



HIV/AIDS Among People Who Inject Drugs in Canada

At a Glance

- Injection drug use exposure accounted for 17.7% of cumulative adult HIV case reports and 8.6% of cumulative adult AIDS cases up to December 31, 2008.
- Over the last decade, a decreasing trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend among women has been observed since 2003.
- The 2008 national HIV estimates indicate that the proportion of new HIV infections attributed to injecting drug use (17%) was slightly higher than the estimate in 2005 (16%).
- High levels of risky injection and sexual behaviours were reported in surveillance data and other cross-sectional and cohort studies, which suggest that the potential for transmission of HIV among people who inject drugs (IDU) continues to be significant.
- Research suggests that among IDU, Aboriginal people are disproportionately affected by HIV.
- High levels of injecting and sexual risk behaviours among younger IDU (less than 30 years) are reported across targeted studies, illustrating that this at-risk IDU population is particularly vulnerable to HIV.

Introduction

In the early 1980s, the Canadian HIV epidemic was concentrated among men who have sex with men (MSM). By the early to mid-1990s, there was a change toward increasing transmission among people who inject drugs (IDU), and by 1996 approximately 35.0% of the total number of estimated new HIV infections that occurred in Canada that year were attributed to the use of injection drugs.¹ The Centre for Communicable Diseases and Infection Control (CCDIC) of the Public Health Agency of Canada (PHAC) has recently published national HIV prevalence and incidence estimates for 2008. The 2008 estimates indicate that the proportion of new infections attributed to injection drug use increased slightly to 17.0% in 2008, compared with 16.0% in 2005.² Routine HIV surveillance data show that, in 2008, 19.1% of adult positive HIV tests reported to CCDIC were attributed to injection drug use, down from a peak of 34.0% in 1996.³ This chapter provides an update on the status of HIV/AIDS among IDU in Canada.

Findings from multiple sources are drawn together to provide an update on the status of HIV/AIDS among IDU in Canada. Specifically, the chapter summarizes selected data from the most recently available routine HIV and AIDS surveillance data, data from the most recently available national estimates of HIV in Canada, and selected findings from Phase 2 of I-Track (the national, second-generation HIV surveillance system focused on IDU in Canada). Selected findings from recent research are also presented, including information on the prevalence and incidence of HIV among IDU in Canada and associated factors, as well as findings from research on risk behaviours and correlates of risk behaviour among IDU in Canada. The chapter concludes with a discussion of the strengths and limitations of existing research and provides a summary of the findings presented.

Routine Surveillance

CCDIC collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information that is collected includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, data on death are also collected.

This information is forwarded to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS cases to CCDIC, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, underreporting, missing information and undiagnosed infections. (Please refer to Chapter 3 for a full description of HIV/AIDS surveillance in Canada.)

AIDS surveillance data³

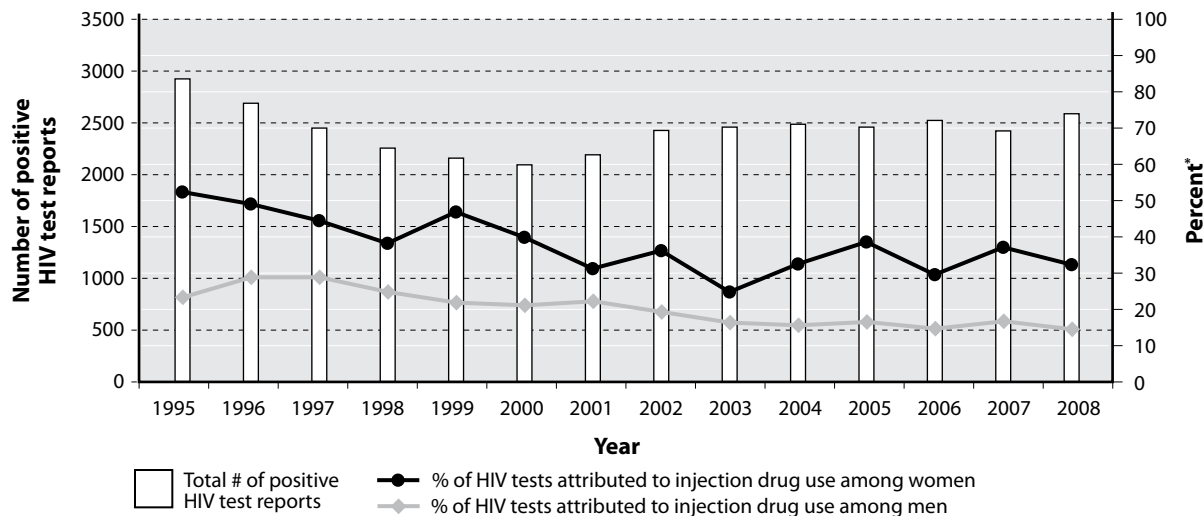
- The cumulative number of adult (≥ 15 years) AIDS cases reported to CCDIC from 1979 to December 31, 2008, was 21,052. Of those with known exposure category, 8.6% ($n = 1,687$) were attributed to injection drug use.
- Overall, among both men and women there was a general rise in the proportion of AIDS cases attributed to injection drug use since reporting began in 1979, until 1998 when the proportion reached 22%. Since 1998 there has been a gradual decline, with slight variations over the years, including a spike to 32.7% in 2006 followed by a decrease in 2008.
- Of the total cumulative adult AIDS cases attributed to injection drug use for which exposure category and sex were reported, 72.5% were male and 27.5% female.

- Of adult AIDS cases attributed to injection drug use, the proportion of males increased steadily from 67.4% in 1998, peaking in 2001 at 82.5% and subsequently decreasing to 39.1% in 2008.

HIV surveillance data³

- Since HIV reporting began in 1985 up to December 31, 2008, a cumulative total of 63,287 positive HIV tests among adults were reported in Canada, of which 17.7% were attributed to injection drug use. An additional 2.4% were attributed to the MSM-IDU exposure category. MSM-IDU refers to a combined exposure category that includes men who have sex with men and men who inject drugs. For details on exposure categories, please refer to Chapter 3.
- Of positive HIV tests reported between January 1, 2008, and December 31, 2008, for which age and exposure category were available, those of individuals aged 30 to 39 years (33.5%) and 40 to 49 years (32.3%) accounted for the highest proportion attributed to injection drug use.
- Over the last decade, a decreasing trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend among women has been observed since 2003 (Figure 1).

Figure 1. Total number of positive HIV test reports and proportion attributed to injection drug use in Canada, by sex, 1995-2008



* Percentage based on total number minus reports for which exposure category was not reported and for which there was no identified risk.

Enhanced Population-Specific Surveillance Data

As part of the *Federal Initiative to Address HIV/AIDS in Canada*, PHAC monitors trends in HIV prevalence and associated risk behaviours in key vulnerable populations

identified in Canada through second-generation HIV surveillance systems.

The overall objectives of these systems (known as the “Track” systems) are to describe the changing patterns in the prevalence and incidence of HIV infections, risk behaviours and testing patterns for HIV, hepatitis C virus (HCV) and other sexually transmitted and blood borne infections (STBBIs) in each respective population. For a more detailed description of the Track systems, please refer to Chapter 3.

I-Track: second-generation HIV surveillance among IDU in Canada

I-Track is the national, second-generation surveillance system focused on people who inject drugs. The pilot phase of I-Track was undertaken between October 2002 and August 2003 at five sites (urban and semi-urban) across Canada (Victoria, Regina, Sudbury, Toronto and the SurvUDI network, including Ottawa/Outaouais, Montreal, Québec City, Montérégie, Mau-

rice/Centre du Québec, Saguenay/Lac St-Jean, Estrie (Eastern Townships) and Abitibi/Témiscamingue).⁴ The pilot phase demonstrated the feasibility of the sentinel surveillance system and also laid the foundation for undertaking I-Track Phase 1.

Phase 1 was completed in seven sites (Victoria, Edmonton, Regina, Winnipeg, Sudbury, Toronto and the SurvUDI network) between October 2003 and May 2005.⁵ Phase 2 was completed in 10 sites between 2005 and 2008 (Victoria, Central and North Vancouver Island sites, Prince George, Edmonton, Regina, Thunder Bay, Sudbury, Toronto, Kingston and the SurvUDI network). The implementation of Phase 3 began in April 2010.

Selected descriptive results from I-Track Phase 2 (2005-2008)^{abcd}

A total of 3,287 IDU participated in I-Track Phase 2 from 2005 to 2008 across 10 sites (Table 1).

Table 1. Summary of I-Track Phase 2 sites and HIV prevalence by site, 2005-2008^b

	Number of participants (total = 3,287)	Year of survey	Laboratory-confirmed HIV prevalence % (no. tested)	Laboratory-confirmed HCV life-time prevalence % (no. tested)
Victoria	250	2005	12 (240)	74 (240)
Central and North Vancouver Island [†]	221	2008	6 (208)	72 (208)
Prince George	157	2008	18 (151)	77 (151)
Edmonton	248	2008	13 (247)	69 (247)
Regina	251	2007	9 (249)	69 (249)
Thunder Bay	150	2007	5 (111)	51 (111)
Sudbury	148	2005	14 (140)	67 (141)
Toronto	362	2006	5 (355)	65 (352)
Kingston	224	2006	3 (202)	73 (202)
SurvUDI Network [‡]	1,276	2006	21 (1271)	69 (1271)

[†] Includes Campbell River, Nanaimo, Port Alberni, Courtenay, Duncan and Port Hardy.

[‡] Includes Ottawa/Outaouais, Montreal, Québec City, Montérégie, Maurice/Centre du Québec, Saguenay/Lac St-Jean, Estrie (Eastern Townships) and Abitibi/Témiscamingue.

Demographic characteristics of I-Track Phase 2 participants

- The majority of participants (68%) were male.
- The average and median age was 38 years.

- Of the total sample, 25% self-identified as Aboriginal (First Nation, Métis or Inuit).
- Over half of the sample (54%) reported having less than high school education, 22% had earned their high school diploma, and 24% had any post-secondary education.

^a Unpublished data from I-Track: *I-Track: Enhanced Surveillance of Risk Behaviours among People who Inject Drugs. Phase 2 (2005-2008)*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2010. I-Track Phase 2 report anticipated for release at a later date.

^b Respondents who did not provide a response (i.e. “missing”) or who responded “Don’t know” or “Refused” were excluded from the analyses, unless otherwise noted. No tests of statistical significance were conducted.

^c HIV screening was performed using the Bio-Rad GS rLAV HIV-1 EIA (enzyme immunoassay). Confirmatory testing was subsequently performed using the Bio-Rad Genetic Systems™ HIV-1 Western Blot assay. A positive result indicates a current HIV infection. Both the HIV screening (EIA) and confirmatory assay (Western Blot) are approved by Health Canada as diagnostic assays for use with dried blood spot (DBS) specimens.

HIV prevalence^c

- Among participants who provided a biological sample of sufficient quantity for testing, the prevalence of HIV ranged from 3% to 21% across the 10 I-Track Phase 2 sites (Table 1).
- The HIV prevalence was 14% among males, 12% among females and 1% among transgender participants.
- Within age groups, the HIV prevalence was 6% among participants under 30 years, 16% among those 30 to 49 years and 15% among those 50 years and older. The prevalence of HIV was 14% among participants of Aboriginal origin and those of other ethnicities.

Life-time HCV prevalence^d

Based on the nature of testing done for HCV, the results relate to “life-time prevalence”, that is, indication that the individual had been infected with the hepatitis C virus at some point in his/her lifetime (past or present).

- Among participants who provided a biological sample of sufficient quantity for testing, the life-time prevalence of HCV ranged from 51% to 77% across the 10 I-Track Phase 2 sites (Table 1).
- The life-time HCV prevalence was 69% among both males and females and 91% among transgender participants.
- Within age groups, 50% participants under 30 years had antibodies indicative of past or present HCV infection. The figures were 73% among those 30 to 49 years and 85% among those 50 years and older. The life-time prevalence of HCV was 69% among participants of Aboriginal origin and those of other ethnicities.

Risk behaviours: selected results from I-Track Phase 2

Injecting practices

- Overall, the drugs most commonly injected in the previous 6 months were cocaine (52%), morphine (non-prescribed) (13%), heroin (7%) and dilaudid (7%).
- Just over 20% of participants reported borrowing or lending used needles or syringes in the previous 6 months.
- Of those who borrowed or lent used needles or syringes, approximately 60% were male, approximately 60% were between 30 and 49 years of age, and about 20% were of Aboriginal origin.

- Of those who borrowed used needles or syringes, the people from whom they borrowed most often were regular sex partners (43%) and close friends (35%).
- Among self-reported HIV-positive participants, of those respondents who reported lending used needles or syringes, 60% were male and 40% were female.
- Approximately 40% of participants reported borrowing or lending used injection equipment, such as cookers, water, filters, tourniquets, swabs and/or acidifiers, in the previous 6 months.
- Of these, just over 60% were male; approximately 60% were between 30 and 49 years of age; and almost 30% were of Aboriginal origin.
- Overall, participants reported most often borrowing used injection equipment from their close friends (45%) and from their regular sex partners (35%).

Sexual practices

- 18% of all participants reported having two or more male sex partners in the previous 6 months; approximately 80% of these participants were female, about 60% were between 30 and 49 years of age, and approximately 30% were of Aboriginal origin.
- 25% of all participants reported having two or more female sex partners in the previous 6 months; over 90% of these participants were male, over 60% were between 30 and 49 years of age, and approximately 20% were of Aboriginal origin.
- In the previous 6 months, 4% of participants reported selling sex in exchange for drugs, money or other material goods and 6% of participants reported buying sex in exchange for drugs, money or other material goods.
- Of those who reported vaginal sex with a casual partner, approximately 50% reported inconsistent condom use (i.e. did not always wear a condom); over 80% of them were male, nearly 60% were between 30 and 49 years of age, and just over 20% were of Aboriginal origin.

HIV testing practices

- Over 90% of all participants had ever been tested for HIV: 91% of males, 93% of females and 92% of transgendered participants.
- Overall, 85% of those who had ever been tested for HIV and who reported being HIV negative had been tested in the previous 2 years.
- Of those who reported that they were HIV negative and had been tested in the previous 2 years, 66% were male and 33% were female.

^d HCV testing was performed using the Ortho® HCV version 3.0 EIA. Confirmatory testing is not performed for samples that test positive. A positive result indicates past or present HCV infection and does not discriminate acute from chronic or resolved infections. Validation of commercially available laboratory tests on DBS specimens for HCV is ongoing.

- Overall, the most common reasons for never having been tested for HIV were as follows: “I am at a low risk for infection” (21%), “I never thought about it” (21%) and “I do not want to know” (18%).
- Of participants with laboratory-confirmed HIV based on the I-Track survey specimen who were unaware of their HIV positive status^e, that is, they reported never having been tested for HIV, or that they were HIV negative at the last test, 67% were male, 74% were between 30 and 49 years of age and 34% were of Aboriginal origin.

Highlights of special analyses from I-Track Phase 1 (2003-2005)

- In a special analyses of population subgroups captured by the M-Track (surveillance for MSM, Phase 1, 2005-2007) and I-Track (Phase 1, 2003-2005) systems, HIV prevalence was similar among MSM-IDU (M-Track - 26.4%) and IDU-MSM (I-Track - 25.7%).⁶
 - o This comparison suggested differences in terms of injecting behaviour, for example, use of methamphetamine (30.4% among M-Track participants vs. 4.7% among I-Track participants), cocaine (63.7% vs. 91.7%) and heroin (18.6% vs. 34.4%).
 - o Significant differences in sexual behaviours differences were also found: sex with women (30.3% among M-Track participants vs. 57.3% among I-Track participants), sex with multiple male partners (75.2% vs. 60.4%), sex with casual partner(s) (81.0% vs. 47.9%), consistent condom use with casual partners (anal sex: 18.3% vs. 62.0%), and paying for sex with a male sex partner (30.7% vs. 6.3%).
 - o These analyses highlighted the complex relationship between sexual orientation and injecting and sexual risk behaviours, which are not necessarily captured by surveillance definitions for at-risk populations and support the notion that a wider range of prevention messages and services should be provided to all at-risk populations, regardless of the population label that is ascribed to them.
- An analysis of crystal methamphetamine (CM) use amongst I-Track Phase 1 participants revealed higher levels of risk behaviour for CM users compared to those who injected other drugs.⁷ CM users were younger, lived in unstable housing, injected most often in public places, injected with used equipment and were of Aboriginal origin. Female CM users were more likely to have engaged in commercial sex and were more like to be HIV positive.
- HIV risk profiles were explored between male IDU reporting male sexual partners (IDU-MSM) and those reporting only female sexual partners (MFSP) in a sample of male IDU from I-Track (Phase 1, 2003-2005).⁸
 - o HIV prevalence was higher among male IDU who had sex with men (25.7%) than among male IDU who only had female sex partners (11.9%).
 - o With respect to injecting behaviours, a higher proportion of IDU-MSM reported injecting cocaine most often (76.7% vs. 53.4%); in public (39.6% vs. 27.2%); with needles previously used by someone else (33.2% vs. 15.4%); and with such used needles, from people they did not know (27.1% vs. 11.0%).
 - o Compared to MFSP, higher proportions of IDU-MSM reported the following sexual risk behaviours: casual sex partners (66.7% vs. 50.0%), client sex partners (42.7% vs. 2.0%) and inconsistent condom use with casual sex partners during vaginal (57.4 vs. 44.9%) and oral sex (82.3% vs. 70.9%).
- Analyses of I-Track Phase 1 (2003-2005) surveillance data found that IDU who had ever used a needle exchange program (NEP) were more likely to have had recent HIV testing than those who had never used NEP services.⁹
 - o Female IDU, IDU under 30 years of age, and IDU who had ever used an NEP were more likely to be recent testers (IDU tested within the preceding year) compared to IDU tested more than one year previously or never tested.
 - o IDU who self-identified as Aboriginal were less likely to have had an HIV test in the previous year than participants of other ethnicities.

In addition to determining the prevalence and identifying patterns of HIV and HCV testing and describing changing patterns and trends in sexual behaviour among IDU, one of I-Track’s primary objectives is to establish a core set of comparable behavioural measures across participating sentinel surveillance sites while also addressing local and regional issues and questions of specific local interest. Respective sentinel sites produce and publish site-specific findings in the form of summary reports, research papers, conference posters and abstracts. Site-specific publications often explore questions and issues of particular interest to community members, researchers, and policy and program analysts. Selected site-specific findings from I-Track sentinel sites are presented along with other independent research findings below (please see “Summary of recent data on HIV prevalence, incidence and risk behaviours among IDU”).

^e Excludes respondents who did not provide answers to questions regarding HIV testing history.

National Estimates of HIV/AIDS Prevalence and Incidence

PHAC uses multiple methods to provide an overall picture of the HIV epidemic among all Canadians living with HIV (including AIDS), including those with both diagnosed and undiagnosed infection. Using these combined methods, PHAC produces two types of estimates: prevalence, the number of people living with HIV (including AIDS), and incidence, the number of new infections in a 1-year period. PHAC produces estimates of national HIV prevalence and incidence approximately every 3 years. (Please refer to Chapter 1 for a full description of national HIV prevalence and incidence estimates for 2008).

National estimates for 2008: HIV/AIDS prevalence data²

- At the end of 2008, an estimated total of 65,000 (54,000-76,000) people in Canada were living with HIV infection (including AIDS), which represents an increase of about 14% from the 2005 estimate of 57,000 (47,000-67,000).
- IDU represented 17% (11,180) of all prevalent cases in 2008, which is slightly lower than the 2005 estimate (18%).
- The combined MSM-IDU exposure category was estimated to represent an additional 3% (2,030) of prevalent cases in 2008, which is unchanged from 2005.
- Approximately 25% of HIV-positive IDU were unaware of their infection. This percentage corresponds to an estimated 2,800 (2,000-3,600) people living with HIV in the IDU exposure category who were unaware of their HIV-positive status.

National estimates for 2008: HIV/AIDS incidence data²

- The number of new infections in 2008 (estimated range between 2,300 and 4,300) was about the same as or slightly greater than the estimated range in 2005 (2,200 to 4,200).
- The injection drug use exposure category continued to account for a high proportion of estimated new cases in 2008, representing 17% (390-750). This was slightly higher than the estimated 16% of new cases (360-680) attributed to injection drug use in 2005. This estimated increase was in part due to new HIV diagnoses among IDU in Saskatchewan.
- The combined MSM-IDU exposure category represented an additional 3% of estimated new HIV cases (50-130 cases) in 2008 which is unchanged as compared to 2005.

- Among Aboriginal persons, an estimated 66% of new HIV infections were attributed to injection drug use, which is higher than the estimation of 63% in 2005.
- Among women, a slightly higher proportion of estimated new infections were attributed to injection drug use in 2008 (29%) as compared to the estimated proportion in 2005 (27%).

Summary of Recent Data on HIV Prevalence, Incidence and Risk Behaviours among IDU

In addition to the national estimates and data collected through routine and enhanced HIV surveillance, many ongoing research studies are exploring HIV prevalence, incidence and risk behaviours among IDU in Canada. This section summarizes the results from HIV/AIDS research among IDU in Canada that were published in peer-reviewed journals from January 1, 2006, to January 31, 2010. Selected site-specific findings from I-Track sentinel sites are also presented here.

Prevalence of HIV and HCV infection among IDU in Canada

Recent measures of the prevalence of HIV and HCV infection in Canada are summarized below.

- The SurvUDI network has been conducting surveillance since 1995 in sentinel sites across the province of Quebec and in Ottawa, Ontario. HIV prevalence for the overall network increased from 11.5% in 1995 to a peak of 18.6% in 2003. Among IDU who participated in the SurvUDI network from 1995 to June 2008, the cumulative HIV prevalence was 14%.
 - From 2003 to June 2008, the prevalence of HCV was 63%, and the overall proportion of those co-infected with HIV and HCV was 13%.¹⁰
 - For the 2007 SurvUDI recruitment year, the overall HIV prevalence was 18%, and sentinel site HIV prevalence was 21.5% in Montreal, 17.0% in Quebec City, 3.0% in Ottawa and 9.9% in semi-urban sites.¹⁰
- In 2006, it was estimated that of the 505,000 people 15 years or older who were living in Vancouver, 6,108 were infected with HIV, providing an overall HIV prevalence of 1.21%. The IDU and MSM subgroups accounted for the greatest proportion of HIV infections.¹¹
- The Cedar Project, a community-based cohort, examined the prevalence of HIV and HCV and associated risk behaviours among Aboriginal youth

(14-30 years of age) who used drugs (injecting and non-injecting) and who were living in Vancouver and Prince George in 2003 to 2005. HIV prevalence was significantly higher among participants living in Vancouver (17%) than those living in Prince George (7%); however, HCV prevalence was found to be lower in Vancouver (57%) than in Prince George (62%).¹²

- o Among female participants of the Cedar Project, HIV prevalence was 13.1%, which was three times higher than the HIV prevalence among male participants (4.3%). HCV prevalence was also higher among females (43.6%) as compared with males (25.4%).¹³
- o The prevalence of HIV among sexually abused Aboriginal youth participating in the Cedar Project was significantly greater than among participants with no history of sexual abuse (13% vs. 4%).¹⁴
- Analyses of data (1996 to 2005) derived from two prospective cohort studies of IDU in Vancouver, the Vancouver Injection Drug Users Study and the Scientific Evaluation of Supervised Injecting cohort, found that Aboriginal IDU had a significantly elevated baseline prevalence of HIV infection as compared with those of other ethnicities (25.1% vs. 16.0%).¹⁵
- A cross-sectional survey examined the prevalence of HIV and HCV infection among inmates from seven Quebec provincial prisons ($n = 1,607$) in 2003. The HIV prevalence was 2.3% among male participants and 8.8% among female participants. The prevalence of HCV infection was 16.6% and 29.2% among male and female participants respectively. Among the male IDU inmates the HIV prevalence was 7.2%, and among male inmates who did not inject drugs it was 0.5%. For females the prevalence of HIV among IDU was 20.6% and among those who did not inject drugs was 0%. The prevalence of HCV infection was 53.3% among the male IDU inmates and 2.6% among the male inmates who did not inject drugs; the respective prevalence of HCV among women in these groups was 63.6% and 3.5%.¹⁶
- In a sample of 400 individuals who had used crack in the previous 6 months and were attending needle exchange distribution programs in Montreal in 2006-2007, HIV prevalence among current injectors (having recently injected), past injectors (not having recently injected) and never-injectors was found to be 22.4%, 8.5% and 6.0% respectively.¹⁷
- HIV and HCV prevalence and associated risk behaviours among IDU crack smokers (dual users) and crack smokers with no history of injection drug use were examined in a support group of the Vancouver

Area Network of Drug Users (VANDU) in 2004. Both HIV and HCV prevalence was high among crack smokers with no history of injection drug use (22% and 43% respectively). Among dual users, HIV prevalence was slightly higher (30%) and HCV prevalence was nearly twice as high (79%) as compared with crack smokers.¹⁸

Incidence of HIV among IDU in Canada

In Canada, only a few studies have estimated HIV incidence, and these results are summarized below.

- HIV incidence was 2.9 per 100 person-years (PY) across all sites of the SurvUDI network from 1995 to 2008. It ranged from 1.3 per 100 PY in semi-urban sites to 2.4 per 100 PY in Quebec City, 3.3 per 100 PY in Montreal and 3.5 per 100 PY in Ottawa. Overall HIV incidence significantly decreased across the SurvUDI network from 1995 to 2006 ($p < 0.001$).¹⁰
- From the analyses of data derived from two prospective cohort studies of IDU in Vancouver (1996 to 2005), the cumulative HIV incidence at 48 months' follow-up was higher among Aboriginal IDU (18.5%) than among IDU of other ethnicities (9.5%). In multivariate analyses, Aboriginal ethnicity was independently associated with elevated HIV incidence.¹⁵

Risk behaviours among IDU in Canada

Recent literature suggests that high levels of risky injection and sexual practices among IDU are not infrequent. Below is a summary of risk behaviour research findings.

Injecting practices

- Data derived from the prospective Vancouver Injection Drug User Study (VIDUS) cohort (1996 to 2005) were used to examine the role of increased crack use, associated factors and HIV seroconversion among IDU over two time periods (past and recent). Analyses revealed that daily cocaine injection was independently associated with HIV seroconversion across both periods, whereas daily crack smoking only emerged as an independent predictor of HIV infection more recently.¹⁹
- Of IDU who participated in the SurvUDI network from 2003 to 2008, 85.7% had injected cocaine, 55.9% had injected opiates (non-prescribed), and 34.9% had injected dilaudid in the previous 6 months.¹⁰
- Among IDU participating in a cross-sectional survey in Montreal in 2004-2005, factors such as large injecting networks, frequent mutual injections, younger age and male sex were stronger predictors of equipment borrowing and/or lending.²⁰

Sexual practices

- The prevalence and potential risk factors for inconsistent condom use (not always using a condom during insertive sex) were examined among Aboriginal youth participating in the Cedar Project (2003–2005). The prevalence was 52%. Inconsistent condom use was significantly associated with ever being forced to have sex, history of a sexually transmitted infection, having a regular sex partner who used injection drugs and having a casual sex partner who used injection drugs.²¹

Social determinants of health

The social determinants of health can be defined as the social conditions in which people live and work.²² These include the conditions associated with early childhood development; education, employment and work; food security, health services, housing, income and income distribution; social exclusion; the social safety net; and unemployment and job security.²³ The following highlights research that examined risk behaviours related to social determinants in IDU populations.

Injecting environment and housing

- The relation between exposure to street-based drug scenes and HIV risk factors was examined from data derived from the VIDUS cohort study (2006–2008). Unstable housing, daily crack use, outdoor assisted injecting and sex work involvement were significantly associated with drug scene exposure.²⁴
- Neighbourhood location was examined as a risk factor for HIV incidence among IDU who participated in the VIDUS cohort study from 1996 to 2004. Residence in Vancouver's downtown east side was an independent predictor of HIV seroconversion.²⁵
- The prevalence of public injecting and related factors were examined among IDU who participated in the VIDUS cohort study from 2003 to 2005. Of 620 participants, 22.9% reported "usually" or "always" injecting in public in the previous 6 months. Factors associated with recent frequent public injecting included homelessness, frequent crack use and frequent heroin injection.²⁶
- In a sample of IDU drawn from the St. Luc Cohort Study, the relations between injection behaviours and neighbourhood characteristics were examined. Inner city IDU living in socio-economically disadvantaged neighbourhoods were more likely to practise high-risk injection behaviours.²⁷

Needle exchange service access and use

- In a sample of IDU drawn from the St. Luc Cohort Study in 2004 to 2006, IDU who exclusively acquired syringes at an NEP or a pharmacy had a lower prevalence of high-risk injection behaviour than IDU with inconsistent syringe-access patterns.²⁸
- Results from a survey conducted in Winnipeg from 2003 to 2004 among IDU showed that syringe sharing among IDU depended on both the availability of clean syringes and social network relationships. The participant's relationship to a risk network member (sex partner, family member) and difficulty of access to syringes were associated with syringe sharing.²⁹

Food security

- The prevalence of food insecurity and associations with injecting risk behaviours were examined in a sample of IDU in London, Ontario. Food insecurity was frequent among IDU and was strongly correlated with sharing of needles and injection equipment (water, cooker, filter).³⁰

Social exclusion and quality of life

- The MAYA project, a longitudinal study on the quality of life of people living with HIV, described the psychosocial characteristics that differentiate male IDU from other subgroups: heterosexual non-IDU males, MSM non-IDU and women. Compared with the other three subgroups, male IDU had significantly lower scores on quality of life, anxiety and depression, and family and friends social integration scales. They had a less diversified social network and more frequently used alcohol and drugs as a coping strategy.³¹

Risk behaviours and their correlates among youth

Youth remain an at-risk population for injection drug use and HIV infection. A summary of recent research examining risk behaviours and their correlates among youth follows.

- The prevalence and correlates of injection drug use were examined among street-involved youth enrolled in the At-Risk Youth Study (ARYS) in Vancouver (2005–2006). Of the 478 participants, 42% reported having injected drugs, and the median age at first injection was 17.5 years. The drugs most commonly used during first injection were cocaine (27%) and CM (23%).³² A high level of borrowing or lending syringes (20.9%) was noted among those who injected drugs. The need for help to inject and frequent heroin use increased the risk of syringe sharing.³³

- In the same ARYS cohort, factors significantly associated with injection drug use included age greater than 22 years, HCV infection, history of sex work, history of incarceration, having dropped out of high school, downtown east side Vancouver residence, age greater than 15 years at first witnessing a drug injection³² and CM use.³⁴
- Participants recruited from the ARYS cohort were interviewed to explore the transition to injecting and first injection experiences. Young IDU aged 16 to 26 years were socialized into injecting by another drug user well known to them who facilitated the first injection episode.³⁵
- An analysis of data from the VIDUS cohort (1996-2006) examined differences between younger (less than 30 years) and older (30 years or older) IDU. Elevated levels of risk behaviours were noted among younger IDU, including a higher proportion of females, more frequent injection, history of sex work, history of incarceration, more frequent syringe borrowing and homelessness.³⁶
- Factors predicting initiation into injection drug use among street-involved youth were examined in a prospective cohort study in Montreal (2001-2005). High levels of self-efficacy had a protective effect, whereas heroin use, cocaine use, heavy alcohol use and sex work increased the risk of initiation into injection drug use.³⁷
- Qualitative interviews with 42 street-involved youth (aged 15 to 25 years) in Montreal examined social contexts and processes influencing the transition to injection drug use. Certain combinations of street life (such as early street life) and drug use trajectories (such as cocaine use) appeared to contribute to injection drug use. Important interacting factors increased the risk of transitioning to injection: poor personal assets, early rupture with primary social institutions, social integration into subcultures in which both street life and “drug trips” are fashionable, drug preferences and the local drug market.³⁸

Risk behaviours and correlates of risk behaviours among inmates

Incarceration has been shown to be associated with injecting and sexual risk behaviours and HIV transmission. The following summarizes recent evidence.

- In the VIDUS cohort from 1996 to 2005, the prevalence and correlates of injection cessation were examined among IDU. Recent incarceration was negatively associated with injection cessation, and longitudinal analyses indicated that incarceration did not reduce drug use among IDU.³⁹
- Patterns of incarceration among IDU and associations between HIV risk behaviours were examined in a prospective cohort study in Vancouver. Of 1,274 participants, 20.5% were infected with HIV. Factors independently associated with incarceration included borrowing a used syringe, lending a used syringe and inconsistent condom use with casual sex partners.⁴⁰

Risk behaviours and correlates of risk behaviours among Aboriginal people

Aboriginal people are overrepresented in Canada's HIV epidemic,¹⁵ and injection drug use and risky injecting practices are among the major risk factors.⁴¹ The following is a summary of risk behaviours and correlates of risk behaviours among Aboriginal people who inject drugs in Canada.

- The Cedar Project examined factors related to the initiation of injection drug use. At baseline, 207 participants (45%) were non-injectors, and, as of July 2007, 39 participants had transitioned to IDU (crude incidence of 19.8%). The transition to IDU was univariately associated with sex, involvement in survival sex work in the previous 6 months, ever having had a sexually transmitted infection and overdosing in the previous 6 months. Having overdosed in the previous 6 months independently predicted transition to IDU.⁴²
- The Cedar Project also found that a substantial proportion of young Aboriginal people struggling with drug dependency had been in youth detention (41%). Of female participants 71% had been sexually abused and 79% had been involved in sex work. Youth detention was associated with being male, ever injecting drugs, HIV-positive status and ever having slept on the street for more than three nights.⁴³
- The Cedar Project examined the characteristics of participants who were removed from their families and communities as children and the risk of HIV infection. Among IDU, ever having been taken from biological parents was predictive of ever overdosing, self harm, involvement in survival sex work and borrowing used syringes.⁴⁴
- A history of sexual abuse among participants in the Cedar Project was associated with several outcomes, including attempted suicide, homelessness, ever having injected drugs, having been paid for sex, current income from the sex trade, reporting 20 or more lifetime sex partners, inconsistent condom use and HIV seropositivity.¹⁴

- Trends in and factors associated with CM use were examined in the Cedar Project cohort using data collected in the period from 2003 to 2006. CM use was associated with younger age, being male, unstable housing, smoking opiates, needing help injecting and binge drug use.⁴⁵
- HIV testing among Aboriginal youth (IDU and non-IDU) who participated in the Cedar Project (2003-2005) was associated with older age, being female, single marital status, completion of high school, unstable housing, sex trade involvement, non-consensual sex, injection drug use, ever being in jail or prison and ever receiving alcohol or drug treatment.⁴⁶
- From the analyses of data derived from two prospective cohort studies of IDU in Vancouver (1996 to 2005), Aboriginal participants were found to be more likely than people of other ethnicities to be women, younger, living in Vancouver's downtown east side, involved in the sex trade, injecting cocaine daily and having had unsafe sex.¹⁵
- The Maka Project examined HIV prevalence and risk factors through an interviewer-administered questionnaire among female survival sex workers in Vancouver. The baseline HIV prevalence was 26%, and HIV infection was associated with early age of sex work initiation (<18 years), Aboriginal ethnicity, daily cocaine injection, intensive/daily crack smoking and unprotected sex with an intimate partner.⁴⁹
- Further analyses from the Maka Project found that the displacement of sex work to primarily industrial settings and side streets pushed women further from health and social supports and reduced their access to safer injection and drug use equipment. This geographic gap between sex work areas and areas of health and syringe availability was particularly noted among women who were younger, who self-identified as Aboriginal, who were active IDU and who smoked crack cocaine daily.^{50,51}

Risk behaviours and their correlates among women

According to national surveillance data, just over 30% of positive HIV test reports attributed to injection drug use have been among women,¹ and as noted in the most recent HIV estimates a slightly higher proportion of estimated new infections were attributed to injection drug use among women (29% in 2008).² The following summarizes risk behaviours and correlates of risk behaviours among women who inject drugs in Canada.

- Women IDU participating in I-Track at the Sudbury site (2005) had a significantly higher HIV prevalence than men (20.4% vs. 8.2%). Women IDU also exhibited higher levels of drug-related risk behaviours than men: they were more likely to borrow used needles or syringes (27.3% vs. 12.2%) and lend used needles or syringes (31.5% vs. 15.6%).⁴⁷
- Analyses of data from the Cedar Project (2003-2005) examined HIV-related vulnerabilities associated with sex work among young Aboriginal women. Sexual violence and drug using patterns were found to be markedly different for women recently involved in sex work. Daily injection of cocaine, smoking crack in the previous 6 months and lifetime sexual abuse were independently associated with sex work.⁴⁸

Comment

Strengths and limitations

The selected findings presented in this chapter came from a variety of recently published HIV research involving IDU in Canada. The inherent design strengths of these studies—cross-sectional and cohort, qualitative and quantitative, involving large community samples—have permitted a wide range of risk behaviours and associations to be robustly examined in this at-risk and hard-to-reach IDU population. Much of this research has generated new evidence that is critical to the development of prevention programs and policy at local, provincial and national levels.

When interpreting the findings presented in the chapter, a number of biases must be considered. HIV diagnostic data are limited to people who present themselves for testing; therefore, trends in these numbers may be influenced by testing patterns and/or improved ability to remove duplicated tests. In addition, identifying information that accompanies HIV testing is sometimes incomplete or inaccurate, and this may limit the usefulness of HIV surveillance data. The research reviewed comprised several studies that varied in methodology, study samples and research aims; for these reasons, the results may not necessarily be comparable across all studies. For more specific study-level limitations, please refer to the respective studies referenced within the chapter.

Conclusion

People who inject drugs continue to represent an important at-risk group for HIV acquisition and transmission. Risk behaviours – injection related and sexual – were reported in national behavioural surveillance surveys and other cross-sectional and cohort studies, which suggests that the potential for transmission of HIV among IDU continues to be significant.

Over the last decade, a downward trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend has been observed among women since 2003. National HIV incidence estimates for 2008 show a slight increase over 2005 in the number of new HIV infections attributed to injection drug use.

Recent research demonstrates that female IDU have unique factors that may put them at heightened risk of HIV infection. The younger IDU population is particularly vulnerable to HIV infection, as seen in reported high levels of injecting and sexual risk behaviours across targeted studies. Prison populations remain a special concern, as evidence has shown that incarceration facilitates risky injection behaviours, placing inmates at higher risk of HIV infection. Among people who inject drugs, Aboriginal people are disproportionately affected by HIV.

The issue of HIV among IDU continues to be a serious problem that requires ongoing research and surveillance that monitor risk behaviours and examines the social conditions in which IDU live and work. Such data is critical to the development and evaluation of responses to the evolving HIV epidemic among IDU in Canada.

For more information, please contact:

Surveillance and Risk Assessment Division
Centre for Communicable Diseases and Infection Control
Public Health Agency of Canada
Tunney's Pasture
Postal locator: 0602B
Ottawa, ON K1A 0K9
Tel: (613) 954-5169
Fax: (613) 957-2842
www.phac-aspc.gc.ca

Mission

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

References

1. Public Health Agency of Canada. *HIV/AIDS Epi Updates, November 2007*. Ottawa: Surveillance and Risk Assessment Division, Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada, 2007.
2. Public Health Agency of Canada. *Summary: Estimates of HIV Prevalence and Incidence in Canada, 2008*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2009.
3. Public Health Agency of Canada. *HIV and AIDS in Canada. Surveillance Report to December 31, 2008*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2009.
4. Health Canada. *I-Track: Enhanced Surveillance of risk behaviours among injecting drug users in Canada. Pilot survey report, February 2004*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2004.
5. Public Health Agency of Canada. *I-Track: Enhanced Surveillance of risk behaviours among injecting drug users in Canada. Phase 1 report, August 2006*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2006.
6. Ogunnaike-Cooke SO, McGuire M, Cule S, Archibald C, et al. What's in a name? Differentiating HIV risk between MSM-IDU and IDU-MSM. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P229).
7. Tarasuk J, Choudhri Y, Fyfe M, Hennink M, et al. Crystal methamphetamine use and associated risk behaviours among people who inject drugs in Canada. *Can J Infect Dis Med Microbiol* 2008;19:SA (Abstract O068).
8. McGuire M, Archibald CP, Fyfe M, Hennink M, et al. HIV risk profiles among MSM-IDU and MFSP-IDU: results from a national enhanced HIV surveillance system. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract O094).
9. Tarasuk J, Choudhri Y, Fyfe M, Hennick M, et al. Time since last HIV test and associated factors among people who inject drugs: results from a population survey. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract O043).
10. Institut National de Santé Publique. *Surveillance des maladies infectieuses chez les utilisateurs de drogue par injection: épidémiologie du VIH de 1995 à 2008*. 2009.
11. McInnes CW, Druyts E, Harvard SS, Gilbert M, et al. HIV/AIDS in Vancouver, British Columbia: a growing epidemic. *Harm Reduct J* 2009;6.
12. Spittal PM, Craib KJ, Tegeee M, Baylis C, et al. The Cedar project: prevalence and correlates of HIV infection among young Aboriginal people who use drugs in two Canadian cities. *Int J Circumpolar Health* 2007;66(3): 226-240.
13. Mehrabadi A, Tegee M, Moniruzzaman A, Pearce ME, et al. Female gender associated with HIV seropositivity in a cohort of Aboriginal youth who use illicit drugs in Vancouver and Prince George, Canada. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract P234).

14. Pearce ME, Moniruzzaman A, Christian WM, Craib KJ, et al. HIV risk behaviours and sexual violence among young Aboriginal drug users in Vancouver and Prince George, British Columbia. *Can J Infect Dis Med Microbiol* 2007; 18:SB (Abstract O048).
15. Wood E, Montaner JSG, Li K, Zhang R, et al. Burden of HIV infection among Aboriginal injection drug users in Vancouver, British Columbia. *Am J Public Health* 2008;98(3):515-519.
16. Poulin C, Alary M, Lambert G, Godin G, et al. Prevalence of HIV and Hepatitis C virus infections among inmates of Quebec provincial prisons. *Can Med Assoc J* 2007;177(3):252-256.
17. Leclerc P, Morissette C, Roy É, Tremblay C. HIV and HCV prevalence among crack users attending needle distribution programs in Montreal. *Can J Infect Dis Med Microbiol* 2008;19:SA (Abstract P204).
18. Shannon K, Kerr T, Morgan R, Oleson M, et al. HIV and Hepatitis C prevalence and related risk among crack cocaine smokers and dual users with a history of injection drug use. *Can J Infect Dis Med Microbiol* 2006;17:SA (Abstract 357P).
19. DeBeck K, Kerr T, Li K, Fischer B, et al. Emergence of crack cocaine as a risk factor for HIV seroconversion among injection drug users in Vancouver, Canada. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P197).
20. De P, Cox J, Boivin JF, Platt RW, et al. HIV and HCV discordant injecting partners and their association to drug equipment sharing. *Scand J Infect Dis* 2009;41(3):206-214.
21. Chavoshi N, Patel SH, Joseph K, Thomas V, et al. The Cedar Project: Inconsistent condom use as a marker of sexual vulnerability among young Aboriginal people who use injection and non-injection drugs in two Canadian cities. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P244).
22. Public Health Agency of Canada. *Canada's response to WHO Commission on social determinants of health*. Available at: <http://www.phac-aspc.gc.ca/sdh-dss/glos-eng.php>. Accessed 3/25/2010.
23. Raphael D, ed. *Social Determinants of Health: Canadian Perspective*. Toronto, ON: Canadian Scholars' Press Inc., 2004.
24. DeBeck K, Wood E, Li K, Montaner J, et al. Street-based drug scene exposure and health risks among injection drug users: the relationship between 'place' and HIV risk. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract O052).
25. Maas B, Fairbairn N, Kerr T, Li K, et al. Neighborhood and HIV infection among IDU: place of residence independently predicts HIV infection among a cohort of injection drug users. *Health and Place* 2007;13(2):432-439.
26. DeBeck K, Small W, Wood E, Li K, et al. Public injecting among a cohort of injecting drug users in Vancouver, Canada. *J Epidemiol Community Health* 2009;63(1):81-86.
27. Généreux M, Bruneau J, Daniel M. Association between neighbourhood socioeconomic characteristics and high-risk injection behaviour amongst injection drug users living in inner and other city areas in Montréal, Canada. *Int J Drug Policy* 2010;21(1):49-55.
28. Bruneau J, Daniel M, Kestens Y, Zang G, et al. Associations between HIV-related injection behaviour and distance to and patterns of utilisation of syringe-supply programmes. *J Epidemiol Community Health* 2008;62(9):804-810.
29. Shaw SY, Shah L, Jolly AM, Wylie JL. Determinants of injection drug user (IDU) syringe sharing: the relationship between availability of syringes and risk network member characteristics in Winnipeg, Canada. *Addiction* 2007;102(10):1626-1635.
30. Strike C, Sarnocinska-Hart A, Anstice S, Lester B, et al. Is there an association between food security and injection-related HIV risk? *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P312).
31. Veillette-Bourbeau L, Otis J, Godin G. Psychosocial profile of men living with HIV (PLHIV) who were also injection drug users (IDU). *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P330).
32. Kerr T, Stoltz J, Miller C, Lai C, et al. Injection drug use among a cohort of street-involved youth in Vancouver. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract O042).
33. Lloyd-Smith EM, Wood E, Zhang R, Montaner JS, et al. Syringe sharing among young drug users in Vancouver. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract P228).
34. Wood E, Stoltz JA, Zhang R, Strathdee SA, et al. Circumstances of first crystal methamphetamine use and initiation of injection drug use among high-risk youth. *Drug Alcohol Rev* 2008;27(3):270-276.
35. Small W, Fast D, Krusi A, Wood E, et al. A qualitative study of injection initiation among street-involved youth who use drugs in Vancouver: implications for strategies to prevent the adoption of injection drug use. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P353).
36. Miller CL, Strathdee SA, Li K, Kerr T, et al. A longitudinal investigation into excess risk for blood-borne infection among young Injection Drug Users (IDUs). *Am J Drug Alcohol Abuse* 2007;33(4):527-536.
37. Roy É, Godin G, Boivin J, Boudreau J. Modeling initiation into drug injection among street youth. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract O041).
38. Roy E, Nonn E, Haley N. Transition to injection drug use among street youth—a qualitative analysis. *Drug Alcohol Depend* 2008;94(1-3):19-29.
39. DeBeck K, Kerr T, Li K, Milloy MJ, et al. Incarceration and drug use patterns among a cohort of injection drug users. *Addiction* 2009;104(1):69-76.
40. Werb D, Kerr T, Li K, Montaner J, et al. HIV risks associated among injection drug users: implications for Canada's new drug strategy. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract P255).
41. Duncan KC, Loppie C, Brandson EK, Borwein AM, et al. HIV incidence and prevalence among Aboriginal peoples in Canada: an in-depth review of the scientific literature. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P201).

42. Moniruzzaman A, Patel SH, Clement K, Christian WM, et al. The Cedar Project: factors of transitioning into injection drug use among young Aboriginal people who use illicit drugs in Vancouver and Prince George, British Columbia. *Can J Infect Dis Med Microbiol* 2008;19:SA (Abstract O049).
43. Clarkson A, Christian WM, Thomas V, Spittal PM, For the Cedar Project Partnership. The Cedar Project: foster care, 'juvi', and health related vulnerabilities among Aboriginal young people who use drugs in two Canadian cities. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P195).
44. Pearce ME, Christian WM, Patel SH, Teegee M, et al. The Cedar Project: experience of foster care and HIV risk among young Aboriginal people who use injection and non-injection drugs in two Canadian cities. *Can J Infect Dis Med Microbiol* 2008;19:SA (Abstract P262).
45. Chavoshi N, Pearce ME, Moniruzzaman A, Richardson CG, et al. The Cedar Project: Concerning trends in crystal methamphetamine use over-time among young Aboriginal people who use injection and non-injection drugs in Vancouver and Prince George, BC, Canada. *Can J Infect Dis Med Microbiol* 2009;20:SB (Abstract P243).
46. Moniruzzaman A, Craib KJP, Schechter MT, Spittal PM. HIV testing patterns and factors associated with testing among Aboriginal youth that use injection and non-injection drugs. *Can J Infect Dis Med Microbiol* 2006;17:SA (Abstract 303).
47. Millson P, Challacombe L, Snelling S, Schwar D, et al. Gender difference in HIV risk among IDUs in Sudbury Ontario. *Can J Infect Dis Med Microbiol* 2007;18:SB (Abstract P237).
48. Mehrabadi A, Craib KJP, Patterson K, Adam W, et al. The Cedar Project: a comparison of HIV-related vulnerabilities amongst young Aboriginal women surviving drug use and sex work in two Canadian cities. *Int J Drug Policy* 2008;19(2):159-168.
49. Shannon K, Bright V, Gibson K, Tyndall MW. Sexual and drug-related vulnerabilities for HIV infection among women engaged in survival sex work in Vancouver, Canada. *Can J Public Health* 2007;98(6):465-469.
50. Shannon K, Kerr T, Allinott S, Chettiar J, et al. Social and structural violence and power relations in mitigating HIV risk of drug-using women in survival sex work. *Soc Sci Med* 2008;66(4):911-921.
51. Shannon K, Rusch M, Shoveller J, Alexson D, et al. Mapping violence and policing as an environmental-structural barrier to health service and syringe availability among substance-using women in street-level sex work. *Int J Drug Policy* 2008;19(2):140-147.