at highest risk and develop effective programs to intervene prior to, and shortly after drug injection initiation.

Among young IDUs in Vancouver, Baltimore, and San Francisco, frequent (> 1 daily) cocaine injection was a significant predictor of HCV seroconversion. Frequent cocaine injection has been a persistent risk factor for blood-borne infection among IDUs in Vancouver and other settings, in part due to the increased frequency of injection characteristic of cocaine use. However, in Vancouver, many of the young IDUs were also frequently using heroin and speedballs along with cocaine. The amount of daily polydrug use occurring among these young injectors is of concern and requires further investigation. Investigating drug use trends among young IDUs and the relationship between drug trends and risk behaviours is an important future direction for research to help elucidate risk for blood-borne infection in this
vulnerable population. It is also important to understand changes over time in drug use trends, high-risk behaviours and treatment access in order to ensure that available interventions, such as drug treatment and substitution therapies, are being accessed by those most in need. Thus, gaps in knowledge include longitudinal information regarding drug use trends, associated risk behaviours and drug treatment and substitution therapy use among younger IDUs.

Other significant factors in multivariable analyses of HCV incidence among young IDUs in Vancouver were requiring help to inject and having a sex partner who also injects. Younger IDUs may be particularly vulnerable to requiring help to inject their drugs due to recent initiation, lack of knowledge regarding injection processes and apprehension of using harm reduction services. Among street youth in Montreal, the majority who initiated injection drug use did so by being injected by someone else the first time, suggesting that young IDUs may be dependent on others to inject their drugs in the time period immediately following initiation. Requiring help to inject has been flagged in other studies of IDUs as increasing drug related harms, but the dynamics of requiring help to inject are poorly understood. Future research into initiation into injection and requiring help to inject is necessary. In particular, qualitative methods exploring the context of requiring help to inject among young IDUs, especially closely following initiation, would be helpful to more fully understand vulnerabilities relating to this phenomenon. In addition, other studies have suggested that intimate partnerships may be protective against blood-borne infections, but among young IDUs in Vancouver, intimate partnerships have been found to contribute to HCV vulnerability. The dynamics between intimate partnerships and requiring help to inject require further exploration in this population.

In a study by Hagan et al., a strong association was found between HCV seroconversion and sharing ancillary drug equipment. Sharing needles and ancillary drug
equipment is the most efficacious way to transmit HCV between IDUs. Among young IDUs in Vancouver, 80% reported sharing ancillary drug equipment and 40% reported sharing syringes. Sharing ancillary drug equipment did not reach statistical significance in Vancouver, most likely because this behaviour is saturated among these young IDUs. However, HCV transmission through shared ancillary equipment should not be ruled out. Among street youth in Montreal, the majority reported using a new syringe the first time, yet over 40% reported sharing other drug use equipment. The dynamics of sharing syringes and other drug equipment requires further investigation among at risk youth. It may be that younger IDUs are less likely to access services, such as needle exchange programs, following initiation into injection and therefore less likely to receive HIV and HCV education and prevention tools and information.

For younger IDUs living in cities where HCV prevalence is high, there exists a window of opportunity for HCV prevention, but it is important to act quickly. Understanding the dynamics of initiation into injection drug use among young IDUs is critical to informing the development of public health interventions for the prevention and treatment of HCV. In addition, understanding contextual factors such as sexual partnership vulnerability and the need for help to inject will increase the public health system’s capacity to respond to HCV transmission among this highly vulnerable population.

2.3 HIV prevalence and incidence among young injection drug users

There were 58,929 positive HIV tests reported in Canada between November, 1985 when testing began, and June 30, 2005. The HIV epidemic in Canada has not reached the levels seen in parts of the United States and other places in the world. This may be due, in
part, to Canada’s more socially supportive and available health and social care system where income support and health care are generally accessible. In addition, Canada has taken a more proactive stance on harm reduction policy such as providing needle exchanges in several locations across the country. However, these programs are constantly under threat. Understanding the dynamics of HIV transmission among IDUs in Canada remains a critical need for averting HIV epidemics such as those recently seen in other parts of the world such as injection drug using populations in Russia and the Ukraine\textsuperscript{54,55}. Providing accurate, evidence-based and consistent HIV prevention and treatment messages will assist governments and policy-makers to make evidence-based decisions regarding prevention and treatment programs in Canada and around the world.

The overall number of positive HIV tests reported in Canada has declined since 2002, so that now approximately 2,500 HIV positive tests are reported annually\textsuperscript{51}. With respect to age, in Canada, the average age at infection has decreased from 32 prior to 1983 to 23 in 1990\textsuperscript{56}. The number of females aged 15 to 29 years testing positive for HIV has increased from 11\% in 1996 to 27\% in 2004\textsuperscript{5}. Among young females, injection drug use accounts for approximately 40\% of positive HIV tests while heterosexual transmission accounts for approximately 60\%\textsuperscript{51}. Worldwide, and particularly in Sub-Saharan Africa, young females have been disproportionally affected by HIV and AIDS and young people overall represent the age group of most critical concern\textsuperscript{57,58}.

Studies examining HIV prevalence among young subpopulations have found excess risk for infection among street youth and IDUs\textsuperscript{31,53,59-62}. Among street youth in Canada, higher HIV prevalence has been found among IDUs and those engaged in sex work\textsuperscript{59,63,64}. Among young people in North America, those disproportionately affected by HIV and injection drug use have been racial and ethnic minorities; African-American, Latino/Latina and American
Indian youth in the United States, and in Canada, young Aboriginal people\textsuperscript{16,17,65-67,68-70}. More recently, public health policies such as mandatory reporting and contact tracing may be affecting the willingness of Aboriginal people and others, especially in small rural communities, to come forward and be tested\textsuperscript{71}. It is estimated that the number of people in Canada who may be living with HIV and have never been tested, is 30\%\textsuperscript{72}. Thus, the number of individuals infected with HIV through injection drug use, either directly or indirectly, may be underestimated\textsuperscript{72,73}.

Among young IDUs in Vancouver, HIV prevalence was associated with female sex, sex work, sexual abuse, injecting heroin and speedballs (heroin and cocaine) frequently (\(\geq 1\) daily) and having a high lifetime number (\(>20\)) of sexual partners\textsuperscript{74}. Similarly, a study in Baltimore, Maryland by Doherty et al. found higher HIV prevalence among young females with dual sexual and drug-related risk factors\textsuperscript{75}. Excess HIV prevalence was also found among young IDUs who inject speedballs frequently in New York and Baltimore \textsuperscript{62,76}. In Vancouver, 87\% of the young IDUs who were baseline HIV-positive were female\textsuperscript{74}. Although not reaching statistical significance, 45\% of the HIV-positive females and all of the HIV-positive males were Aboriginal, despite the fact that young Aboriginal people account for only 27\% of the young VIDUS cohort\textsuperscript{77}. Excess risk for HIV infection among young female and Aboriginal people requires further investigation. In particular, understanding the context in which risk occurs by using qualitative methods in combination with quantitative methods may strengthen our understanding of socioenvironmental factors that elevate risk among some youth.

With respect to HIV incidence among younger IDUs, several studies have highlighted the association between younger age, fewer years injecting and elevated HIV incidence rates among young IDUs\textsuperscript{31,75,77}. Studies of young IDUs in New York and Italy have noted higher
HIV incidence rates among young females than among males\(^46,78\). In a study from Baltimore, Maryland, HIV incidence among young IDUs was associated with frequent injection cocaine and crack use\(^75,78,79\). In Vancouver, the HIV incidence rate among young IDUs was 4.37 per 100 person-years and was associated with Aboriginal ethnicity, frequent cocaine injection and crack use\(^77\). The association between younger age, more recent injection onset and HIV incidence is poorly understood. Very few studies have been able to look at factors relating to elevated risk for HIV longitudinally and particularly the impact of drug use trends and available structural interventions on risk among younger IDUs.

### 2.4 HIV and HCV co-infection among young injection drug users

HIV and hepatitis C (HCV) co-infection is of growing concern in North America, particularly among injection drug users (IDUs) where the majority of coinfections are concentrated\(^27,80\). It has been estimated that approximately 40% of individuals living with HIV are co-infected with HCV and among HIV-positive IDUs the estimate is between 50% and 90%\(^11,45,81,82\). While the impact of HCV infection on HIV disease progression remains unclear, evidence suggests that coinfection has been associated with more rapid HCV progression\(^83-86\). In addition, some of the antiretroviral therapy used to decelerate HIV disease progression has been shown to be associated with liver toxicity\(^87\). Since this condition may be worsened by HCV infection, coinfection of IDUs is becoming a more important factor in the management and treatment of HIV/HCV coinfection.

The age of individuals becoming coinfected with HIV and hepatitis C in North America is decreasing\(^11,25,27\). Young IDUs provide an important opportunity to examine the incidence of coinfection due to more recent initiation into injection drug use, lower baseline
infection(s) and increased risk for seroconversion. The median age of young IDUs becoming coinfected in Vancouver was 24, and they had been injecting for a median of only 3 years. Coinfection in Vancouver was concentrated among young female and Aboriginal youth engaged in sex trade work. The finding that the burden of infection lies with females and Aboriginal people was consistent with other studies conducted on HIV prevalence and incidence in this population. The vulnerability of young females and Aboriginal people in this setting is clear. This evidence should persuade public health policy makers of the need to work with young female and Aboriginal people to develop interventions that are acceptable and accessible for these two vulnerable sub-populations.

Youth particularly vulnerable to acquiring HIV/HCV coinfection in Vancouver were frequent cocaine injectors and those who borrowed needles. Cocaine injection has been associated with HIV and HCV incidence in a number of studies, including in our setting in Vancouver. In this setting, the use of methadone maintenance therapy in the previous six months was protective. These findings suggest that there is a need for future research on how the risk environment influences potential syringe sharing contexts and how to make methadone and other forms of substitution therapy more accessible for young IDUs.

2.5 Female and Aboriginal drug related vulnerability

While HIV continues to infiltrate and spread rapidly in a number of countries worldwide, an estimated two-thirds of those living with HIV are in Sub-Saharan Africa. Of those, an astounding 77% are women and two thirds of those are young females. The scope and scale of the global AIDS pandemic has demanded the critical appraisal of all previously held assumptions regarding risk for disease and the need for understanding the political, social,
economic and cultural realities that play into risk. In this setting in Vancouver, the research summarized above indicates young IDUs at highest risk for blood-borne infection are females and Aboriginal people. These findings have implications for the development of effective interventions for prevention and treatment in these vulnerable groups. Understanding vulnerability as it relates to gender and culture is critical for developing effective interventions, particularly among young IDUs in this setting.

A great deal of HIV/AIDS research to date has used epidemiologic methods to count quantifiable facts. The research resulting from these studies has often been accepted unchallenged and has provided the impetus for policy and program development for HIV and AIDS prevention. As a result, prevention policies and programs have largely focused on behaviour change at the individual level, ignoring the larger social, political, economic and cultural contexts. In particular, interventions have focused on increasing condom use and, among IDUs, decreasing needle sharing, despite the fact that individuals, may be seriously challenged by external forces such as poverty and social and cultural dislocation, that make individual level behaviour change extremely challenging from a personal perspective and an impractical solution from a public health perspective.

Feminist social scientists and researchers have criticized "risk factor" research and have said that applied social and behavioural science methods used to determine risk for disease have fallen short of explaining why risk factors are more present among some populations than others. Risk-factor research methods often have not considered theoretical perspectives on relationships between peoples practices and the social contexts in which they live. The problem has been that these methods follow traditional epidemiologic investigation and while they have determined new individual level risk factors, they have done little to explain the social and environmental contexts that influence risk for
disease\textsuperscript{105,106}. The impact of social and environmental contexts on vulnerable sub-populations such as young women and Aboriginal people is particularly important in this setting. Understanding the complex ways in which gender and culture influence the overall risk environment will increase our capacity to reduce the disproportionate burden of injection drug use and blood-borne infection risks among vulnerable subpopulations such as young women and Aboriginal people\textsuperscript{93}.

Among young female IDUs in Vancouver and elsewhere, the incidence of childhood sexual abuse is exceedingly high\textsuperscript{74,107,108}. The link between childhood sexual abuse and increased risk for injection drug use and sex work has been established\textsuperscript{109-113}. The context for current drug related harm among young female victims of childhood sexual abuse, and their continued vulnerability through drug dependency and sex work requires further investigation\textsuperscript{114,115}. Understanding these contextual relationships are critical for developing appropriate, effective and context dependent public health interventions\textsuperscript{116}. Interventions to date have generally ignored sexual abuse as a risk factor for blood-borne infection transmission among IDUs despite the established relationship. Building interdisciplinary research teams to investigate contextual factors such as the relationship between sexual abuse and risk for injection drug initiation and blood-borne infection, may improve our ability to respond to effectively.

Research regarding the relationship between historical and current violence against women and drug related vulnerability is an important future direction for research in Canada. Violence against women puts girls and women at risk for HIV and HCV both directly and indirectly through forced or coercive sexual intercourse with an infected partner, limitation of women's ability to negotiate safe sexual behaviours, and establishment of a pattern of sexual risk taking among individuals assaulted during childhood, adolescence and adulthood\textsuperscript{43,117,118}. 
Many HIV prevention efforts continue to focus on advocating condom use in sexual partnerships despite the fact that women may be unable to negotiate the use of condoms with sexual partners who are unwilling to use them. Emerging from the HCV incidence data was the association between infection and having an IDU sexual partner. This relationship is likely a more indirect one where young people, particularly young women, may be faced with power imbalances within their sexual partnerships and may lack control over their injection processes with their intimate partner(s). Using combined methods to provide epidemiologic evidence and qualitative explanations for the relationships between social and environmental contexts will help to support structural level interventions that consider the unique vulnerabilities of young women.

While gender theory has contributed knowledge towards the deconstruction of epidemiologic research and a broader understanding of women's risk for HIV/AIDS, it has also asked important questions regarding the relationships between culture and social and environmental context that relate to risk for HIV/AIDS among ethnically diverse populations. In Canada, the HIV/AIDS epidemic remains a growing concern among young Aboriginal peoples in both urban and rural areas. In the province of British Columbia, Canada, HIV surveillance data indicated that Aboriginal people accounted for approximately 4% of the total population but comprised 18% of new HIV infections between 1996 and 2000. Aboriginal people in Canada are overrepresented among marginalized groups at risk for HIV/AIDS such as IDUs, particularly in the western provinces where a higher proportion of Aboriginal people reside. In addition, young Aboriginal people are an important population because it is estimated that nearly half of the urban Aboriginal population in Canada is under the age of 25 years, compared to 30% of the non-Aboriginal population.
National Canadian epidemiologic surveillance data suggests that Aboriginal youth may be at particularly high risk of HIV/AIDS; 33% of newly diagnosed Aboriginal people were under the age of 30 as compared with 20% of non-Aboriginal people\textsuperscript{127}. In addition, between 1998 and 2000 an estimated 60% of new HIV infections among Aboriginal people were attributed to injection drug use\textsuperscript{17}. In Vancouver, Canada, young Aboriginal IDUs were more than four times as likely to be HIV-infected at enrolment and more than twice as likely to become HIV-infected during follow-up than non-Aboriginal youth who injected drugs\textsuperscript{126}.

In the Vancouver study, none of the young Aboriginal injectors had ever accessed methadone maintenance therapy even though almost half reported at baseline using heroin frequently. Methadone maintenance therapy has been shown to aid in risk reduction among IDUs\textsuperscript{128,129}. In the United States some studies have suggested that African-American IDUs are less likely to be enrolled in methadone maintenance programs\textsuperscript{130-132} which may be due in part to African American peoples distrust of methadone as a substance abuse treatment\textsuperscript{133}. This finding may also suggest an apprehension among Aboriginal youth about accessing treatment services not specifically designed for and in collaboration with this population\textsuperscript{123,133}. Ultimately, all service delivery programs including drug treatment and methadone maintenance therapy, require Aboriginal involvement to validate and provide culturally appropriate assessments of the services offered\textsuperscript{134,135}.

Thus research that emphasizes interdisciplinary collaboration and grass roots organizations' participation in the research production process is an important future research direction. Interdisciplinary research can contribute to our understanding of the way in which culture and gender impact on the overall risk environments for young Aboriginals and females. Using interdisciplinary methods can help improve the quality of epidemiologic research and facilitate the inclusion of theoretical, historical and "Indigenist" perspectives that help to
contextualize risk for HIV among Aboriginal peoples. HIV/AIDS research will continue to benefit from Aboriginal inclusion in and ownership of the research process to gain breadth and depth of understanding regarding the effects of historical and current traumas, unresolved grief and mourning related to loss of land, discrimination, poverty and the multigenerational effects of the residential school system.

Some previous research may have helped to compound the stigma associated with HIV/AIDS transmission and worked to further decontextualize sex and drug behaviour as “lifestyle choices” without acknowledging that these behaviours have relationships to sets of social, cultural and environmental contexts. For example, psychosocial drug treatment and substitution therapies rarely address larger contextual issues such as criminalization, poverty, culture, and gender-based violence. Thus, for young women and Aboriginal people, available drug treatment may not be an accessible alternative if it does not address or empathize with the context in which their drug use was initiated and in which it occurs. In addition, while harm reduction initiatives such as needle exchange programs, have been highly effective, accessing sterile syringes 100% of the time simply by making them available assumes that injection drug users have control over when, where and with whom they inject their drugs. This may not be the case, particularly for young women who may be in relationships with pimps, dealers, or sexual partners in which they have little control over the injection process. Issues such as access to drug treatment, relationship vulnerabilities among new injectors and needle-sharing vulnerabilities among IDUs who require help to inject their drugs require further exploration from an interdisciplinary perspective. Epidemiologic investigation can benefit from the use of mixed method approaches and theoretical perspectives that can help to bring contextual information to the research.
2.6 Mixed methods approach

Research into prevention and transmission of HIV has traditionally focused on identifying and modifying individual risk behaviours\textsuperscript{140,141}. More recently, to increase our capacity to respond to drug-related harms and emerging public crisis such as blood-borne infection transmission among IDUs, research has begun focusing on social and environmental factors that influence the context in which these behaviours occur\textsuperscript{138,142,143}. These contextual factors are often referred to as factors that contribute to "risk environments" and directly impact on the ability of individuals to engage in healthier behaviours and/or prevent blood-borne infection transmission\textsuperscript{55,144}. Marginalized populations, such as younger IDUs, are particularly vulnerable to environmental influences. Environmental factors that contribute to positively or negatively to influencing the risk environment are often conceptualized as "structural level factors". Structural level factors that play a role in the risk environment for IDUs can include policing behaviours and jails\textsuperscript{145-147}. Structural level interventions that can influence positive health behaviours among IDUs can include needle exchange programs, subsidized and supportive housing and supervised safer injecting facilities\textsuperscript{148-151}. Understanding the role of structural level factors and interventions on the risk environment for younger IDUs may help to facilitate positive behaviour change and establish positive social norms for this population.

Quantitative studies have made important contributions towards our knowledge of harmful exposures (e.g. increased frequency of injection cocaine) on disease outcomes (e.g. HIV incidence) and provide a breadth of evidence to justify public health interventions (e.g. expanding needle exchange services). However, quantitative approaches generally provide limited information regarding the unique relationships and contexts between individuals and their social environment that limit or facilitate access to health-promoting behaviours and
structural interventions. Qualitative approaches can provide a more in-depth analysis of the processes by which social and structural level factors contribute to the risk environment and influence individuals' behaviours\textsuperscript{44,152,153}. Qualitative methods also provide gender and cultural specificity to the analysis, crucial for developing culturally relevant and accessible public health interventions\textsuperscript{154,155}. Thus, in order to address complex environmental and structural influences on risk behaviour, mixed methodologies are becoming increasingly important\textsuperscript{44,156}.

In response, injection drug use researchers are building interdisciplinary teams in order to gain breadth and depth of understanding through large samples, epidemiologic methods and qualitative approaches that consider experiential knowledge and factors such as gender and cultural implications on the risk environment\textsuperscript{96,157}. While these teams have been producing research that is advancing the field, Dr. Samuel Friedman, a respected injection drug use researcher, has recently suggested the need for individual researchers who have expertise in mixed methods and interdisciplinary approaches\textsuperscript{156}.

The training the candidate received towards her doctoral training sought to increase her capacity to conduct mixed methods research to contribute new knowledge regarding individual level risk behaviours and some of the social and environmental contexts in which these behaviours occur among younger IDUs. The research in this thesis, both epidemiologic and mixed methods (Chapter 5), was designed to look at salient individual level behaviours that can be used to inform structural level interventions and investigate the role of environmental influences (e.g. needle exchanges) in responding to behavioural contexts (e.g. the role of injection heroin dependency on needle sharing behaviours).
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CHAPTER 3

FACTORS ASSOCIATED WITH EARLY ADOLESCENT INITIATION INTO INJECTION DRUG USE

FOOTNOTE

This chapter has been published in part as:


Contributions of the candidate:

The candidate initiated exploration of the topic, designed the study and directed the statistical analyses. The candidate also wrote the manuscript.
3.1 Introduction

It is estimated that over 125,000 Canadians and over 1 million people in the United States use injection drugs (1) (2). The number of injection drug users in specific states and provinces vary widely with higher numbers tending to be concentrated in low-income neighbourhoods within large urban settings (3). Among high school students in Canada (4) and the United States (5), an estimated 2.5% in both countries have ever used injection drugs. These figures do not include the youth at highest risk for injection drug use such as street youth and youth who are not currently attending school (6, 7). In a recent study of street youth in Montreal, Quebec, the estimated incidence of initiation into injection drugs was 7.1 per 100 person years (6), suggesting that among street youth this phenomenon is exceedingly common. While the proportion of chronic injection drug use in the overall population remains small, the extreme personal, social, and economic harms of injection drug use remain high (8). As such, developing a deeper understanding of injection drug use among youth and related prevention and addiction treatment approaches are important public health goals.

Other studies of injection drug use initiation among young people have highlighted that youth at increased risk of initiating injection drug use include those who have had recent episodes of homelessness (6), a history of traumatic familial events including sexual abuse (9), early criminal behaviour, and recent use of non-injected narcotics (10, 11). A recent study of street youth indicated that initiation into injection was associated with age younger than 18 years (6). Other studies have also shown increased HIV risk among younger injection drug users (6, 12). A study of recently initiated young injectors found an association between HIV risk and early shooting gallery attendance, places noted for their association with high-risk injection practices such as syringe sharing and high-risk injecting networks (13). However,
much remains unknown about the age of onset of injection drug use or the risk environments and risk factors associated with early adolescent injection drug use(14).

Therefore, we undertook this study to explore demographic and social risk factors associated with early adolescent (<16 years of age) initiation into injection drug use as a means to gaining a better understanding of this vulnerable population. We also sought to explore drug and sexual risk differences between early and older adolescent initiates.

3.2 Methods

This study uses baseline VIDUS data to explore factors relating to initiation into injection drug use among younger (<29 years) IDUs. Relevant baseline socio-demographic, risk factors and drug treatment access were assessed. Socio-demographic variables included in these analyses were gender, ethnicity (Aboriginal vs. other)(17), HIV and HCV-positivity and homelessness. Female is defined as gender at birth. Aboriginal is self-reported and includes, First Nations people, Inuit and/or Métis. The variable homelessness is defined as spending time in the previous six months sleeping on the street, shelter or squat. For the purpose of this study, we have defined the following available variables as psycho-social factors potentially mediating early entry into injection drug use; sexual abuse, suicidal ideation, men who have sex with men (MSM) and women who have sex with women (WSW). Sexual abuse is defined as forced or unwanted sexual contact ever. For this analysis we also compared early vs. later initiates with respect to median age at first sexual abuse. Suicidal ideation is defined as a positive response to the question; “Have you ever thought seriously about taking your own life?” MSM and WSW were defined as having ever had any sexual contact with a person of the same sex.
Drug and sexual risk factor covariates used in the present analyses were elicited in reference to the previous six-month period at the time of baseline interview with the exception of methadone maintenance therapy (MMT), drug treatment (excluding MMT) and juvenile detention and/or jail which were elicited in reference to ever spending one night or longer in such a program or facility. Drug risk variables considered in the analyses included: binge drug use, needle borrowing and lending, shooting gallery attendance, incarceration, frequent cocaine and heroin injection and crack and polydrug use. Binge drug use is a common local term understood to mean increased drug use over a period of time and was elicited in reference to the question; “have you been on drug binges or runs in the past six months?” Frequent drug use, as defined previously, is greater than once daily. Frequent polydrug use refers to at least daily use of more than one drug or one combination of drugs (ie: at least daily injection of heroin and use of crack). Shooting gallery attendance is defined as entering a known shooting gallery to inject drugs in the previous six months at the time of interview. Sexual risk variables included; sex trade work, and unprotected vaginal and/or anal intercourse. Sex-work involvement was defined as exchanging sex for money, goods, drugs, or shelter during the previous 6 months and unprotected vaginal or anal intercourse was defined as one or more instances with any sexual partnership including regular, casual and/or client partners.

3.3 Statistical analysis

These analyses were restricted to VIDUS participants aged 29 years and younger who were recruited between May 1996 and May 2003. The rationale for the age criterion is based on age cut-points used in other studies of young injection drug use cohorts(11, 18). We defined early adolescent initiation into injection drug use as aged 16 years and younger. To our knowledge, there have been no other studies looking at early adolescent initiation, thus our
We used contingency table analysis to compare baseline socio-demographic, psycho-social, sexual and drug related risk variables between young injectors (≤ 29 years) who initiated injection drug use during early (≤16 years) and later (17-29 years) adolescence. Chi-square and Fischer’s exact tests were used to compare variables between the two groups of youth. In order to determine factors associated with early adolescent initiation into injection drug use we built three separate multivariable models that considered statistically significant variables at the p < 0.05 level in univariate analyses. The first logistic regression model considered all socio-demographic, psycho-social, drug and sexual risk variables associated with early injection initiation in univariate analyses. In addition and in order to control for colinearity between fixed demographic, psycho-social and behavioural variables, we also built two separate multivariable logistic regression models. The first to show independent fixed covariate socio-demographic and psycho-social variables and the second to show independent drug and sexual HIV risk factor covariates associated with early initiation into injection drug use.

All statistical analyses were performed using SAS software version 8.0 (SAS, Cary, NC). All reported p values were 2-sided.

3.4 Results

Between May 1996 and November 2003, 1548 participants were recruited into the VIDUS study among whom there were 542 (35%) participants aged ≤29 years. Overall, 151 (28%) of the youth were Aboriginal and nearly half 253 (47%) were female. Of the young IDUs, 205 (38%) initiated injection drug use at aged 16 years and younger. Despite younger
age; 22 (IQR: 19-25) vs 24 (IQR: 22-27 [p=<0.001]), early adolescent initiates compared to older initiates were more likely to have been injecting a greater number of years; 7 (IQR: 4-11) vs. 3 (IQR: 1-5) [p=<0.001], be HIV positive (44 [21%] vs. 50 [15%]; (OR:1.57 [95%CI:1.00-2.46]) and HCV positive (136 [66%] vs. 184 [55%]; (OR:1.64 [95%CI:1.14-2.35]) (data not shown).

3.4.1 Demographic and psycho-social characteristics

As shown in Table 3.1, young injectors who initiated injection drug use in early adolescents were more likely to be female (OR: 1.90 [95% CI: 1.34-2.70]), to have been sexually abused (OR: 1.76 [95%CI: 1.23-2.50]), and to have experienced suicidal ideation (OR: 1.46 [95%CI: 1.02-2.08]). There were no differences between the youth who initiated injection drug use in early adolescence and those who did not with respect to Aboriginal ethnicity (OR: 1.36 [95%CI: 0.92-1.99]), homelessness (OR: 1.27 [95%CI: 0.85-1.89]), young MSM (OR: 1.28 [95%CI: 0.76-2.17]) and young WSW (OR: 1.33 [95%CI: 0.81-2.19]). There was a marginal association between younger age at first incidence of sexual abuse and early initiation (median age: 10 [IQR: 6-15] vs. 12 [IQR: 6-17]; p=0.054).

3.4.2 Drug and sexual HIV risk

As shown in Table 3.2, sex work (OR: 1.76 [95%CI: 1.24-2.50]), ≥1 daily cocaine injection (OR: 1.61 [95%CI: 1.13-2.30]), ≥1 daily polydrug use (OR: 1.54 [95%CI: 1.03-2.30]), binge drug use (OR: 1.49 [95%CI: 1.05-2.11], jail and/or juvenile detention ever (OR: 1.90 [95%CI: 1.27-2.83]) and shooting gallery attendance (OR: 1.69 [95%CI: 1.18-2.44]) were positively associated with early adolescent initiation into injection drug use. There were no differences between the two groups with respect to unprotected vaginal (OR: 0.69 [95%CI: 1.08-1.01]).
0.46-1.02]) and anal sex (OR: 1.01 [95%CI: 0.40-2.52]), ≥1 daily heroin use (OR: 1.35 [95%CI: 0.95-1.91]), ≥1 daily crack cocaine use (OR: 1.03 [95%CI: 0.62-1.70]), ≥1 daily speedball injection (OR: 1.13 [95%CI: 0.72-1.77]), drug treatment entry (OR: 0.87 [95%CI: 0.46-1.63]), MMT (OR: 1.07 [95%CI: 0.49-2.33]), borrowing needles (OR: 1.28 [95%CI: 0.90-1.83]) and lending needles (OR: 1.37 [95%CI: 0.96-1.96]).

3.4.3 Multivariable analyses

When we considered all variables statistically associated with early adolescent initiation into injection drug use, no variables reached significance in multivariable modeling suggesting colinearity among some of the variables (data not shown). Thus we present two final models that considered socio-demographic and psycho-social variables in one model and a second model considering drug and sexual risk variables (refer to Table 3.3).

Model 1

In multi-variable analyses that adjusted for all demographic and psycho-social variables significant in univariate analysis, the only variable independently associated with early adolescent initiation was female gender (OR: 1.63 [CI: 1.09-2.44]).

Model 2

In multivariate model 2, sexual and drug related risk factors independently associated with early adolescent initiation were sex work (OR: 1.61 [CI: 1.11-2.31]), binge drug use (OR: 1.45 [CI: 1.01-2.08]), and juvenile detention and/or jail (OR: 1.78 [CI: 1.16-2.66]).
3.5 Discussion

There are several important factors from this study that should be considered at the policy and programmatic level for prevention and treatment of injection drug use among youth. First, the age at initiation into injection drug use among young injectors is surprisingly low. More than one third of youth in our overall sample and one half of young females had injected drugs before the age of 17 years. Second, youth who initiated injection in early adolescence were more likely to enter into the study already HIV and hepatitis C positive. Third, adolescents who initiate drug use early were at increased risk for high-risk drug use behaviour including bingeing, sex trade work and criminalization. Fourth, psycho-social factors such as childhood sexual abuse and suicidal ideation may mediate early initiation into injection drug use. Given the serious adverse public health implications of injection drug use in early adolescence, evidence-based new public health strategies are in urgent need of implementation in order to address the needs of youth at risk for injection drug use.

There are several important factors that should be considered in developing new public health strategies and interventions for HIV and injection drug use prevention among youth. For instance, in our study, many of the youth initiated injection drug use at early ages and as such, public health planners may need to revise target age groups for prevention interventions so that younger adolescents are considered. In addition, while school based efforts to address drug use begin early in some settings, the current formats and content do not appear to be effective in reaching many young people, particularly those who are at higher risk for injection drug use such as street youth(21, 22). Clearly, drug prevention education in its current form is not sufficiently protective(23). Evidence based injection drug use prevention programs, including ones that give special consideration to the needs of young women, are urgently required.
In the current study, early adolescent initiation into injection drug use was associated with greater involvement in sex work. Other studies have suggested that entry into sex work typically occurs between ages 12 and 14 years (24, 25). The relationship between sex work and injection drug use among adolescents warrants further investigation. At the very least, it appears that an appropriate public health response would involve the development of “exit” programs for children and young adolescents involved in sex work as a means of assisting those who wish to exit sex work, as well as measures to reduce the harm associated with young female sex workers who also use injection drugs (26, 27).

The present study indicates that youth who initiated injection drug use in early adolescence were more likely to engage in drug binges. Drug binges in our setting have been linked to cocaine use (28) and among youth, may be associated with methamphetamine use. In a recent study involving all participants in the VIDUS, binge drug use independently predicted HIV seroconversion (29). Thus youth who initiate injection drug use in early adolescence appear to be more likely to engage in drug use behaviours that have been associated with increased risk for HIV and HCV.

Youth in our study were far more likely to have spent time in youth detention or jail than in drug treatment and/or to access MMT. In fact youth who initiated injection drug use in early adolescence were ten times more likely to have been involved with the criminal justice system than they were to have received any form of drug treatment. Although we were limited in our ability to examine other psycho-social variables that may mediate adolescent initiation into injection drug use due to the questions asked of study participants, the univariate associations between childhood sex abuse and suicidal ideation and early adolescent initiation suggest that childhood trauma may mediate risk for early adolescent initiation which in turn predicted more high-risk drug use behaviour and criminalization (30, 31). These findings
suggest that we need to carefully examine our current public health response to adolescent injection drug use, in particular whether criminalization is an appropriate response to adolescent injection drug use. This is particularly relevant given mediating factors such as childhood trauma and psychological disorders.

3.6 Limitations

There are several limitations that should be noted in regards to this study. Most importantly, due to measurement limitations we were unable to more fully measure other psycho-social and antecedent factors that may mediate initiation into injection drug use among adolescents. Further qualitative and quantitative investigations of the psycho-social context in which injection drug use occurs among youth will likely be beneficial in targeting appropriate individual, social and structural level interventions. In addition, as with many other studies of IDUs, the study population was not a random sample of all IDUs, however we have no reason to believe that any sampling bias occurred, particularly among the youth recruited. Socially desirable reporting is always a possibility in such studies, however, previous studies have shown that self-reporting among injection drug users is valid, and that adjustment for measures of social desirability had only a negligible impact on associations between HIV and risky behaviours(32).

3.7 Interpretation

Adolescents who initiated injection drug use in early adolescence were at increased risk for blood-borne infections and high-risk sex and drug use practices. Non-behavioural factors such as female gender, childhood trauma and suicidal ideation were potentially mediating factors for initiation into injection drug use in early adolescence. Arguably the social stigma
of injection drug use has allowed policy makers to ignore problematic injection drug use behaviour among adolescents and has left the criminal justice system, for the most part, to cope with this phenomenon. However there is a growing body of evidence suggesting that criminalization does not reduce the negative impacts of injection drug use but rather increases the potential negative consequences of injection drug use such as risk for HIV and HCV(33, 34). Developing more effective HIV/AIDS and drug use prevention and intervention programs for high-risk adolescents will most likely require intervention at the individual, social and structural level and the co-operation of policy makers and program planners.

Unlike drug addiction, cigarette addiction among adolescents has more recently become viewed within a wider social context whereby adolescents who become addicted to cigarettes are presumed influenced by external forces such as tobacco company ad campaigns. In turn, interventions developed more recently that target adolescent smoking have demanded change at the structural level including change from tobacco companies and law reform, changes that are designed to protect children from tobacco addiction(35, 36). Similarly, other addictions such as food addictions resulting in obesity or other eating disorders have been afforded a more sympathetic perspective whereby policies and programs are created that require change not only at the personal level but also at the structural, institutional, and social levels(37, 38). Drug addiction in general and injection drug use in particular among adolescents has not been afforded a similar perspective by policy makers and program planners. Understanding the contextual realities that mediate initiation into injection drug use, such as childhood trauma and other psycho-social factors, may contribute to a deeper social empathy for drug dependent adolescents thereby facilitating a greater possibility of more effective interventions and preventions occurring at the social and structural levels as well as the individual level.
3.8 References


12. Fennema JS, Van Ameijden EJ, Van Den Hoek A, Coutinho RA. Young and recent-onset injecting drug users are at higher risk for HIV. Addiction, 1457-65, 1997 Nov.


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Table 3.1  Demographic and psycho-social risk factors for early adolescent initiation into injection drug use among young injection drug users (N= 542)

<table>
<thead>
<tr>
<th>Demographic and Psycho-Social Factors</th>
<th>Early Initiation (&lt;16 years)</th>
<th>Later Initiation (≥17 years)</th>
<th>Odds Ratio (95% CI)</th>
<th>*P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>116 (57)</td>
<td>137 (41)</td>
<td>1.90 (1.34-2.70)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>65 (32)</td>
<td>86 (26)</td>
<td>1.36 (0.92-1.99)</td>
<td>0.119</td>
</tr>
<tr>
<td>&quot;Sexual Abuse&quot;</td>
<td>101 (49)</td>
<td>120 (36)</td>
<td>1.76 (1.23-2.50)</td>
<td>0.002</td>
</tr>
<tr>
<td>*Median Age (IQR)</td>
<td>10 (6 - 15)</td>
<td>12 (6 - 17)</td>
<td>--------</td>
<td>0.054</td>
</tr>
<tr>
<td>&quot;Suicidal Ideation&quot;</td>
<td>126 (61)</td>
<td>176 (52)</td>
<td>1.46 (1.02-2.08)</td>
<td>0.036</td>
</tr>
<tr>
<td>Homelessness</td>
<td>56 (27)</td>
<td>72 (23)</td>
<td>1.27 (0.85-1.89)</td>
<td>0.258</td>
</tr>
<tr>
<td>&quot;MSM&quot;</td>
<td>32 (36)</td>
<td>61 (31)</td>
<td>1.28 (0.76-2.17)</td>
<td>0.360</td>
</tr>
<tr>
<td>&quot;WSW&quot;</td>
<td>60 (52)</td>
<td>61 (45)</td>
<td>1.33 (0.81-2.19)</td>
<td>0.253</td>
</tr>
</tbody>
</table>

*Ever vs. never, *Age of first abuse
Table 3.2  Drug and sexual related risk factors for HIV and Hepatitis C among young injection drug users who initiate injection drug use in early adolescence or later adolescents (N= 542)

<table>
<thead>
<tr>
<th></th>
<th>Early Initiation</th>
<th>Later Initiation</th>
<th>Odds Ratio</th>
<th>*P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(≤16 years)</td>
<td>(≥17 years)</td>
<td>(95% CI)</td>
<td></td>
</tr>
<tr>
<td><strong>Sex-Related Risk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex Trade</td>
<td>109 (53)</td>
<td>132 (39)</td>
<td>1.76 (1.24-2.50)</td>
<td>0.002</td>
</tr>
<tr>
<td>*Vaginal</td>
<td>93 (55)</td>
<td>159 (64)</td>
<td>0.69 (0.46-1.02)</td>
<td>0.063</td>
</tr>
<tr>
<td>*Anal</td>
<td>22 (65)</td>
<td>31 (65)</td>
<td>1.01 (0.40-2.52)</td>
<td>0.991</td>
</tr>
<tr>
<td><strong>Drug-Related Risk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 per day Heroin</td>
<td>118 (58)</td>
<td>169 (50)</td>
<td>1.35 (0.95-1.91)</td>
<td>0.094</td>
</tr>
<tr>
<td>≥ 1 per day Cocaine</td>
<td>96 (47)</td>
<td>119 (35)</td>
<td>1.61 (1.13-2.30)</td>
<td>0.008</td>
</tr>
<tr>
<td>≥ 1 per day Crack</td>
<td>28 (14)</td>
<td>45 (13)</td>
<td>1.03 (0.62-1.70)</td>
<td>0.920</td>
</tr>
<tr>
<td>≥ 1 per day Speed</td>
<td>39 (19)</td>
<td>58 (17)</td>
<td>1.13 (0.72-1.77)</td>
<td>0.593</td>
</tr>
<tr>
<td>≥ 1 per day Polydrug</td>
<td>59 (29)</td>
<td>70 (21)</td>
<td>1.54 (1.03-2.30)</td>
<td>0.034</td>
</tr>
<tr>
<td>Binge Drug Use</td>
<td>109 (53)</td>
<td>146 (43)</td>
<td>1.49 (1.05-2.11)</td>
<td>0.026</td>
</tr>
<tr>
<td>‡Juvenile Detention/Jail</td>
<td>161 (79)</td>
<td>222 (66)</td>
<td>1.90 (1.27-2.83)</td>
<td>0.002</td>
</tr>
<tr>
<td>‡Drug Treatment</td>
<td>16 (8)</td>
<td>30 (9)</td>
<td>0.87 (0.46-1.63)</td>
<td>0.657</td>
</tr>
<tr>
<td>‡MMT</td>
<td>11 (5)</td>
<td>17 (5)</td>
<td>1.07 (0.49-2.33)</td>
<td>0.870</td>
</tr>
<tr>
<td>Needle Borrowing</td>
<td>85 (41)</td>
<td>120 (36)</td>
<td>1.28 (0.90-1.83)</td>
<td>0.173</td>
</tr>
<tr>
<td>Needle Lending</td>
<td>85 (41)</td>
<td>115 (34)</td>
<td>1.37 (0.96-1.96)</td>
<td>0.086</td>
</tr>
<tr>
<td>Shooting Gallery</td>
<td>84 (41)</td>
<td>98 (29)</td>
<td>1.69 (1.18-2.44)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

*Any unprotected vaginal or anal intercourse, ‡Ever vs. never, †Other than MMT
Table 3.3  Unadjusted and adjusted variable analyses of psycho-social and HIV and HCV risk associations with early adolescent initiation into injection drug use among young injection drug users

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted Odds Ratio (95% CI)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1: Socio-demographic and Psycho-Social Risk Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.90 (1.34-2.70)</td>
<td>1.63 (1.09-2.44)</td>
</tr>
<tr>
<td>Sex Abuse</td>
<td>1.76 (1.23-2.50)</td>
<td>1.29 (0.85-1.96)</td>
</tr>
<tr>
<td>Suicidal Ideation</td>
<td>1.46 (1.02-2.08)</td>
<td>1.30 (0.90-1.88)</td>
</tr>
<tr>
<td><strong>Model 2: Drug and Sexual Risk Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 per day Cocaine</td>
<td>1.61 (1.13-2.30)</td>
<td>1.40 (0.83-2.24)</td>
</tr>
<tr>
<td>Sex Trade</td>
<td>1.76 (1.24-2.50)</td>
<td>1.61 (1.11-2.31)</td>
</tr>
<tr>
<td>≥ 1 per day Polydrug</td>
<td>1.54 (1.03-2.30)</td>
<td>0.99 (0.56-1.74)</td>
</tr>
<tr>
<td>Juvenile Detention/Jail</td>
<td>1.90 (1.27-2.83)</td>
<td>1.78 (1.16-2.66)</td>
</tr>
<tr>
<td>Binge Drug Use</td>
<td>1.49 (1.05-2.11)</td>
<td>1.45 (1.01-2.08)</td>
</tr>
<tr>
<td>Shooting Gallery</td>
<td>1.69 (1.18-2.44)</td>
<td>1.37 (0.93-2.00)</td>
</tr>
</tbody>
</table>
CHAPTER 4

RISK FACTOR DIFFERENCES BETWEEN YOUNGER AND OLDER INJECTION DRUG USERS

FOOTNOTE

This chapter has been submitted in August of 2006 as:

Miller CL, Strathdee SA, Li K, Wood E, Kerr T. Risk factor differences between younger and older injection drug users: Implications for public health interventions

Contributions of the candidate:

The candidate initiated exploration of the topic, designed the study, directed the statistical analyses and wrote the manuscript.
4.1 Introduction

Cohort studies of injection drug users (IDUs) in North America and other settings have found that younger IDUs and those more recently initiated into injection drug use are at increased risk for blood-borne infections\(^1\), \(^2\). A few of these studies have found higher proportions of females in the population as compared to older IDUs and an increased risk for HIV infection among younger female IDUs\(^3\), \(^4\). Studies of young IDUs have revealed that excess risk for HIV may be related to increased frequency and combinations of drugs used, sex work, initiating injection drug use in early adolescence, and a high lifetime number of sexual partners\(^5\)-\(^7\). However, little is known about longitudinal risk behaviour and drug use patterns over time and if these trends are associated with younger age. Information regarding longitudinal drug use trends and risk behaviours among young IDUs can provide important information to help tailor interventions for this population.

Trends in drug use have been important for helping to explain blood-borne infection patterns among IDUs. For example, the explosive epidemics that occurred in some urban centres in North America during the mid-1990’s were, in part, attributed to the rise in availability of injection cocaine\(^8\), \(^9\). More recently, some settings have seen a rise in the consumption of methamphetamines and crack cocaine and studies have suggested that their use may be associated with elevated sex and drug related risk\(^10\)-\(^13\). Heroin injection as the primary reason for IDUs entering drug treatment declined during the 1980’s and began to increase again during the early 1990’s with the largest increase in the proportion of heroin injectors being those in younger age groups\(^14\). Very little is known regarding longitudinal changes in drug use patterns and associated risks among young IDUs.
Previously, high HIV and HCV incidence rates have been found among young IDUs in this setting, corroborating findings from other settings. However, little is known regarding why HIV and HCV incidence rates are high among younger IDUs as compared to older IDUs and most studies that have examined younger and older IDUs have done so cross-sectionally as opposed to prospectively. Therefore, this study explores longitudinal drug and sexual risk factors and drug use patterns associated with younger age among people who use injection drugs in Vancouver, Canada.

4.2 Methods

4.2.1 Relevant variables

Socio-demographic variables included in these analyses were gender, ethnicity (Aboriginal vs. other), HIV and HCV-positivity, incarceration and homelessness. Aboriginal is self-reported and includes, First Nations people, Inuit and/or Métis. All drug use and sexual variables refer to activities in the six months prior to the baseline and each semi-annual follow-up visit. Homelessness was defined as sleeping on the street, shelter or squat. Drug and sexual risk variables included in these analyses were history of sexual abuse, sex work, unprotected sexual intercourse, non-injection opiates, methamphetamine, and speed use and greater than once daily crack smoking and greater than once daily injection of heroin, cocaine and/or speedballs (a mixture of heroin and cocaine), binge drug use, and non-fatal overdose. Drug treatment use was assessed with available data and included being denied drug treatment, access of methadone maintenance therapy (MMT) and drug treatment (excluding MMT). Sex-work involvement was defined as exchanging sex for money, goods, drugs, or shelter and unprotected sex was defined as vaginal and/or anal intercourse without a condom with regular, casual and/or client partners. Binge drug use is a common local term referring to higher than
usual use of drugs, often characterized by several consecutive days and nights of high intensity injection drug use\textsuperscript{18}.

\textbf{4.2.2 Statistical analyses}

We used contingency table analysis to compare baseline socio-demographic and sexual and drug related variables between young injection drug users (≤ 29 years) and older injection drug users (≥ 30 years). Chi-square and Fischer’s exact tests where appropriate were used to compare variables between the two groups. Since longitudinal data was available with serial measures for each subject, we used generalized estimating equations (GEE) for binary outcomes with logit link\textsuperscript{19} for the analysis of correlated data to determine which factors were associated with younger age (≤ 29 years) in the prior six months throughout the 115-month follow-up period. These methods provided standard errors adjusted by multiple observations per person using an exchangeable correlation structure. In this case, participants aging past age 29 years during the study period then contributed to the older age category ensuring that any correlations found were attributable to younger age. Thus, data from every participant follow-up visit among those aged 29 years and younger was considered in these analyses. For instance, an individual participant may have gone in and out of jail or used heroin frequently or not during follow-up and this approach serves to examine behaviors and characteristics throughout the follow-up period that correlated with younger age both within individuals and between individuals. This approach has been used successfully in previous studies examining correlates of drug treatment access in prospective cohort studies of IDUs\textsuperscript{19}. Variables potentially associated with younger age were examined in bivariate GEE analyses. In order to adjust for potential confounding we also fit a multivariate logistic GEE model using an \textit{a priori} defined model building protocol of adjusting for all variables that were statistically
significant at the $p < 0.10$ level in bivariate analyses in the previous six months for reasons described above. To ascertain drug use patterns over time, regression analyses was used to test for trends among younger and older IDUs by calendar year. If participants completed both observation periods during a given calendar year, data from the first visit was used. All statistical analyses were performed using SAS software version 8.0 (SAS, Cary, NC). All p-values are two sided.

4.3 Results

4.3.1 Study population

In total, 1598 participants had been enrolled into the VIDUS project between May 1996 and the end of December 2005, among whom 582 (36%) were aged 29 years and younger. During 1996-1997, 1165 (72.9%) subjects were enrolled in the study, and only 198 (12.4%) were enrolled during 2000-2005. Of these individuals, 1381 (86.4%) had at least one follow-up visit, and 314 (19.6%) have died since enrollment. Overall, these participants contributed to 13,921 observations during the follow-up period and the median number of follow-up visits was 10.

4.3.2 Baseline results

With respect to socio-demographic variables, in comparison to older IDUs, younger IDUs were more likely at baseline to (please refer to table 4.1): initiate injection drug use in early adolescence ($\leq 16$ years), have been injecting a shorter duration, be female, homeless, and incarcerated in the previous 6 months. With respect to sexual and drug related variables, younger IDUs were more likely to: engage in sex work (both females and males), have been sexually abused, engage in unprotected sex, non-injection opiates and speed, and use crack and
inject heroin at least daily, require help injecting and be denied access to treatment. Younger IDUs were less likely to access drug treatment (excluding MMT) and MMT. There was no difference between younger and older IDUs with respect to Aboriginal ancestry, consuming alcohol and injecting cocaine and speedballs at least daily, and borrowing or lending used syringes.

4.3.3 Longitudinal results

The bivariate GEE analyses (refer to Table 4.2) indicates that all socio-demographic and risk factors considered were significantly associated with younger age, with the exception of Aboriginal ancestry which did not differ statistically. Factors positively associated with younger age were: female sex, homelessness, incarceration, sex work, borrowing used syringes, non-fatal overdose, binge drug use, and at least daily injection of heroin, cocaine, and speedballs. Factors negatively associated with younger age were HIV and HCV-positivity and accessing drug treatment and MMT. In the multivariable model, younger people who use injection drugs remained more likely over time to be: female, homeless, incarcerated, engage in sex work, borrow syringes, experience a non-fatal overdose, and use injection heroin and cocaine at least daily. Younger age was inversely associated with HIV and HCV prevalence, daily crack use, drug treatment and methadone maintenance therapy.

4.3.4 Trends over time

Drug use trends between the years 1997 and 2005 revealed that younger age was consistently associated with daily use of injection heroin, speedballs and crack use, while the use of injection cocaine was similar to the patterns of older injection drug users. More recently, the use of crystal methamphetamines has garnered concern in many settings,
particularly among younger populations, however in this population, crystal methamphetamine use has risen and should be noted, but was used relatively infrequently. In addition, HIV and HCV incidence rates have dropped since the initial outbreak in 1997, however incidence rates have generally remained elevated among the younger IDUs (refer to Figures 4.1 and 4.2).

4.4 Discussion

This study identified several important factors relating to younger age and injection drug use that have implications for the development of social and structural level interventions. First, higher percentages of younger IDUs consistently used injection and non-injection drugs at least daily over time compared to older IDUs. Second, compared to older IDUs, younger injectors had consistently different and elevated risk profiles over time including higher proportions of females, elevated drug use, engaging in sex work, greater use of borrowed syringes, homelessness, bingeing, and risk for non-fatal overdose. Third, despite the greater percentages of younger IDUs injecting heroin and other drugs frequently as well as engaging in higher risk behaviours, younger participants were less likely to access MMT or drug treatment programs at baseline and over time. These findings help to explain excess risk for blood-borne infection among younger IDUs. In addition, the greater proportion of younger IDUs initiating injection drug use at age 16 years and younger and the fewer years injecting at baseline suggest that important injection drug use contexts may exist early on following initiation of injection drug use that elevate risk for blood-borne infection among younger IDUs. A study by Bailey et al suggested that while frequent needle exchange program (NEP) use predicted lower risk behaviours among younger IDUs, the majority did not use NEP services\textsuperscript{20}. Thus, despite higher risk behaviours among younger IDUs, this data and other studies suggest lower access of services such as NEPs, available substitution therapies and
treatment. These findings are worrisome and indicate that those at highest risk are not accessing available services at appropriate levels and underscore the need to develop youth friendly services that attract and retain this vulnerable population.

There are several theoretical perspectives that may explain the higher percentage of younger IDUs engaging in higher risk behaviours. Adolescent theorists have suggested that adolescence is a period in life characterized by greater risk taking and experimentation, particularly where drugs and sexual behaviours are concerned \(^\text{21-23}\). Furthermore, in populations of IDUs, this theory of development may hold true for older adolescence because it has been postulated that victims of childhood abuse and neglect may be more delayed in their emotional development and greater proportions of young IDUs have experienced childhood abuse and neglect than the general population \(^\text{24-27}\). The prevalence of childhood sexual abuse in this young population is exceedingly high, particularly among young females \(^\text{28}\). These findings highlight the need for younger and older adolescent specific interventions including ones that address addiction holistically including consideration for sexual abuse.

This study indicates that younger IDUs were more likely to engage in frequent heroin use than older IDUs. Few cohort studies have examined injection heroin and the associated risks among younger IDUs, however data from treatment based populations suggest that more recently there has been a rise in younger individuals entering treatment for injection heroin dependency \(^\text{29,30}\). In this study younger IDUs were less likely to access methadone despite the higher proportion injecting heroin frequently, in fact only a small percentage reported accessing MMT or any other kind of drug treatment. Other studies have shown that the average age of people entering MMT are in their 40’s \(^\text{31,32}\). In addition, studies have shown that younger IDUs do not relate to drug treatment models that have not been specifically
designed for them\textsuperscript{33}. These findings highlight the need to engage and work with young IDUs to develop and implement effective and accessible drug treatment strategies, including heroin substitution therapies.

Young injectors were also significantly more likely to use non-injection opiates than older IDUs. Studies have highlighted non-injection heroin use and its relationship to initiation of injection heroin among younger IDUs and more recently, studies have suggested that some heroin injectors have switched to smoking heroin to reduce the harms\textsuperscript{33}. While smoking heroin does not have the same intensive effects of injecting, working with heroin dependent youth to help stabilize their addictions and promote other means of using heroin may be a short term opportunity for intervention with this population to reduce the harms associated with injection drug use\textsuperscript{3}.

In addition to at least daily heroin use, almost half of the younger IDUs in our study smoked crack cocaine daily. Other studies have highlighted the harms associated with crack use including higher risk sexual practices\textsuperscript{11, 34}. Anecdotal evidence suggests that the relationship between heroin dependency, crack use and sex work requires further investigation particularly for young women dependent on clients and/or pimps to sustain their habits\textsuperscript{35}. Crack may be one way that young IDUs stay awake and balance out the subduing effects of heroin. The continued rise in crack cocaine use in this population is concerning and has implications for the types of treatment programs developed for this population. There is clearly a need to develop novel treatment approaches that address polysubstance abuse of this kind and among younger populations.

In this study, we found that younger IDUs were more likely to be homeless than older IDUs. Other studies have shown homelessness to be associated with additional harms among people who use injections such as greater public injecting and greater HIV and HCV related
harm[s][36-38]. In urban centers, such as Vancouver, where vacancy rates are low, rental costs are high and social housing is rare, addicted youth may have a harder time accessing housing and may be caught in a cycle whereby their addictions are creating problems with access to housing and being homeless is causing increased drug related harms. Homelessness among this young vulnerable population requires additional research and offers a potential avenue for public health interventions through the implementation of youth specific housing programs.

While frequent cocaine injection helped explain elevated HIV incidence in this setting during the outbreak of HIV infection in 1996-1997 among people who use injection drugs, cocaine injection itself does not offer the complete explanation for the continued elevated risk for blood-borne infection among younger people who use injection drugs[39]. Crystal methamphetamine use, particularly among younger populations, has been gaining concern, however among this population, drug use trends revealed that crystal methamphetamine use remains low[13]. Younger people who use injection drugs have distinct drug use and risk profiles including more frequent use of injection heroin and crack. Innovative treatment programs such as substitution therapies that attempt to stabilize addictions by using combined prescriptions and education around alternatives to injection drug use (eg: smoking heroin), may help to retain younger, high risk IDUs and stabilize behaviours as a temporary harm reduction measure. In addition, innovative treatment programs that attract and retain heroin and crack cocaine dependent young people such as prescription heroin and cocaine may help reduce blood-borne infection transmissibility among younger IDUs at highest risk.

4.5 Limitations

There are several important limitations that should be considered. The first is our non-traditional use of age as a dependent variable in longitudinal analyses. While it may be
challenging to generalize these data to other young populations of people who use injection drugs, we used this method to ensure greater generalizability by having participants who aged past 29 years contribute information to the older age category thus helping to confer the associations with younger age. In addition, due to resource limitations, there have been fewer participants enrolled into the study in recent years, thus the HIV and HCV incidence rates may be lower then in the general population of young people who use injection drugs as the number of young people at higher risk may become diluted over time. However, the VIDUS cohort represents approximately one third of the estimated number of people who use injection drugs in the area. Socially desirable responding is always a possibility in studies that rely on self-report, and reporting stigmatized behaviours, such as syringe borrowing, may have been underestimated because of this tendency\textsuperscript{40}.

4.6 Interpretation

The consistently lower HIV and HCV prevalence over time and the spikes in incidence, combined with the higher risk drug patterns and the lower access of treatment strategies, suggest that windows of opportunity for prevention exist. However young people require specific and tailored interventions. The consistently elevated incarceration of young people is a short term and ineffective solution to the public health crisis associated with injection drug dependency in this young population. Including young people who use injection drugs in the development of innovative interventions such as substitution therapies, drug treatment, needle exchange services, sex worker resources and safer crack use strategies may improve the overall access of services and reduce the harms associated with injection drug use among young people.
4.7 References


2. Fennema, JS, Van Ameijden, EJ, Van Den Hoek, A, Coutinho, RA. Young and recent-onset injecting drug users are at higher risk for HIV. Addiction 1997; 92:1457-65.


17. Fennema, JS, Van Ameijden, EJ, Van Den Hoek, A, Coutinho, RA. Young and recent-onset injecting drug users are at higher risk for HIV. Addiction. 1457-65, 1997 Nov.


Table 4.1  Baseline sociodemographic characteristics and sexual and drug related risk variables between younger (aged ≤ 29 years) and older (aged ≥ 30 years) VIDUS participants

<table>
<thead>
<tr>
<th></th>
<th>Younger IDUs (582, 36%)</th>
<th>Older IDU (1016, 64%)</th>
<th>Odds Ratios [95% CI]</th>
<th>*p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at First Fix</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 16 years</td>
<td>221 (38)</td>
<td>334 (33)</td>
<td>1.25 (1.01-1.55)</td>
<td>0.039</td>
</tr>
<tr>
<td>Years Fixing</td>
<td>4 (IQR: 1-8)</td>
<td>16 (IQR: 6-24)</td>
<td>0.83 (0.81-0.84)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>274 (47)</td>
<td>309 (30)</td>
<td>2.04 [1.65-2.51]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>167 (29)</td>
<td>265 (26)</td>
<td>1.14 [0.91-1.43]</td>
<td>0.258</td>
</tr>
<tr>
<td>Homeless</td>
<td>150 (26)</td>
<td>62 (6)</td>
<td>5.34 [3.89-7.34]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Jail/Youth Detention</td>
<td>216 (37)</td>
<td>317 (31)</td>
<td>1.30 [1.05-1.61]</td>
<td>0.016</td>
</tr>
<tr>
<td>Sex Trade</td>
<td>258 (44)</td>
<td>202 (20)</td>
<td>3.21 [2.56-4.02]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>197 (72)</td>
<td>153 (50)</td>
<td>2.61 [1.85-3.68]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male</td>
<td>61 (20)</td>
<td>49 (7)</td>
<td>3.32 [2.22-4.96]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex Abuse</td>
<td>237 (41)</td>
<td>354 (35)</td>
<td>1.28 [1.04-1.58]</td>
<td>0.029</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>465 (80)</td>
<td>708 (70)</td>
<td>1.73 [1.36-2.20]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non-injection opiates</td>
<td>350 (60)</td>
<td>466 (46)</td>
<td>1.78 [1.45-2.19]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≥ 1 Daily Crack</td>
<td>57 (10)</td>
<td>61 (6)</td>
<td>1.70 [1.17-2.48]</td>
<td>0.005</td>
</tr>
<tr>
<td>≥ 1 Daily Heroin</td>
<td>268 (46)</td>
<td>283 (28)</td>
<td>2.21 [1.79-2.74]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≥ 1 Daily Cocaine</td>
<td>191 (33)</td>
<td>357 (35)</td>
<td>0.90 [0.73-1.12]</td>
<td>0.347</td>
</tr>
<tr>
<td>≥ 1 Daily Speed</td>
<td>79 (14)</td>
<td>115 (11)</td>
<td>1.23 [0.91-1.67]</td>
<td>0.184</td>
</tr>
<tr>
<td>Borrow</td>
<td>209 (36)</td>
<td>380 (37)</td>
<td>0.94 [0.76-1.16]</td>
<td>0.552</td>
</tr>
<tr>
<td>Hard to Find Needles</td>
<td>53 (9)</td>
<td>85 (8)</td>
<td>1.10 [0.77-1.57]</td>
<td>0.612</td>
</tr>
<tr>
<td>Help Injecting</td>
<td>269 (46)</td>
<td>397 (39)</td>
<td>1.34 [1.09-1.65]</td>
<td>0.005</td>
</tr>
<tr>
<td>Overdose</td>
<td>290 (50)</td>
<td>551 (54)</td>
<td>0.84 [0.68-1.03]</td>
<td>0.090</td>
</tr>
<tr>
<td>Drug Treatment</td>
<td>393 (68)</td>
<td>788 (78)</td>
<td>0.60 [0.48-0.76]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Deny Treatment</td>
<td>131 (23)</td>
<td>187 (18)</td>
<td>1.29 [1.00-1.66]</td>
<td>0.048</td>
</tr>
<tr>
<td>MMT †</td>
<td>33 (6)</td>
<td>139 (14)</td>
<td>0.38 [0.26-0.56]</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*All reported p-values are two-sided; † MMT = methadone maintenance therapy.
Table 4.2  Bivariate and multivariate GEE* of factors associated with younger age
(<29 years) during follow-up (n = 1598)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
<th>p-value</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV ♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>0.58 (0.49 – 0.69)</td>
<td>&lt; 0.001</td>
<td>0.75 (0.63 – 0.90)</td>
<td>0.002</td>
</tr>
<tr>
<td>HCV ♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>0.35 (0.28 – 0.44)</td>
<td>&lt; 0.001</td>
<td>0.37 (0.29 – 0.47)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(female vs. male)</td>
<td>1.99 (1.63 – 2.45)</td>
<td>&lt; 0.001</td>
<td>2.04 (1.66 – 2.51)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Aboriginal ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.14 (0.92 – 1.42)</td>
<td>0.236</td>
<td>1.06 (0.84 – 1.34)</td>
<td>0.615</td>
</tr>
<tr>
<td>Homeless †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.15 (1.06 – 1.24)</td>
<td>0.001</td>
<td>1.11 (1.02 – 1.20)</td>
<td>0.014</td>
</tr>
<tr>
<td>Incarceration †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.22 (1.15 – 1.30)</td>
<td>&lt; 0.001</td>
<td>1.16 (1.08 – 1.24)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex work †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.51 (1.38 – 1.66)</td>
<td>&lt; 0.001</td>
<td>1.35 (1.23 – 1.48)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Borrowed syringes †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.24 (1.17 – 1.32)</td>
<td>&lt; 0.001</td>
<td>1.08 (1.01 – 1.16)</td>
<td>0.019</td>
</tr>
<tr>
<td>Non-fatal overdose †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.27 (1.20 – 1.35)</td>
<td>&lt; 0.001</td>
<td>1.09 (1.01 – 1.16)</td>
<td>0.018</td>
</tr>
<tr>
<td>Binge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.15 (1.10 – 1.21)</td>
<td>&lt; 0.001</td>
<td>1.04 (0.99 – 1.09)</td>
<td>0.128</td>
</tr>
<tr>
<td>≥1 daily heroin †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.25 (1.17 – 1.35)</td>
<td>&lt; 0.001</td>
<td>1.11 (1.03 – 1.19)</td>
<td>0.008</td>
</tr>
<tr>
<td>≥1 daily cocaine †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.18 (1.11 – 1.26)</td>
<td>&lt; 0.001</td>
<td>1.07 (1.00 – 1.15)</td>
<td>0.042</td>
</tr>
<tr>
<td>≥1 daily speedball †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>1.15 (1.04 – 1.27)</td>
<td>0.007</td>
<td>1.01 (0.91 – 1.12)</td>
<td>0.908</td>
</tr>
</tbody>
</table>
### Table 4.2  Bivariate and multivariate GEE* of factors associated with younger age (≤29 years) during follow-up (n = 1598) (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odds Ratio (95% CI‡)</th>
<th>p-value</th>
<th>Adjusted Odds Ratio (95% CI‡)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1 daily crack †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>0.85 (0.79 – 0.91)</td>
<td>&lt;0.001</td>
<td>0.85 (0.79 – 0.92)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Drug treatment †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>0.74 (0.70 – 0.80)</td>
<td>&lt;0.001</td>
<td>0.93 (0.86 – 0.99)</td>
<td>0.041</td>
</tr>
<tr>
<td>MMT †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(yes vs. no)</td>
<td>0.65 (0.58 – 0.72)</td>
<td>&lt;0.001</td>
<td>0.77 (0.68 – 0.87)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: * GEE = Generalized Estimating Equation; ‡ CI = Confidence Interval; † Denotes activities/events in the previous 6 months; * Prevalence estimates per follow-up period; all statistically significant variables shown in univariate GEE analysis were included in the multivariate GEE analysis.
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005

Panel 1: Frequent injection cocaine
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 2: Frequent crack use
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 3: Frequent heroin injection
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 4: Frequent speedball injection
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 5: Crystal methamphetamine use
Figure 4.1: Drug use trends by calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 6: Crystal methamphetamine injection
Figure 4.2: HIV and HCV incidence rates per calendar year among younger and older participants between 1997 and 2005

Panel 1: HIV incidence
Figure 4.2: HIV and HCV incidence rates per calendar year among younger and older participants between 1997 and 2005 (continued)

Panel 2: HCV incidence
CHAPTER 5

A QUANTITATIVE AND QUALITATIVE EXPLORATION OF CHALLENGES IN PREVENTING BLOOD-BORNE INFECTION TRANSMISSION AMONG YOUNG INJECTION DRUG USERS IN THE CONTEXT OF INJECTION HEROIN DEPENDENCY AND WITHDRAWAL

FOOTNOTE

This chapter will be submitted during summer 2006 and is temporarily noted as:

Miller CL, Spittal PM, Li K, Kerr T, Wood E. Challenges in preventing blood-borne infection transmission among young injection drug users in the context of injection heroin dependency and withdrawal.

Contributions of the candidate:

The candidate designed the study, collected the qualitative data and led in the interpretation of the findings. The candidate also wrote the manuscript.
5.1 Introduction

Among populations of people who use injection drugs, the types of drugs used vary by calendar year, situational and geographical availability and social and peer networks\textsuperscript{1-4}. It is important from a public health perspective to understand the types of drugs used among injection drug users (IDUs) in order to ensure existing interventions are being effectively accessed and others are developed to respond to population needs. For example the number of IDUs smoking crack cocaine has long been on the rise in several North American settings\textsuperscript{5,6}, and in some areas, public health agencies have worked to implement safer crack use strategies including "safer crack kits" to reduce the likelihood of Hepatitis C transmission and mouth sores\textsuperscript{7}. In the mid-1990's several settings in North America, including Vancouver, Canada, witnessed explosive HIV outbreaks among IDUs, attributed in part to, an increase in availability and consumption of injection cocaine\textsuperscript{8,9}. Since this time, public health authorities have worked to increase the availability of clean syringes through the expansion of needle exchange programs to respond to the increased demand due to the frequency of cocaine injection\textsuperscript{10}. However, there is a dearth of recent information regarding heroin injection trends and the associated risks, particularly among young IDUs, a population noted for increased risk for blood-borne infection transmission and overdose death\textsuperscript{11,12}.

The overall prevalence of heroin injection among general populations of young people is relatively low. For example, among high school students in Canada and the United States the figures are estimated to be approximately 2% in both countries\textsuperscript{13,14}. Recent treatment-based population data indicates that treatment seeking injection heroin users tend to be younger with higher proportions being under the age of 25 years than in previous decades\textsuperscript{15-18}. Among general populations of IDUs, injection heroin use has been decreasing over time while other injection drugs have been increasing, however some studies have noted an
association between younger age and more frequent heroin use\textsuperscript{19,20}. There is scant information regarding longitudinal injection heroin use trends among younger IDUs and if heroin injection has similarly decreased in this population. Furthermore, substitution therapy programs available in North America (eg: methadone maintenance therapy [MMT] and bupenephrine) were designed for the treatment of heroin dependency \textsuperscript{21,22}, thus information regarding injection heroin and treatment access trends is important to ensure those who are most in need are accessing available interventions.

Vancouver, Canada has recently expanded the scope and availability of harm reduction strategies including MMT, and currently there is an ongoing trial of prescription heroin, in an effort to reduce the harms associated with injection drug use among the cities IDUs\textsuperscript{23,24}. In cities where multiple substitution therapies are available such as MMT and prescription heroin, the reduction of risk among IDUs has been noted\textsuperscript{25,26}. It is important for cities such as Vancouver, where harm reduction services and structural level interventions are being considered and implemented to understand the population most at risk.

More recently, research on injection drug use has emphasized ecological approaches to investigating the interaction between drug use behaviour and the social context in which it occurs\textsuperscript{27,28}. Concurrently, public health agencies and other interventionists have begun to emphasize the need to change social structures in an effort to respond to persisting public health crisis among IDUs, including blood-borne infection transmission. Thus, researchers are increasingly employing multiple methods of analyses to better understand the context surrounding “risky” behaviour. To this end, qualitative research methods are being used to compliment epidemiologic research, to bring voice to the experience of the “social actors” and to better respond to drug-related harm. It is increasingly recognized that the use of mixed
methods are important for informing prevention and intervention policies, particularly among hidden populations such as young IDUs.

Thus, we undertook this study to characterize injection heroin dependency among young IDUs using both epidemiologic and qualitative methods. Our aim is to inform context specific interventions to help reduce drug-related harms among young IDUs. We used survey data collected over the past decade and also interviewed young participants regarding their experience of injection heroin dependency in Vancouver, Canada where an explosive outbreak of HIV has been recorded and where several structural level interventions are being implemented and considered among IDUs. To date, there has been little emphasis on interventions designed specifically for young IDUs and there is a dearth of information regarding longitudinal drug use and treatment access patterns in this population.

5.2 Methods

5.2.1 Study setting

To give a sense of the setting and some relevant situational factors where this study takes place, Vancouver, Canada differs from many American contexts (and even from several Canadian contexts) in terms of local drug policy. Vancouver was one of the first cities in Canada to identify explosive HIV epidemics occurring among IDUs during the early and mid-1990's. Since this time, there has been a flurry of local research, political debate and programmatic development to respond to this and other drug-related harms among the injection drug using community. Like other settings worldwide, Vancouver's drug policies have been influenced by the political power(s) of the time, and to some extent by external pressures from the US. However, Vancouver has implemented several evidence-based strategies to address drug-related harms among the cities IDU community. Vancouver has
been noted internationally for its progressive drug policy whereby it is the first city in North America to have: expanded the needle exchange program so that it is now one of the largest programs of its kind in North America; opened a supervised safe injection facility (SIF); initiated a heroin maintenance trial; and expanded existing treatment services such as MMT distribution.

Vancouver’s visible injection drug using population is concentrated in a central location known as the Downtown Eastside (DTES). The DTES is Vancouver’s poorest neighborhood where an estimated 4,700 IDUs and 1,000 street youth reside in an area of approximately ten city blocks, and where inexpensive housing in the form of hotels and single room occupancies (SROs) are abundant. A combination of historical and situational factors such as close proximity to a major international port, a long history of drug and sex work availability, concentration of bars and strip clubs, low-income housing and resource allocation have concentrated the cities visible injection drug using community into this geographically small area.

5.2.2 Study population

Participants in the current study were recruited from VIDUS, a prospective cohort study of IDUs who have been recruited through self-referral and street outreach from Vancouver’s Downtown Eastside (DTES) since May 1996. The study site is located in close proximity to major outdoor and indoor gathering points attracting people who use injection drugs. The cohort has been described in detail previously. Briefly, persons were eligible for VIDUS if they had injected illicit drugs at least once in the previous month determined through track site inspection, were aged 14 years and older and resided in the greater Vancouver region. At baseline and semi-annually, subjects provide venous blood samples and
completed an interviewer-administered questionnaire. All participants provide informed consent, and were given a stipend ($20 CDN) at each study visit as compensation for their time. This study has been approved by the University of British Columbia’s Research Ethics Board.

5.2.3 Survey data

Questionnaires elicit socio-demographic, drug and sexual information. Socio-demographic variables in these analyses included: gender, ethnicity (Aboriginal vs. other)\textsuperscript{30}, HIV and HCV-positivity, incarceration and homelessness. Aboriginal is self-reported and includes, First Nations people, Inuit and/or Métis. Homelessness was defined as sleeping on the street and/or in a shelter and/or in a squat and incarceration was defined as being in jail and/or youth detention in the previous six months. All drug use and sexual variables refer to activities in the six months prior to interview. Drug and sexual risk variables included in these analyses were history of sexual abuse, sex work, borrowing used syringes, experiencing a non-fatal overdose, binge drug use, non-injection opiate use, greater than once daily crack smoking and greater than once daily injection of heroin, cocaine and/or speedball (a mixture of heroin and cocaine), access of methadone maintenance therapy (MMT) and drug treatment (excluding MMT) and having been denied access to treatment. Sex-work involvement was defined as exchanging sex for money, goods, drugs, or shelter. Binge drug use is a common local term referred to as an increase in regular use or going on a drug run usually accompanied by several 24-hour periods of heavy drug use\textsuperscript{31}. Injection heroin dependency in these analyses was defined as greater than once daily injection of heroin to capture young IDUs who are both physically and psychologically dependent on heroin and require at least daily injections to avoid the pain associated with withdrawal.
5.2.4. Qualitative interviews

We used purposive sampling methods to recruit young (≤29 years) females (N= 15) and males (N=13) who were actively using injection drugs to ensure the sample included young people with recent experiences with injection drug use. We used iterative data collection and analyses methods, thus were able to inform our sampling at the early stages of recruitment based on emergent findings from the data. Interviews were conducted in the VIDUS office located in the hub of Vancouver’s Downtown Eastside. The majority of interviews were conducted on a drop-in basis during the study sites drop-in hours. Interviews were conducted following obtaining both oral and written informed consent. The initial interview guide was pilot tested with four young IDUs and modified as the interviews progressed to allow for investigation of emerging themes. The interviews explored four main areas of experience; Initiation into injection drug use, sterile syringe acquisition, drug use patterns following initiation and needle sharing vulnerabilities. This qualitative study was exploratory and conducted to address the paucity of young IDUs voice in this setting and to triangulate the quantitative data. The emerging themes regarding injection heroin dependency and dope sickness were driven by young IDUs experience. Thus all youth interviewed were injection heroin experienced and the sample was diversified by degree of dependence. The sampling strategy allowed for us to reach theoretical redundancy whereby no new information was emerging regarding the topics that were explored. All interviews were tape recorded and subsequently transcribed verbatim. Study participants were provided with an honorarium of $20 CDN as compensation for their time.
5.3 Quantitative analyses

We used contingency table analysis to compare baseline socio-demographic and sexual and drug related variables between young injection drug users (≤ 29 years) who use injection heroin frequently (≥ 1 daily) and those who do not. Chi-square and Fischer's exact tests, where appropriate, were used to compare variables between the two groups. Since longitudinal data was available with serial measures for each subject, we used generalized estimating equations (GEE)\(^3\) for binary outcomes with logit link for the analysis of correlated data to determine which factors were associated with frequent heroin injection in the prior six months throughout the 86-month follow-up period. These methods provided standard errors adjusted by multiple observations per person using an exchangeable correlation structure. In this case, participants aging past age 29 years during the study period were removed from further analyses at the time of their 30\(^{th}\) birthday. Thus, repeated measures of every participant aged ≤ 29 years during follow-up visit was considered in these analyses. Variables potentially associated with frequent heroin use were examined in bivariate GEE analyses. In order to adjust for potential confounding, we also fit a multivariate logistic GEE model using an\(\textit{a priori}\) defined model building protocol of adjusting for all variables that were statistically significant at the \(p < 0.10\) level in bivariate analyses. All statistical analyses were performed using SAS software version 8.0 (SAS, Cary, NC). All p-values are two sided.

5.4 Qualitative analyses

Interview transcripts were checked for accuracy. In addition to the interviews, memos were written to record important contextual features and were incorporated into the analyses. Constant comparative techniques were used to identify emerging patterns in the data. During initial analyses of the data a set of codes was generated to capture key constructs. Subsequent
analyses were undertaken to assign data segments to categories and examine negative evidence. This process was repeated until consistency in coding was attained. Overall three major themes emerged from the interviews; 1) types of injection heroin initiation experiences, 2) increased risk for sharing syringes among heroin dependent youth and 3) risks associated with coping with “dopesickness” (heroin withdrawal).

Various strategies were employed to ensure the validity, reliability, and credibility of the data. Memos were taken during each session that included salient information regarding the data. In addition, continual coding was conducted and the interviewer was able to clarify potential themes in additional interviews with young IDUs. Following the development of the initial codes, the data were reviewed by two other, qualified members of the research team and consensus validation was used to confirm emerging categories and placement of transcribed quotes into codes arising from the analyses. A final test for accuracy involved having qualified observers from the research community respond to the categories to ensure they were represented by the data contained in this study.

5.5 Results

5.5.1 Quantitative findings

In total, 582 participants aged 29 years and younger have been enrolled into the VIDUS since May 1996. With respect to socio-demographic variables, younger IDUs who inject heroin frequently were more likely at baseline to (Table 5.1): have a greater number of years injecting, be HCV-positive, female and incarcerated in the previous 6 months. With respect to sexual and drug related variables, younger frequent heroin injectors were more likely to: engage in sex work, inject cocaine and speedballs (a mixture of heroin and cocaine) frequently, experience non-fatal overdose(s) and having sought, but been denied access to
treatment. There was no difference between the two groups with respect to being of Aboriginal ancestry, homeless, sexual abuse, using non-injection opiates, using crack frequently, borrowing used syringes, requiring help to inject, bingeing, drug treatment and MMT use.

In multivariate GEE analyses (Table 5.2), factors associated with frequent heroin injection among younger IDUs were: female sex, incarceration, borrowing used syringes, binge drug use, and frequent cocaine and speedball injection, frequent crack use, and being denied access to drug treatment. Factors negatively associated with frequent heroin injection were being HIV-positive and accessing MMT.

5.5.2 Qualitative findings

Types of experiences surrounding initiation of injection heroin

Most of the young participants spoke candidly about their first injection experience and described very specific details and feelings about the circumstances and the time following the initial injection. All of the young people we interviewed described their first time injecting heroin. Almost all of the young people interviewed had prior drug use experience with narcotics whereby many described smoking crack cocaine and “dragons” (heroin) prior to initiating injection. Most of the young IDUs interviewed did not inject themselves the first time, rather someone else had injected them. There were three main experiences surrounding their initiation into injection heroin use: 1) Experimentation characterized by curiosity and desire for “a better high”, 2) forced and/or coerced and 3) experiencing dopesickness from smoking heroin and needing a more potent dose of heroin to avoid the pain associated with withdrawal. Within these three types of experiences, two salient differences emerged between the three experiences. In the first experience, the youth described having had some level of
control over their initiation and the two other experiences, the youth described having no control or very little.

Young IDUs who expressed having control over the initiation process also described wanting to inject. These youth described convincing others to get and prepare the heroin, and/or inject them with heroin the first time, by saying they had previously injected heroin. Youth in this group, those who expressed control over the initiation process, generally discussed subsequent lower risk patterns whereby they tended to relay greater efficacy around self-care in their drug use patterns. For example some were now accessing MMT treatment, had regular dealers and access to clean needles. Below are some examples of initiating heroin injection among this group:

_"I had always wanted to try injecting but could not find anyone to help me. And it was...when I went into treatment, I met a guy who taught me I guess. We started injecting heroin and right away, I loved the high."_

Female, Age 28

_"I just decided I would try it [injecting heroin] for a different high, see how it felt. And I guess I liked it so I kept doing it for a while._

Male, Age 26

_"I was living with my parents and I was very rebellious I guess. It just made me want to go against everything my parents asked me to do, so I ended up running away from home because I met some guy...I didn’t know he was a drug dealer._
at the time. I lied to him and told him I was wired on down [heroin] so I started
using down then.

Female, Age 24

In contrast, other young people described little or no control over their initiation process. In these instances, the youth described having been forced or coerced into injecting by adults. Five of the young IDUs described initiation by family members, mostly parents and/or foster/adoptive parents, while others described traveling back to their communities and/or families of origin and first initiating there. In small and rural communities in British Columbia, some of the youth said that injection drug use was not so much a case of “if” it happens to them, but “when”, describing crack use and injection drug use as highly prevalent in their communities. Following are quotes by young people who were initiated by family and/or foster caregivers.

I was six years old. My adoptive father injected me but I didn’t really learn how to do it myself until I was 11 years old when I hit (injected) myself and after learning how to hit myself, it kind of scared me and I quit for some time. After that I was 15 and at a time in my life when I was having it rough. I lived here in Oppenheimer Park on a bench for 3 years, homeless and day in and day out, just on the same bench and that was really, really the lowest point in my life for...I just sat there. Eventually it was cocaine and from cocaine I got into heroin, which I was born addicted to and I started mixing both of them and wound up in jail for awhile. It was a time when I wanted to just ground up all my pain and the suffering that I’ve been through and stuff. It was just too much
and I wanted to forget about it and when I look back on it now, I realize that I did not forget.

Male, Age 26

The very first time I fixed was when I was 13 years of age. I didn’t fix myself, my mother and my foster mom fixed me when I was sleeping. I was out cold.

Female, Age 28

The experience of being in a rural community and witnessing drug use was also described by young people, sometimes they described drug houses or “crack shacks” as places they would go to hang out and eventually started injecting there. The following quote describes a rural community in BC where family drug connections facilitated initiation of drug use during early adolescence.

I was 13 years old. I was in Prince Rupert. That’s where I’m from. I was just with some guy that I knew from my uncle. I saw him at parties and stuff like that, and he’s just some guy that sold dope that’s all, the same as everyone else that my uncle hung around with. It was my birthday and the guy was just like...oh I have something to keep you awake all night and whatever so you can party all night for your birthday. And he’s like, “give me your arm”, and I was like, “what are you doing”? And he’s like, “don’t worry, you’ll be up all night”, and I was like “whatever”. He used to come by all the time, by my mom’s place. He used to come over so much that he knew when I’d be home alone. When my Mom would leave and when my Uncle would leave.
Female, Age 24

One particularly disturbing interview (quote below) highlights the ways in which young women / girls can be vulnerable to sexual exploitation in the context of drug using environments. The interview describes a young woman who came to crack use in a rural community in BC following the break up of her relationship and the loss of her baby. At the local “crackshack” she met a much older man who injected her with heroin so that she would “blackout” and other men would come and use her sexually. This same older man brought her to Vancouver’s Downtown Eastside and introduced her to a similar group of men whom she “parties” with as a way to have access to crack, however, these men have ensured that she is wired to heroin so that she is compliant when men use her sexually. In this particular circumstance, the young women describes having never injected herself and is only interested in smoking crack, yet she is addicted to injection heroin. This circumstance highlights the vulnerability of young women who rely on others to inject them and underscores the contextual aspect of needle sharing risk suggesting that the simple availability of clean needles will not always ensure accessibility or use, particularly in these types of contexts where young people have little control over the injection process.

I've wanted my rock [crack] and these guys would hit me high [inject cocaine] and put down [heroin] in my pipe and I didn't know what it was and I'd get fucked right up and fall asleep. At first I was so paranoid... I'd go out to parties or whatever and light it out [use crack] and this is a way for me to have cash and they'd give me whatever to get me high, and I started to realize it was heroin and also I was not quite sleeping, but waiting for something else to
happen and then they'd do what they want to me. I have never personally injected heroin. I have never personally put a needle in my arms, even now... someone else always injects me with down, like the guys I'm partying with...

Female, Age 23

Unfortunately, the above experience describing a relationship between forced / coerced injection heroin initiation and the sexual exploitation of young women by older people, was not an isolated incident. In total 4 of the 13 women described similar experiences of forced initiation into injection drug use by older people for the purposes of sexual exploitation. Below describes another disturbing initiation event.

I told her I was really scared of needles and they actually held me down and put it in my arm, she got her old man to hold me down, lay on me and hold my arm down while she did it. But I was so scared, right. Like they gave me a pretty big hit so they could take advantage of me while I was under, and when I came out of it I was totally naked and that girl was eating me out and stuff and she was feeling me up. It was just harsh, I couldn't believe it, but I was high. I wasn't able to defend myself for nothing right, and I was scared of these people, I was very scared. For about 3 or 4 years, it happened. Then they got me to work the streets for them and everything. They told me I couldn't work the streets by myself because the other girls would take my money and that. But they were taking my money from me. They were making me work the streets for them.

Female, Age 27
In addition to the forced initiation described by some, several youth described initiating heroin injection because they were in physical pain due to dopesickness because they had been smoking “dragons”. Injection heroin dependent young people in this setting used the terms “sick” or “dopesick” for heroin withdrawal and described it as being painful, often associated with muscle and stomach aches, vomiting, diarrhea, cold and flu-like symptoms, lack of energy and/or ability to think clearly. Over time, the youth who were smoking dragons said smoking became no longer effective for reducing their withdrawal pain or symptoms, leading them to initiate injection. In addition to the physical pain of withdrawal, some youth described depression as an additional precursor for initiation. These initiation experiences highlight another way that youth expressed having little control over injection initiation, describing initiating in order to avoid physical and/or emotional pain associated with dopesickness or depression.

*I was hooked onto dragons. The first time I fixed, I did it because I was really, really sick. It was prepared for me. I didn’t know how to do it.*

Female, Age 25

*I was smoking heroin and rock before, so I was really sick and uh...somebody said, well if you fix it then you’ll get better and so he fixed it for me and I got better and it just escalated from there. I was very sick and I had already done heroin...I’d already smoked it and I still didn’t get better so I fixed it and I got better so then I liked it. It was a quick right now I’m better and I’m not sick anymore thing.*
I was like uh... with the mother of my kid, but we lost our kid due to welfare and stuff, so we both got really depressed and heavily into addictions, right. And I started using heroin and I started smoking at first and that wasn’t getting me high enough so I started using needles. The fact I wasn’t getting high on smoking anymore. You get to that point where smoking just makes you feel sick.

Male, Age 26

Following initiation of injection heroin, many of the young people described how heroin became less a drug of choice and more a physical need in order to avoid dopesickness.

After I started injecting heroin, it was like, more and more and more.

Female, Age 25

I thought it (injecting heroin) would be just a trial. And I would only use a needle once, twice a week maybe. And then I got wired to heroin... and then I was getting careless, everyday, all day. Some days it’s six or seven times per day, some days it’s fifteen, eighteen times a day.

Female, Age 28
Another important theme that emerged was the context for increased risk of sharing syringes, particularly among new initiators, associated with injection heroin use. One important finding was that most of the young people interviewed described their dependence on others to inject them both the first time and for a time period following initiation. Some of the young people also said that they did not want to access services such as needle exchanges because they were ashamed of their drug use and were trying to hide it from family and/or friends. Some of the youth relied on sexual partners and others said they would find someone in the alleys or on the street to help them inject. Below are some of the young peoples descriptions of requiring help to inject following initiation.

*My ex used to doc me all the time, because when you first learn how, you can’t do it yourself.*

Female, Age 29

*Um...only when I first started out I needed help and ever since then I haven’t.*

Male, Age 27

*When we started we were just doing each other. And I could do other people but I could never do myself, but now I can, but back then I couldn’t. If I was down on Hastings I’d find somebody who could inject me. If I had a lot of money, I’d take them to my place and they’d shoot me up and I’d get them high right.*

Male. Age 29
Another vulnerable time for young people in terms of sharing syringes was when they were dopesick. Many of the youth talked about needing help to inject their drugs when they were dopesick, including some who required help when dopesick, yet were usually able to inject themselves when they were not experiencing withdrawal symptoms. Many of the heroin injection dependent young people described destroying your veins by using multiple times per day, particularly those who had not been taught to inject themselves properly. Some of the young people, mostly women, described having their sex partners inject them and others described looking for anyone to inject their heroin for them. Many describe the vulnerability of needing to rely on strangers to inject them.

*I can inject myself, but if I’m really, really dopesick, I need somebody else to do it. Most of the time I fix by myself. Being dopesick is worse. It’s even harder on a dopesick person because there’s only one thing on a dopesick mind. If you’re dopesick it’s to get better. You’re not thinking about the clean rig or anything.*

Female, Age 26

*I’ve seen guys who’ve been dopesick pick rigs up out of fucking puddles in the alley to use. Like, when you’re really, really sick it doesn’t matter, right.*

Male, Age 28

*It pissed me right off, like I was really sick and I had a guy who was supposed to be my friend hit (inject) me... he fixed me a little so he could steal mine as*
well and he was supposed to be injecting me. I was in the alley and Insite wasn’t open.

Female, Age 27

*When I’m sick, when I’m really weak or when I’m outside and I’m freezing cold or when I’m too sick to find a vein, I have no veins except for one spot. When I can’t find it, I don’t have patience, it’s just whoever I find that I assume that fixes. When I’m sick or run out of rigs, and nobody’s around I just find someone.*

Female, Age 25

In contrast, some of the young people talked about having greater self-care strategies in their drug use patterns. Some of the young women talked of making sure they always had enough money or heroin to avoid getting dopesick, and a couple of young people suggested they were very fearful of sharing needles and avoided it altogether. These youth expressed greater control over their drug use contexts.

*I’ve never had to share needles, I guess I’ve never needed to. I always make sure I have something in the mornings when I wake up so I never get sick so I am never forced into sketchy situations. I have never had to live on the street and I live across from Insite where I usually go to get my rigs and inject sometimes. I work enough to maintain my habit. It’s all about maintenance.*

Female, Age 24
I wasn’t willing to use somebody’s needle. I wasn’t willing to share. It was just in my mind...see I don’t like to kiss so forget about sharing needles, you know what I’m saying. That’s why I still haven’t got nothing, no Hep C, no nothing I haven’t caught. I’m a very cautious kind of guy. I’d rather be safe than sorry. You know, that’s just me...but sometimes you’ll be dope sick and you just want to shoot, I know how it feels. But there’s times when you just have to be strong for the night.

Male, Age 25

Coping with Dopesickness

Heroin withdrawal not only facilitated risk for sharing, but also increased young peoples vulnerability with regards to engaging in sex work and criminal activity. The young men described instances where being dopesick prompted them to engage in criminal activity, several also said that they would do sex work to make money to avoid dopesickness. The men described regret for engaging in both criminal activity and sex work and some said that they had never discussed their engagement in sex work prior to the interview.

Like when I’m dopesick, I’d go do the date, get some money, have some dope, get some dope and then do it and then get another call, do the date, right. And then, nighttime comes around...go to the bar...get drunk, get a call, go do it and just...it just kept going on like that. And I just kept going on until I could barely walk anymore, right. You know, it’s like, oh fuck. Just the fact I was doing it, I just hated myself, like doing the dates. After awhile, I couldn’t even
work anymore, because that was starting to shit and then I started just doing crime and shit. Like I'd break into cars and stuff like that. But I remember when I'd get sick, I wouldn't even think, I'd just do stupid shit right. Like, I tried grabbing this man's wallet one time out of his back pocket but I didn't get it and he grabbed me by the arm and the next thing I know I'm fighting with this guy and then he ended up getting away and taking off. I was like, Oh, god, I can't believe I did that. I'd never do anything like that.

Male, Age 29

The sicker you are, the more desperate you get right. Like, if you're really sick, you won't care as much. When you're sicker, you'll do more, obviously to get money...like more desperate things that you never done before sort of thing, like...everyone goes through that. Well, I mean, like I never thought I'd sell my body before. That's basically what I do now to get my money, the working boys, stuff like that, but you know, I never thought I'd sell my body.

Male, Age 28

If I'm dopesick, I do robberies or whatever, even better, right. So I'm pretty attractive out there I guess around the girls, they like me because they heard I can do good things or whatever, because you do one and then they tell each other. Go out and do a robbery, a B & E, sex trade, whatever, basically anything for money.

Male, Age 22
When I got hooked to heroin, I started robbing people. I remember the first time I did it, I was fucking scared shitless. You know, fuck, how am I going to rob somebody though and sure enough I pulled out a loony or something, “Got some change” then bop, bop, bop, bop, bop. Ya, and I got fucking sick of kicking in doors and I got sick of robbing people. I got sick of breaking into cars and I fucking got introduced to working the streets, which I very rarely talk about to anybody and that was kind of the worst part of my job. I mean, sell my ass, but I mean I had to do fucking other disgusting crap that I never wanted to do, but I thought, I need to get high man.

Male, Age 28

A couple of the men said that their female sex partners would engage in sex work to make money so that they could “cure” the pains of heroin withdrawal. When their partners were not able to get money, the men would resort to robbery or drug dealing.

When I’m sick, sometimes my girlfriend would go out, pull a date, come back and sometimes she wouldn’t come back, she’d just run off and I’d find myself having to pull some stupid shit like a robbery or a B and E....

Male, Age 28
When I'm dopesick, my girlfriend usually takes care of that 'cause she's a working girl. I do my own thing, I don't know, I sell weed or sell crack or something on the side to make my own money but she pretty much sells her ass in the cold, right. I don't really do nothing, I just let her do it, whatever.

Male, Age 26

Sex work is common among the young women in this sample. All of the young injection heroin dependent women in the qualitative sample were currently working in the sex trade. Young women discussed their vulnerability in relation to doing “dates” when they were dopesick. While both men and women discussed engaging in sex work, women also discussed the relationship between physical vulnerability and sex work in the context of experiencing dopesickness whereas none of the men mentioned physical vulnerability in this context. This may be due to an apprehension on the part of the young men to discuss physical vulnerability and sex work, however the association between violence and murder among drug dependent female sex workers has been well documented in this setting and elsewhere\(^{33}\). Heroin withdrawal may be a particularly vulnerable time for young females and these findings underscore the need to develop youth friendly interventions for heroin dependent young women.
Going through withdrawal can be really terrible sometimes because I can’t say that I look or feel well enough to even fake or perform as a working girl and I’ve gotten myself in trouble with that. Definitely, less choosy when you’re dopesick. A lot less weary, a lot less freedom of choice or a lot less leverage or power.

Female, Age 27

You could be standing down here and any man will come up to you and ask you if you want to go make some money and whatever. It doesn’t take long, there’s always perverts around, they’re driving around or whatever. Or somebody will offer you something, right. When I’m sick I’ll do just about anything to not be sick and the perverts kinda know it...

Female, age 27

When I’m sick, I’m not so choosy. The things I do... then I just wanna use more, you know what I mean. It’s like this vicious cycle, where I work, I use, I work, I use, more and more and more. Then I get disgusted with myself and I use more and I work more.

Female, Age 25

5.6 Discussion

In this study, almost half of the young IDUs used injection heroin frequently. In quantitative analyses, youth who injected heroin frequently were more likely to also use other drugs frequently, go on binges, be incarcerated, be denied drug treatment and be less likely to
access drug treatment or MMT. Clearly, current treatment and MMT programs are not attracting those at highest risk for drug-related harms or are not accessible when they need them. Younger IDUs must be made a public health priority for drug intervention services such as drug treatment, MMT and other substitution therapy programs under consideration, including heroin maintenance. Specifically, these programs must consider the needs of not only younger IDUs, but also the needs of young women IDUs due to the higher prevalence of females at risk in this population. To this end, interventions for young IDUs should take into consideration the context in which gender may mediate risk for injection drug use harm, including young female vulnerability to power imbalances in injection administration relationships and the potential for historical or current relationships characterized by sexual exploitation. Thus in addition to making substitution therapies more available, combining pharmaceutical interventions with psychological interventions, such as sexual and physical abuse counseling, may be worth considering.

In 1992, Connors published an award-winning article regarding the challenges faced by IDUs in preventing blood-borne infections in the context of the physical and emotional pain associated with drug withdrawal. In this study, young IDUs described the desperation and vulnerability of acquiring and injecting drugs while being dopesick and many also discussed passionately their desire for self-care, including always trying to use clean needles. The most promoted form of intervention for IDUs in most North American settings to prevent blood-borne infection transmission are needle exchange programs, which rely on the premise that the drug equipment itself, rather than the context under which drugs are injected, are of primary importance for prevention. Grund et al. warned against the over emphasis on drug equipment itself and put forth the need to also understand the context in which drugs are injected in order to recognize and respond to other factors impacting on the risk environment.
for IDUs\textsuperscript{38}. Thus, blood-borne infection prevention, in the context of dopesickness, complicates the efficacy of IDUs to have control over their own self-care and/or their risk environment due to the compelling nature of pain to avoid or avert it. Additional interventions are required that address the context under which drug equipment may be shared, such as during times of dopesickness. Thus, increasing the availability, hours of operation and locations of services where young people can get help injecting, such as safer injection facilities, may be important for this population. In addition, greater access to substitution therapies such as MMT, buprenephrine and heroin maintenance among younger IDUs may support them in avoiding the harms associated with dopesickness\textsuperscript{39-41}.

Several youth in this study described early relationships between parents, extended families, foster parents and communities of origin and initiating injection, raising the issue of control over drug use behaviour among vulnerable young people. Additionally, in a separate study, we found that almost 40% of this sample began injecting at age 16 years and younger\textsuperscript{42}. For some youth, injection drug use may be less of a behavioural choice, and more of a coping mechanism that has been introduced to them and normalized within their social and environmental contexts\textsuperscript{43, 44}. The high prevalence of criminalization, the low prevalence of drug treatment and MMT uptake, combined with the accounts of early childhood exposure and forced initiation of injection drugs, suggests that our social safety net is failing to adequately respond to vulnerable youth. Increasing access to harm reduction services and drug treatment for vulnerable youth, including those in rural communities, is important for supporting these youth to avoid criminal behavior and find alternate means for coping with drug addiction.

Some of the youth discussed non-injection heroin and other non-injection drug use prior to initiating injection heroin. Youth also discussed depression in relation to initiating injection heroin use. Depression among young drug users who are not yet injection drug
dependent may be worth further exploration, particularly among young people who are coping with the loss of a child through child apprehension\textsuperscript{45, 46}. One potential target population for intervention are youth who smoke crack and/or heroin and are not yet injection drug dependent. Providing harm reduction education around safer injection drug use, including vein care education for adolescents at risk or for those recently initiating injection drug use, may decrease young people’s need for requiring others to help them inject following initiation\textsuperscript{47, 48}. In addition, involving vulnerable youth in the development and operation of needle exchanges may reduce needle exchange program use stigma among youth who are recent initiators and attract these youth sooner to harm reduction services following initiation. Another potential avenue for reducing the risk of initiation into injection drug use may be providing substitution therapy to non-injection opiate drug dependent youth to help them avoid the pain of withdrawal symptoms before they start injecting\textsuperscript{16}.

For young women, dopesickness can mean vulnerability in sex work by reducing their ability to make careful decisions regarding their sexual partners, potentially putting themselves at risk physically and emotionally\textsuperscript{33, 49}. In this study, several young men discussed sex work, and some also discussed putting themselves at risk with the law, in the context of avoiding dopesickness. The association between injection heroin dependence among young people in this setting and incarceration, may be explained by the severity of dependence on heroin and other drugs and the desperation to avoid getting sick, underscoring this population for targeted interventions. In particular, young women and men who are injection heroin dependent may require interventions to address the gendered risks associated with sex work and criminal vulnerability\textsuperscript{50}. In addition to increasing accessibility to youth friendly substitution therapies and supervised safer injection facilities, employment and housing programs for young sex
workers may help to reduce drug-related harms\textsuperscript{51}. Any interventions, existing or proposed, must include experiential youth in their development and implementation.

This study has several limitations that should be noted. This study interviewed IDUs with several years experience with injecting and therefore familiarity with local injection drug use resources. Thus, a more accurate description of recent experiences with initiation into injection drug use may be found among street youth and younger vulnerable youth at risk of transitioning to injection drug use. In addition, the data was obtained through self-report and may therefore be susceptible to socially desirable reporting. Finally, this study was not designed to evaluate the use of treatment services by younger IDUs, thus a youth participatory evaluation of services would strengthen our knowledge and ability to respond to the needs of this vulnerable population.

Vancouver, BC has implemented several structural level interventions to cope with drug-related harms among the city’s injection drug using population\textsuperscript{52}. Existing programs, and those being considered must ensure that they are attracting the most vulnerable; Vancouver’s young IDUs. MMT and any other substitution programs that may become available need to consult with young IDUs to ensure these programs are accessible and available to this population. Considering context specific factors such as vulnerability to drug-related harms in relation to dopesickness and recent initiation experiences may increase our capacity to reduce injection drug use initiation and associated harms in this population.
5.7 References


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Table 5.1  Baseline sociodemographic characteristics and sexual and drug related risk variables between younger (aged ≤ 29 years) participants who inject heroin frequently (≥1 daily) and those who do not (N=582)

<table>
<thead>
<tr>
<th></th>
<th>≥ 1 daily heroin users (268, 46%)</th>
<th>≤ 1 daily heroin users (314, 54%)</th>
<th>Odds Ratios [95% CI]</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years fixing</td>
<td>5 (IQR:2-8)</td>
<td>4 (IQR:1-7)</td>
<td>--------</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HIV</td>
<td>36 (13)</td>
<td>56 (18)</td>
<td>0.72 (0.45-1.13)</td>
<td>0.147</td>
</tr>
<tr>
<td>HCV</td>
<td>168 (63)</td>
<td>158 (50)</td>
<td>1.66 (1.19-2.31)</td>
<td>0.003</td>
</tr>
<tr>
<td>Female</td>
<td>149 (56)</td>
<td>125 (40)</td>
<td>1.89 (1.36-2.63)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>71 (26)</td>
<td>96 (31)</td>
<td>0.82 (0.57-1.18)</td>
<td>0.278</td>
</tr>
<tr>
<td>Homeless</td>
<td>74 (28)</td>
<td>76 (24)</td>
<td>1.20 [0.82-1.73]</td>
<td>0.349</td>
</tr>
<tr>
<td>Jail/youth detention</td>
<td>115 (43)</td>
<td>101 (32)</td>
<td>1.59 [1.13-2.22]</td>
<td>0.007</td>
</tr>
<tr>
<td>Sex Trade</td>
<td>137 (51)</td>
<td>121 (39)</td>
<td>1.67 [1.20-2.32]</td>
<td>0.003</td>
</tr>
<tr>
<td>Sex Abuse</td>
<td>117 (44)</td>
<td>120 (38)</td>
<td>1.25 [0.90-1.75]</td>
<td>0.183</td>
</tr>
<tr>
<td>Non-inject opiates</td>
<td>157 (59)</td>
<td>193 (61)</td>
<td>0.89 [0.64-1.24]</td>
<td>0.479</td>
</tr>
<tr>
<td>≥ 1 Daily Crack</td>
<td>32 (12)</td>
<td>25 (8)</td>
<td>1.57 [0.90-2.72]</td>
<td>0.108</td>
</tr>
<tr>
<td>≥ 1 Daily Cocaine</td>
<td>103 (38)</td>
<td>88 (28)</td>
<td>1.60 [1.13-2.27]</td>
<td>0.005</td>
</tr>
<tr>
<td>≥ 1 Daily Speed</td>
<td>60 (22)</td>
<td>19 (6)</td>
<td>4.48 [2.60-7.73]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Borrow</td>
<td>97 (36)</td>
<td>112 (36)</td>
<td>1.02 [0.73-1.44]</td>
<td>0.895</td>
</tr>
<tr>
<td>Help Injecting</td>
<td>115 (43)</td>
<td>154 (49)</td>
<td>0.78 [0.56-1.08]</td>
<td>0.139</td>
</tr>
<tr>
<td>Drug Treatment</td>
<td>32 (12)</td>
<td>46 (15)</td>
<td>0.79 [0.49-1.28]</td>
<td>0.339</td>
</tr>
<tr>
<td>Deny Treatment</td>
<td>78 (29)</td>
<td>53 (17)</td>
<td>2.02 [1.36-3.00]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MMT</td>
<td>14 (5)</td>
<td>19 (6)</td>
<td>0.86 [0.42-1.74]</td>
<td>0.667</td>
</tr>
</tbody>
</table>

*All reported p-values are two-sided. MMT = methadone maintenance therapy.
Table 5.2  Bivariate and multivariate GEE* of factors associated with frequent (≥1 daily) heroin injection among young (≤29 years) people who use injection drugs during follow-up (n = 582)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odd Ratio (95% CI)</th>
<th>p-value</th>
<th>Adjusted Odd Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years fix per year greater 1</td>
<td>1.03 (1.00-1.07)</td>
<td>0.059</td>
<td>1.01 (0.98 - 1.05)</td>
<td>0.437</td>
</tr>
<tr>
<td>HIV * yes vs. no</td>
<td>0.75 (0.57 - 0.97)</td>
<td>0.031</td>
<td>0.59 (0.43 - 0.80)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HCV * yes vs. no</td>
<td>1.27 (0.98 - 1.64)</td>
<td>0.075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender female vs. male</td>
<td>1.76 (1.38 - 2.25)</td>
<td>&lt;0.001</td>
<td>1.71 (1.29 - 2.26)</td>
<td>0.001</td>
</tr>
<tr>
<td>Aboriginal ethnicity yes vs. no</td>
<td>0.84 (0.65 - 1.10)</td>
<td>0.209</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homeless † yes vs. no</td>
<td>1.32 (1.09 - 1.60)</td>
<td>0.004</td>
<td>1.15 (0.94 - 1.40)</td>
<td>0.178</td>
</tr>
<tr>
<td>Incarceration † yes vs. no</td>
<td>1.68 (1.42 - 1.98)</td>
<td>&lt;0.001</td>
<td>1.39 (1.15 - 1.69)</td>
<td>0.001</td>
</tr>
<tr>
<td>Sex work † yes vs. no</td>
<td>1.80 (1.49 - 2.18)</td>
<td>&lt;0.001</td>
<td>1.08 (0.86 - 1.34)</td>
<td>0.512</td>
</tr>
<tr>
<td>Borrowed syringes † yes vs. no</td>
<td>1.85 (1.50 - 2.29)</td>
<td>&lt;0.001</td>
<td>1.15 (1.22 - 1.95)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hard to find* † yes vs. no</td>
<td>1.39 (1.11 - 1.73)</td>
<td>0.003</td>
<td>1.15 (0.89 - 1.48)</td>
<td>0.300</td>
</tr>
<tr>
<td>Non-fatal overdose † yes vs. no</td>
<td>1.57 (1.29 - 1.91)</td>
<td>&lt;0.001</td>
<td>1.00 (0.88 - 1.37)</td>
<td>0.407</td>
</tr>
<tr>
<td>Binge yes vs. no</td>
<td>1.54 (1.32 - 1.81)</td>
<td>&lt;0.001</td>
<td>1.23 (1.03-1.47)</td>
<td>0.023</td>
</tr>
<tr>
<td>≥1 daily cocaine † yes vs. no</td>
<td>2.82 (2.29 - 3.48)</td>
<td>&lt;0.001</td>
<td>2.03 (1.60 - 2.57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≥1 daily speedball † yes vs. no</td>
<td>4.44 (2.97 - 5.51)</td>
<td>&lt;0.001</td>
<td>2.59 (1.87 - 3.60)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Table 5.2  Bivariate and multivariate GEE* of factors associated with frequent (≥1 daily) heroin injection among young (<29 years) people who use injection drugs during follow-up (n = 582) (Continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odd Ratio (95% CI)</th>
<th>p-value</th>
<th>Adjusted Odd Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1 daily crack †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes vs. no</td>
<td>2.07 (1.68 – 2.54)</td>
<td>&lt;0.001</td>
<td>2.03 (1.61 – 2.55)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Deny treatment †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes vs. no</td>
<td>1.77 (1.44 – 2.16)</td>
<td>&lt;0.001</td>
<td>1.48 (1.19 – 1.84)</td>
<td>0.001</td>
</tr>
<tr>
<td>Drug treatment †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes vs. no</td>
<td>0.64 (0.55 – 0.78)</td>
<td>0.001</td>
<td>0.86 (0.69 – 1.07)</td>
<td>0.167</td>
</tr>
<tr>
<td>MMT †</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes vs. no</td>
<td>0.51 (0.38 – 0.67)</td>
<td>&lt;0.001</td>
<td>0.64 (0.46 – 0.89)</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Note:  * GEE = Generalized Estimating Equation; † CI = Confidence Interval; † Denotes activities/events in the previous 6 months; * Prevalence estimates per follow-up period; † Hard to find new syringes; all variables shown in univariate GEE analysis were included in the multivariate GEE analysis
FOOTNOTE

This chapter is under review as:


Contributions of the candidate:

The candidate initiated exploration of the topic, designed the study and directed the statistical analyses. The candidate also wrote the manuscript.
6.1 Introduction

Premature mortality among injection drug users (IDUs) is higher than in the general population with rates of mortality estimated to range between 0.8-3.26/100 person-years\(^1\). Young IDUs are at higher risk for a number of adverse health outcomes, including blood-borne infection, than among young people in the general population\(^3\). In a study of new onset injection drug users, mortality rates varied by calendar year, were elevated in comparison to the general population and were estimated to be 3.3 per 100-person years\(^2\). In 2002, Roy et al. reported that street youth in Montreal, Quebec, aged 29 years and younger, had a standardized mortality ratio of 11.4 and one of the independent predictors of mortality was injection drug use\(^4\). Younger IDUs represent an important group to examine with respect to mortality due to their higher risk for drug related harms\(^5\). Younger IDUs represent an important group to examine with respect to mortality due to their higher risk for drug related harms\(^5\),\(^6\) and the opportunity to offer new information regarding avenues for prevention among this vulnerable population.

Recent studies in the United States and Scotland have found that mortality rates peaked among IDUs in the mid-1990s due to an increase in HIV/AIDS related deaths and have since declined\(^2\),\(^7\). Mortality among IDUs typically results from infectious diseases, overdose and injuries\(^8\)-\(^10\). Overdose is a leading cause of death among IDUs\(^11\) and varies between calendar years depending on factors such as purity and quality of drug availability and potentially on the HIV status among individuals\(^12\),\(^13\). Among IDUs in Edinburgh, Scotland deaths due to overdose and suicide were higher among younger IDUs than among older IDUs, with higher proportions of young males than females dying by suicide\(^7\). In the study of street youth in Montreal, Quebec, overdose deaths and suicide represented the leading causes of premature mortality\(^4\).

Investigating causes of mortality among injection drug users (IDUs) is important not only as a means for understanding risk among this population, but mortality can also be a
measure of well existing public health interventions are working to address drug related harms. Studies have shown increased mortality rates since the advent of AIDS among IDUs, particularly prior to the advent of HIV antiretroviral therapy\(^7,14\). Nevertheless, other studies have shown that IDUs are more likely to die without ever accessing lifesaving HIV treatment when compared to other populations affected by HIV\(^15\). This information provides public health agencies with knowledge regarding a gap in the scope and effectiveness of existing systems of care. Thus, information on mortality can provide critical public health information for authorities to gauge how well existing services have been effective in addressing the ongoing public health crisis among IDUs.

This study was designed to investigate factors associated with mortality prior to age 30 years among young injection drug users and to determine rates and causes of premature mortality in this population.

6.2 Methods

6.2.1 Sources of information on cause of death

The VIDUS office is situated in the hub of the DTES and the office serves as a drop-in where participants regularly stop by for coffee and conversation. The majority of the VIDUS staff have been working in the community for several years and stay connected with residents and other community workers alike. This close community serves as an informal watch and information is shared when residents become missing, ill, incarcerated or die. This informal system is complemented with regular linkages with the provincial Coroner’s Office where the coroner’s report is reviewed for each confirmed death. In addition, deaths among participants were confirmed through the provincial Vital Statistics Agency. Thus, information on cause of death were obtained through regular follow-up, coroner’s reports, and annual electronic
linkages with BC Vital Statistics. The underlying cause of death reported on each death record was coded in accordance with the International Classification of Diseases, Tenth Revision (ICD-10).

6.2.2 Variables included in the present analyses

Socio-demographic variables included in these analyses were gender, ethnicity (Aboriginal vs. other)\(^1\), HIV and HCV-positivity and homelessness. Aboriginal is self-reported and includes: First Nations people, Inuit and/or Métis people. Homelessness was defined as sleeping in the street, shelter and/or squat. Drug and sexual risk variables included in these analyses were history of sexual abuse, sex work, greater than once daily crack cocaine use and greater than once daily injection of heroin, cocaine and/or speedball (a mixture of heroin and cocaine), and use of methadone maintenance therapy (MMT). Sex-work involvement was defined as exchanging sex for money, goods, drugs, or shelter. All risk variables refer to activities in the six months prior to each semi-annual follow-up visit with the exception sexual abuse, defined as ever occurring.

6.2.3 Statistical analyses

In longitudinal analyses (Table 6.3), the follow-up period for each participant started at recruitment and ended at the first of the following events: death or age 30 years. Mortality rates were calculated overall and by subgroups defined by variables selected from the above listed characteristics, based on the literature and sample size. Mortality rates were calculated using the person-time method; 95% confidence intervals (CI) were calculated using the Poisson distribution.
Standardized mortality ratios were calculated using the indirect method of standardization by sex and age group. The comparison group was the Canadian population of the same age in 2000. Abridged life tables were calculated using methods adopted by Lopez et al. at the World Health Organization. Predictors of mortality were identified using univariable and multivariable Cox regression analyses. All variables with p values ≤ 0.05 in univariable analyses were included in Cox regression analyses. All behavioral independent variables were treated as time updated.

6.3 Results

6.3.1 Characteristics of the study participants

Between May 1996 and December 2004, 572 participants aged ≤ 29 years were enrolled into the study. Participants completed between 1 and 15 questionnaires (average 7 per participant; 83% completed at least 1 follow-up questionnaire following the baseline interview). During follow-up 182 participants reached 30 years of age. In total, participants cumulated 1608 person-years of follow-up time prior to age 30 years.

The median age of participants at study entry was 23.9 (IQR: 20.9-26.3) and the number of years injecting was 4 (IQR: 1.5-8). As indicated in Table 6.1, approximately half were female and 29% of Aboriginal ancestry. The percentage of young people HIV and HCV infected was 16% and 57% respectively and 25% were homeless. Of the sex risk variables, 40% reported a history of sexual abuse, 44% engaged in sex work and 80% had unprotected intercourse. Among the young participants, 10% had smoked crack (cocaine) daily, 45% had injected heroin daily, 33% had injected cocaine daily, 14% had injected speedballs (heroin and cocaine combined) daily and 5% had accessed methadone maintenance therapy (MMT).
6.3.2 Mortality results

In total, 42 deaths occurred during the study period, 20 of those occurring after 30 years of age and were excluded from further analyses. Thus, there were 22 deaths that occurred during the follow-up period among participants aged 29 years and younger. Of note, 1 of the observed deaths was classified as "assault" and for this study we included it in the homicide category. Thus, among females, the leading cause of death (refer to Table 6.2) was homicide (n=9) and among males suicide (n=3) and overdose death (n=3). Death due directly to HIV infection occurred among 2 female participants and 1 male participant.

The 22 deaths observed among this population during follow-up represented a mortality rate of 1368 per 100,000 person-years. Among females, the mortality rate was 1645 per 100,000 person-years and among males the rate was 1045 per 100,000 person years. In comparison with the Canadian population of the same age in 2000, young IDUs were 16.4 times (95% confidence interval [CI]; 9.1-27.1) more likely to die; young IDU women were 54.1 times (95% CI; 29.6-90.8) and young IDU men were 12.9 times (95% CI; 5.5, 25.3) more likely to die. At age 15, IDUs could expect to live another 36.8 years, compared to the Canadian population at age 15 who could expect to live another 64.8 years or nearly double the life expectancy of IDUs in this study population.

Univariable and multivariable Cox regression analyses assessing associations between mortality and participant characteristics are presented in Table 6.3. In univariable analyses, factors associated with mortality among the young participants were sex work (Hazard Ratio [HR]; 2.76 [95% CI; 1.16-6.56]) and HIV infection (HR; 4.55 [95% CI; 1.92-10.80]). The only factor to remain significantly associated with mortality among the young participants in multivariable analyses was HIV infection (HR; 4.55 [95% CI; 1.92-10.80]).
6.4 Discussion

The mortality rate observed among this population of young people is high. Young male and female IDUs in this setting had rates of mortality that were 12 and 51 times higher respectively than the Canadian population of the same age. Life expectancy at age 15 years is half of what is observed at a national level. Particularly concerning was the number of deaths due to homicide among the young women participating in the study.

A previous study identified mortality from homicide as the leading cause of death among young homeless males and females in an urban setting in the United States where homicide rates are generally higher than in other developed nations\textsuperscript{18}. However in this Canadian setting where homicide deaths rank low, young drug dependent women appear to be at very high risk of death by this means. The high number of young drug dependent women dying by homicide combined with the generally low rate of homicide in this setting warrants public health intervention, particularly due to the preventable nature of this cause of death. In this study, approximately half of the young IDUs were involved in sex work at baseline and among young females, this figure approaches 80\% (data not shown). In longitudinal analysis, sex work was an important predictor of mortality in this study, however this factor did not reach significance in multivariable analyses likely due to power issues. The relationship between injection drug dependency, younger age, female sex and sex work has previously been shown\textsuperscript{19-21, 22}.

Of note, investigation of Robert Pickton for the serial murders of drug dependent women from Vancouver's Downtown Eastside has recently begun\textsuperscript{23}. This investigation may account for the high number of homicide deaths observed among young women in this setting. Other similar investigations in parts of Mexico and the US (the Green River and Ciudad Juarez serial killer investigations) suggest that women who engage in sex work are at high risk for
being targeted by sexual predators\textsuperscript{24,25}. It has also been suggested by community workers that young women who deal drugs to support their habits rank particularly low in the hierarchy of drug dealing relationships and may be at risk for death by "being made an example of" when using the drugs they are meant to sell. The development of public health interventions to reduce the risk for violence among young injection drug dependent women who engage in sex work is important. More recently, legal reform for sex workers in this setting has been proposed and these findings underscore the need to support legal reform and other harm reduction initiatives for sex workers to reduce the risk of violence and homicide death\textsuperscript{26}. Additional public health interventions require further investigation, particularly qualitative, to ascertain types of interventions that may be acceptable to young injection drug dependent women who also engage in sex work. Given the potentially deadly consequences, considering innovative drug treatment and pharmaco-therapeutic interventions such as prescription drug maintenance may provide effective stabilization and reduce the risks associated with injection drug use including premature mortality in this population\textsuperscript{27}.

In the final Cox model, the only predictor of premature mortality was HIV infection. Similarly, Roy et al. found that HIV was the strongest predictor of mortality among Montreal street youth; however HIV represented a small proportion of the overall causes of death\textsuperscript{4}. The consistency between these results may imply that youth who are vulnerable to premature mortality may also be the ones who are much more likely to be vulnerable to blood borne infections.

Similar to other findings regarding mortality among younger age groups and males in particular, death by suicide and overdose were common\textsuperscript{28}. In this study, the deaths by overdose were not deemed intentional by coroner reports, however other literature has indicated that overdose may be one of the ways that young people commit suicide and among
young people who use injection drugs, intention may be may be hard to prove. Suicide among young people is always a tragic phenomenon and given the higher risk for suicide of young IDUs, community suicide prevention resources should be mobilized to address the needs of the young IDU community. In addition, ensuring overdose prevention education and tools are accessible to younger IDUs may be important for prevention of premature mortality in this population.

6.5 Study limitations

There are several limitations that should be considered with regards to the data presented here. First, this study sample was relatively small and although a smaller number of associations were considered, power issues may have constrained the longitudinal analyses. The second potential limitation may be the potential for misclassification bias relating to self-reported behaviours, however the interviewers are trained to probe any potentially misleading information and every precaution is taken to assure the participant of confidentiality. Third, there is a possibility that the number of deaths occurring were underestimated, particularly if the participant was lost to follow-up and the death occurred out-of-province. Finally, in this setting, a higher number of homicides were found among young women than in other studies suggesting that these results may represent an anomaly. However, the experiences of sex workers who work without legal protection such as in most North American settings and other settings worldwide, violence and the risk of predation is high and for drug dependent women, the risks may be even greater. There is a need for more research on violence and predation among young women involved in sex work and a need for better protection of their human rights.
6.6 Interpretation

Mortality among injection drug users may be an assumed risk consequential to a high-risk behaviour. However the data presented here suggests that the majority of risk for premature mortality among young IDUs is resulting not from their injection drug use but from preventable causes. Clearly, better public health interventions must be established with this vulnerable population including safe houses and treatment options. In addition, given the ongoing harms associated with sex work, structural changes including legal and policy reform are warranted. The high rates of mortality presented here should send a clear message to public health agencies that young IDUs have unique risk profiles and innovative interventions are required to avert preventable premature mortality among this population.
6.7 References


22. Miller, CL, Spittal, PM, LaLiberte, N, Li, K, Tyndall, MW, O'Shaughnessy, MV, Schechter, MT. Females experiencing sexual and drug vulnerabilities are at elevated risk for HIV infection among youth who use injection drugs. JAIDS. 30(3):335-41, 2002 Jul 1.


Table 6.1  Characteristics of the 572 young participants at study entry

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>268 (47%)</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>163 (29%)</td>
</tr>
<tr>
<td>HIV Positive at Baseline</td>
<td>92 (16%)</td>
</tr>
<tr>
<td>HCV Positive at Baseline</td>
<td>326 (57%)</td>
</tr>
<tr>
<td>Homeless in the 6 mos. prior</td>
<td>144 (25%)</td>
</tr>
<tr>
<td>Sex Abuse Ever</td>
<td>231 (40%)</td>
</tr>
<tr>
<td>Sex Work in the 6 mos. prior</td>
<td>252 (44%)</td>
</tr>
<tr>
<td>Sex Without a Condom in the 6 mos. prior</td>
<td>456 (80%)</td>
</tr>
<tr>
<td>≥1 per day Crack in the 6 mos. prior</td>
<td>57 (10%)</td>
</tr>
<tr>
<td>≥1 per day Heroin in the 6 mos. prior</td>
<td>260 (45%)</td>
</tr>
<tr>
<td>≥1 per day Cocaine in the 6 mos. prior</td>
<td>188 (33%)</td>
</tr>
<tr>
<td>≥1 per day Speedballs in the 6 mos. prior</td>
<td>78 (14%)</td>
</tr>
<tr>
<td>Methadone Maintenance Therapy in the 6 mos. prior</td>
<td>31 (5%)</td>
</tr>
</tbody>
</table>
Table 6.2  Profile of cause of death among young injection drug users who died during the study period

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Females No.</th>
<th>Males No.</th>
<th>Total No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicide</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Accident</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Suicide</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>HIV</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Overdose</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Undetermined Illness</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Total No.</td>
<td>14</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>
Table 6.3  Mortality Rates and Cox Regression Analyses of Mortality among Young Injection Drug Users (N= 572)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of Deaths</th>
<th>Mortality Rate per 100,000 Person Years</th>
<th>Unadjusted Hazard Ratio (95% CI)</th>
<th>Adjusted Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older than 24 yrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13</td>
<td>1,679</td>
<td>1.41 [0.60-3.30]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9</td>
<td>1,213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>1,645</td>
<td>1.77 [0.74-4.22]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>1,057</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aboriginal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
<td>1,282</td>
<td>1.07 [0.44-2.62]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>15</td>
<td>1,412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13</td>
<td>3,137</td>
<td>4.55 [1.92-10.80]</td>
<td>4.01 [1.67-9.56]</td>
</tr>
<tr>
<td>No</td>
<td>9</td>
<td>1,035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>1,689</td>
<td>0.96 [0.37-2.51]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>959</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homelessness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>1,220</td>
<td>1.19 [0.44-3.25]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>1,412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>2,159</td>
<td>2.76 [1.16-6.56]</td>
<td>1.97 [0.80-4.84]</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>692</td>
<td></td>
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</table>
Table 6.3  Mortality Rates and Cox Regression Analyses of Mortality among Young Injection Drug Users (N= 572) (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of Deaths</th>
<th>Mortality Rate per 100,000 Person Years</th>
<th>Unadjusted Hazard Ratio (95% CI)</th>
<th>Adjusted Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexual Abuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12</td>
<td>1,829</td>
<td>1.66 [0.72-3.84]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>1,050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1 per day Heroin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10</td>
<td>1,389</td>
<td>0.84 [0.35-1.97]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12</td>
<td>1,351</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1 per day Cocaine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8</td>
<td>1,501</td>
<td>1.40 [0.58-3.37]</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>14</td>
<td>1,302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1 per day Crack</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>2,959</td>
<td>2.41 [1.00-5.81]</td>
<td>1.94 [0.79-4.80]</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>1,181</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 7

GENERAL DISCUSSION AND THESIS SUMMARY

7.1 Introduction

Young people who use injection drugs are important with respect to blood-borne infection transmission in Vancouver, Canada and other cities worldwide coping with injection drug use among their populations\textsuperscript{1-5}. Young people represent the age group at greatest risk for blood-borne infection transmission across populations, however young IDUs are often hidden and hard to reach\textsuperscript{6}. While there was evidence to suggest that younger, recently initiated IDUs were at higher risk for blood-borne infection transmission\textsuperscript{5,7}, there was little data, particularly longitudinal, available to help explain this phenomenon. In addition, there are few studies using combined methods approaches to gain breadth of understanding regarding risk associations and depth of understanding regarding the contextual relationship between individual risk behaviour and socio-environmental factors that contribute to the risk environment for young IDUs\textsuperscript{8,9}.

To address the dearth of available longitudinal and contextual information regarding this vulnerable population, the candidate set out to accomplish 5 main objectives: to review what was known about HIV and Hepatitis C transmission among young IDUs, to identify what age and factors are important with respect to adolescent initiation of injection drug use, to identify what longitudinal drug patterns and drug-related risk factors are associated with younger age, to use combined methods to contribute new information regarding contextual factors contributing to the risk environment among young IDUs, and to determine mortality
rates and patterns among younger IDUs. These findings represent a unique contribution towards providing evidence for the development and implementation of public health interventions for this population. With respect to these five main objectives, the research findings are discussed below. In addition to discussing the findings, recommendations for policy and implementation are made for each of the respective sub-studies found within the chapters of this thesis.

7.2.1 Findings regarding HIV and Hepatitis C Vulnerability (Chapter 2)

Research findings regarding HIV and Hepatitis C (HCV) vulnerability among young IDUs living in Vancouver, have important implications for blood-borne infection prevention and treatment in this context. These findings indicate that, with respect to target groups, young Aboriginal people, particularly Aboriginal females, and young females are the young sub-populations at highest risk for blood-borne infection transmission\(^1\text{,}\text{10,}\text{11}\). Younger IDUs were less likely to be baseline HCV and HIV-positive, however, time from initiation to infection was estimated to be 2 and 4 years respectively among high-risk youth, suggesting that a window of opportunity for prevention exists, but the need to target young sub-populations early on is critical. Thus, specific interventions developed in consultation with young Aboriginal and non-Aboriginal females who either smoke crack or heroin, or who have recently initiated injection drug use, are important for prevention in this setting.

Factors facilitating vulnerability to HIV and HCV infection were frequent crack use and frequent injection drug use, including cocaine, speedballs and heroin. In the study looking at HIV and HCV co-infection, methadone maintenance therapy was found to be protective against infection, suggesting there is a need to develop youth friendly and accessible treatment including drug treatment and substitution therapies for young poly-substance abusers\(^2\).
HIV and HCV vulnerability was also found to be associated with factors relating to issues of gender. Factors emerging from the findings that increase vulnerability to blood-borne infection in this setting included: sexual abuse, sex work, requiring help to inject and having a sex partner who uses injection drugs. These factors require that public health interventions designed for young IDUs use a gender lens to consider the impact that differences in power between young women and men in sexual and injecting relationships have on the risk environment\textsuperscript{12,13}. In addition, in this setting, HIV and HCV prevention among IDUs must consider the impact of multi-generational effects of the residential school system, cultural dislocation and past and present racist policies on higher vulnerability to blood-borne infections among young Aboriginal people\textsuperscript{14-17}. To this end, public health authorities need to acknowledge that high risk behaviour among young IDUs is a complex phenomenon, and for some, injection drug use may be a coping mechanism for physical and emotional pain\textsuperscript{18,19}. Thus, interventions to address high-risk youth must also be complex, potentially long term and holistic, meaning they address not only drug use itself, but the contexts under which injection drug use takes place. Below are specific recommendations for public health agencies to use this research for intervention on blood-borne infection risk among at-risk youth.

7.2.2 Recommendations for Public Health Agencies with regards to vulnerability to HIV and HCV among at-risk youth

1. Existing harm reduction and drug treatment programs, and those under consideration, need to develop strategies for the meaningful participation of young female and Aboriginal people, including current and former IDUs, in the development of policies and programs that are designed for them. Meaningful participation means that the youth are invited to participate in whatever way they can, whether they are high, dopesick, homeless or facing other adverse
circumstances and their contributions and suggestions are listened to and given equal
consideration to those suggested by others.

2. Existing harm reduction and drug treatment programs, and those under consideration, must
consider the high rates of poly-drug use among young IDUs, thus requiring programs that
address withdrawal issues beyond heroin and risk factors other than injection only (e.g. sexual
risk factors that may be associated with other types of drugs such as crack use). Thus drug
treatment and substitution therapy programs require youth participation to address existing
access barriers. In addition to making MMT and possibly prescribed heroin available to
younger IDUs, research regarding the acceptability of other prescription drug substitutes, such
as cocaine, as shorter term solutions to reducing harm among young IDUs, requires further
investigation.

3. Other interventions must also be considered that integrate healing programs for survivors of
sex abuse and sexual exploitation in the context of early injection drug use. In addition, drug
treatment for young men who have worked or continue to work in the sex trade must be
developed to deal with the role that shame may play in injection drug use risk among young
people in this setting.

4. In this setting, there were a number of young IDUs, particularly female and Aboriginal
people, living with HCV and HIV co-infection. It is important that this young population is
being provided with access to the necessary knowledge and available treatment options to stay
healthy.

7.2.3 Recommendations for Implementation

1. The public health authorities in this setting must ensure that they consult with and employ
young Aboriginal, female and male IDUs, including those with current poly-substance use and
sex work experience to inform and prioritize interventions for this population. In addition, rural areas in BC require harm reduction and intervention services for young IDUs and youth at risk for injection drug initiation. Chiefs and elders on Aboriginal reserves must include youth at risk and young IDUs in the development and implementation of harm reduction services.

2. Public health agencies must work with interdisciplinary teams to inform and prioritize interventions. For example, consulting with existing sexual abuse healing and employment programs and integrating them into drug treatment programs for young IDUs may improve the effectiveness of abstinence-based drug treatment. Interventions for this population must also be holistic, multi-stage and realistic (abstinence may not be the goal or realistic for some at-risk youth in the shorter term).

7.3.1 Initiation into Injection Drug Use (Chapter 3)

In the sub-studies noted above, HIV and HCV incidence occurred within a short period of time following initiation into injection drug use. Research findings contributing towards this thesis found that 40% of the young IDUs in this setting initiated injection drug use at age 16 years and younger. Those that initiated injection drug use in early adolescence were more likely to be female, HIV and HCV-positive, engage in sex work and be incarcerated. These findings underscore the need to develop injection drug use prevention programs in this setting.

This study also found that young IDUs were more likely to be incarcerated than to have accessed any form of drug treatment. The primary means for coping with injection drug use and associated harms, continues to be through enforcement policies. Public health agencies, police and the judicial system must work on preventing drug-related harms among young people through other means than incarceration. Juvenile detention may be one
opportunity to consider for injection drug use prevention programs as well as other programs discussed above such as healing and employment programs.

7.3.2 Recommendations for Public Health Agencies Regarding Early Adolescent Initiation into Injection Drug Use

1. The target age for injection drug use prevention interventions should be re-considered. In particular, street youth and at-risk female youth, younger than age 16 years, require injection drug use prevention programs as well as access to harm reduction information in case they do initiate injection drug use.

2. Young adolescents who are engaged in sex work are often hidden. Sex work exiting programs, that include injection drug use prevention and treatment, must be developed that attract and retain high-risk youth in early adolescence. Sexually exploited youth require meaningful participation in the development, implementation and evaluation of these types of programs.

7.3.3 Recommendations for Implementation

1. Injection drug initiation prevention and harm reduction education should occur among younger adolescents. Existing high school programs must be evaluated to determine their effectiveness and changed if they are found to be ineffective. Substitution therapy and drug treatment programs for street youth and youth who smoke crack and/or heroin must be made available to these youth and be an attractive alternative to injection initiation for youth at-risk.
7.4.1 Longitudinal Factors Associated with Younger Age (Chapter 4)

In the previously discussed thesis sub-study, a high proportion of young IDUs initiating injection drug use at age 16 years and younger was found. In the sub-study examining longitudinal factors associated with younger age, younger IDUs had consistently elevated drug use patterns and risk profiles, over time, than older IDUs. Younger IDUs were also found to use poly-drugs, both injection and non-injection, frequently, yet were less likely to access methadone maintenance therapy or other drug treatment. In addition, they were more likely to be at elevated risk for engaging in numerous behaviours associated with drug-related harms such as sex work, binge drug use, borrowing syringes, homelessness and incarceration. This study contributes new knowledge regarding excess risk for blood-borne infection that has been previously found in studies of younger IDUs. This study made novel contributions to research on young IDUs by identifying longitudinal drug use and risk behaviour patterns that were unique to younger IDUs. These findings underscore the need to focus on younger IDUs, as a separate target group from older IDUs, for public health interventions that address their unique and elevated risk profiles.

7.4.2 Recommendations for Public Health Agencies Regarding Risk Patterns Among Younger IDUs

1. Drug treatment and substitution therapies must increase their accessibility and acceptability to younger IDUs and consider their unique risk profiles. For example, drug treatment should be made available on an emergency basis, with no waiting time, particularly for young females who engage in sex work, may be coping with dopesickness, or are on a binge and are seeking out a safehouse to get off the streets temporarily.
2. Substitution therapy programs such as low threshold methadone maintenance therapy and heroin maintenance, if a program begins, must acknowledge that younger IDUs comprise a critical target population, yet they tend not to access these services. These types of programs must be made available to young IDUs and increase their capacity to attract and retain this population.

3. Homelessness is highly prevalent among young IDUs in this setting and housing for high-risk youth should be a public health priority.

7.4.3 Recommendations for Implementation

1. Present health authorities and treatment program managers with this evidence and urge them to consult with young IDUs to explore ways to make interventions more accessible and acceptable to young IDUs, including poly-substance using females involved in sex work and Aboriginal people.

7.5.1 Research Findings Regarding Contextual Factors that Elevate Risk Among Injection Heroin Dependent Young People. (Chapter 5)

In the sub-study previously discussed, longitudinal research findings provided evidence that younger IDUs have elevated risk patterns that differ from older IDUs over time. This previous analyses helped to inform the investigation in this sub-study that examined drug-related harms associated with frequent heroin use among young IDUs using a multi-methods approach. Almost 50% of young IDUs used injection heroin frequently, and those that did were at increased risk for frequent poly-substance use and were also less likely to access drug treatment or available substitution therapies. This sub-study made a unique contribution by
providing evidence that the current drug treatment and substitution therapy models are not adequate or accessible to this young and vulnerable population.

Young injection heroin dependent people were more likely to be incarcerated. In qualitative analysis, the young IDUs talked about the desperation they felt to cure the pains associated with dopesickness, and for many of the youth, this sometimes meant needing to commit crimes or put themselves at risk by not being as careful when choosing sex work clients. Among young IDUs, dopesickness not only increased vulnerability to criminal activity, but also to sharing needles and initiating injection among young heroin smokers. These findings contribute new information to our understanding of risk among young IDUs and suggest that blood-borne infection prevention requires innovative and new programs beyond needle exchange programs.

In this sub-study, young IDUs identified three reasons they initiated heroin injection. The first pathway was dopesickness relating to smoking heroin and being no longer able to cure the pains associated with heroin withdrawal by smoking alone. The second pathway related to curiosity about the injection high and seeking out an opportunity to initiate heroin injection. The third pathway to initiating injection heroin use highlighted by the youth was coercion or forced initiation. Public health agencies need to take heroin smoking and crack use more seriously among young people, particularly among street youth. Education in schools, including in rural communities, regarding the harms associated with heroin, crack and other highly addictive substances, in conjunction with harm reduction education on how to reduce drug-related harm and where to access youth friendly resources such as needle exchanges, may help to reduce transition into injection and the initial harms among those who do transition. Also, reducing opportunities for injection initiation among young people who are curious (e.g. separating addiction treatment for younger and older and injection and non-
injection groups is important as one youth pointed out that she had always been curious about injecting, and it was in drug treatment when she met an older male injection drug user who introduced her to injection drug use) is a public health priority. With respect to the third pathway, consulting young sexually exploited youth to find ways to support, protect and encourage sexually exploited youth to come forward and seek help is critical.

**7.5.2 Recommendations for Public Health Interventions for Heroin Dependent Young People.**

1. Interventions must be developed among at risk young people (e.g. street youth and youth who are smoking crack and/or heroin), prior to drug injection initiation, to support avoidance and provide education around harm reduction practices in case initiation occurs. Harm reduction education for non-IDUs could include proper injection practices, clean syringe access and where to find youth friendly services to get education and help.

2. Current and future drug treatment and substitution therapy programs should consider the impact that dopesickness has on the risk environment in this setting. Risk reduction in this context may require that public health agencies make available 24-hour emergency substitution therapies to reduce the pain, and subsequent high-risk behaviours, associated with dopesickness. In addition, increasing the number of supervised safer injection facilities and the hours of operation may provide additional opportunities for prevention.

3. Young injection and non-injection drug users require separate and multi-stage drug treatment programs, including substitution therapy programs that deal with heroin withdrawal and poly-drug use. These programs must be flexible, realistic (abstinence may not be achieved) and holistic addressing other contextual factors that play into risk such as sexual
exploitation, homelessness, and criminal records relating to drug crime (e.g. offer employment training opportunities).

3. There are children, girls in particular, who are being initiated into injection drug use for the purposes of sexual exploitation. Additionally, other young IDUs discussed the normalization of injection drug use within their communities and families of origin with some citing a parent or foster parent as initiating them. We need to collectively work harder to develop an empathetic, rather than a shaming, lens for young IDUs who find themselves injection drug dependent as a survival or coping mechanism for emotional and physical pain. Hence, public health authorities, police and the judiciary must work towards reducing incarceration rates among young IDUs and develop alternative means to cope with injection drug use among young people.

7.5.3 Recommendations for Implementation

1. Public health authorities should investigate the acceptability of having youth friendly substitution therapy programs, such as 24-hour emergency mobile health clinics that may be able to prescribe effective withdrawal medications for heroin dependent and poly-substance users.

2. Public health authorities need to work with young IDUs to develop transitional models of drug treatment that may start with substitution therapy but graduate to multiple stages of treatment and healing such as relationship and familial counseling, housing, parenting programs, job training and opportunities, and other areas of need that young IDUs themselves identify.
7.6.1 Research Findings Regarding Premature Mortality among Young IDUs (Chapter 6)

In the previous sub-studies, young IDUs have been identified as being at elevated risk for numerous drug-related harms. In turn, these studies have found, despite elevated drug-related harms, that young IDUs are less likely to access available services, while being more likely to be criminalized. In the final thesis sub-study looking at the ultimate drug-related harm – premature mortality, young IDUs were found to have exceedingly high rates of mortality due to preventable causes. Confirmed were the elevated risks for injection drug dependent young women, many of whom were murdered. Mortality rates in this young population are unacceptably high.

7.6.2 Recommendations for Public Health Interventions to Reduce Premature Mortality

1. There are a number of overdose prevention programs among IDUs occurring. Ensuring that younger IDUs are aware of, and are accessing overdose prevention education and services is important.

2. More needs to be done for young injection drug dependent women facing numerous socio-environmental and gender-related harms. Reducing stigma for young drug dependent women around sex work violence may help bring women forward and increase reporting of predators and access of services among this population.

7.6.3 Recommendations for Implementation

1. Ensure public health authorities are aware that younger IDUs are an important and distinct sub-population from older IDUs, and ensure that younger IDUs are accessing available services, including overdose prevention services.
2. Ensure that vulnerable target sub-populations are included in a meaningful way (e.g. through employment opportunities) in the development of interventions designed to reduce harms among young IDUs including sex work violence and dopesickness prevention.

7.7 Summary

In this collection of sub-studies comprising this thesis, new information was collected and confirmed regarding target populations for elevated drug-related harms among young IDUs. This thesis found that almost 40% of young IDUs initiated injection drug use at age 16 years and younger. This study provided new information regarding drug related harms associated with early adolescent initiation as well as information regarding age groups to target prevention and harm reduction information. Novel longitudinal data was also produced confirming elevated risk behaviours among young IDUs, over time, as compared to older IDUs. The mixed methods chapter (Chapter 5) further explored excess risk found among new initiates and found additional vulnerabilities following initiation into injection drug use where young IDUs identified dependency on others to help them inject in the time period immediately following initiation. This finding combined with numerous elevated risks in this age group contributed evidence to help explain the increased burden of risk for blood-borne infection among new initiates found in other studies.

Despite the high levels of drug-related harm found in these studies, young IDUs were less likely to access treatment services. These studies provide evidence that will be shared with public health authorities regarding the distinct and elevated risk profiles of younger IDUs to help inform existing and future interventions for this population. Finally, high rates of premature mortality were found in this setting, particularly among young females, further underscoring the need to target younger IDUs as a separate and unique group to older IDUs.
7.8 Limitations

In addition to the limitations discussed in each of the sub-studies, there are others that should be noted and further discussed. With respect to the quantitative and qualitative samples and generalizability, these studies are not meant to be generalizeable to all other injection drug using populations, but are meant to provide evidence for this setting and information for other urban industrialized settings coping with injection drug use among their young people. Therefore, as with other studies of IDUs, this sample was not random and therefore may not be representative of all IDUs. In particular, it may be the case that young females were over-represented in this sample, however the candidate does not believe this is the case. For example, the Aboriginal sample in the younger group of IDUs mirrors the proportion in the older group (approximately 25% among both the younger and older VIDUS participants) and also reflects the estimated number of Aboriginal IDUs in Vancouver's Downtown Eastside. In addition, other samples of IDUs in other North American settings have found similar proportions of females among younger IDU cohorts.\textsuperscript{7,23}

Another limitation of these studies is the lack of young IDUs participation in the design and analyses. Meaningfully (e.g. employing) including young IDUs in the study process was beyond the scope of this study, however the candidate notes that the omission of their full participation in the study designs, collection and analysis of data, and is an important issue and one that should be considered in the future. Using qualitative methods iteratively with the quantitative data in Chapter 5 allowed the voice of experiential youth to be part of the research process, and the qualitative data was an important and valuable aspect of these studies. In addition, it was beyond the scope of these studies to directly investigate the experiences of young IDUs with drug treatment and available substitution therapies. Thus, future directions
7.9 Future Directions

As injection drug use research matures and moves from descriptive studies to focus more on intervention research, understanding the relationships between behaviours and the socio-environmental context in which they occur become increasingly important. Using mixed methods to understand these relationships is important and future research directions should include the use of mixed methods approaches for examining these relationships. In addition, participatory methods such as action research that increase youth participation and ownership over the research process, where realistic and relevant, are important future directions in order to fully understand the existing risk environment.

Monitoring drug use trends and their relationship to accessing services among young IDUs is important, particularly given emerging trends such as methamphetamine use. Particularly important is the study of street youth in this setting and across Canada. Street youth are an important population with respect to transitioning from non-injection to injection drug use. Street youth may also be an important group with respect to interventions concerning early adolescence, sexual exploitation and injection drug use relationships with older people. Thus supporting street youth cohorts, such as ARYS (the newly launched Vancouver street youth cohort) is important for understanding early vulnerability to drug related harms. In addition, supporting Aboriginal research on youth and drug use is critical in this setting. Studies such as the CEDAR project, a study with sites in Vancouver and rural areas in BC, that have strong Aboriginal partnerships and involvement in the research process must also be supported.
In addition, research that seeks to provide population level information may help in reducing the stigma of injection drug use and provide more political and governmental support for research, treatment and prevention among IDUs. For example, Vancouver Mayor Sam Sullivan recently discussed his new support for harm reduction initiatives by comparing and understanding injection drug use as a “disability” (Mayor Sullivan is a paraplegic). While this comparison may not always be relevant, capitalizing on opportunities to encourage people, particularly those in power, to understand and empathize with people who use injection drugs, by providing consistent scientific evidence, is important. Research that helps to reduce injection drug use stigma may also help to encourage local and national support for the development of interventions beyond incarceration for young IDUs.
7.10 References


APPENDIX 1

VIDUS CERTIFICATE OF ETHICAL APPROVAL
APPENDIX 2

QUALITATIVE CERTIFICATE OF ETHICAL APPROVAL