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HIV/AIDS Epi Updates

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Information to the readers of *HIV/AIDS Epi Updates*

The Surveillance and Risk Assessment Division of the Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada, is pleased to provide you with the November 2007 edition of *HIV/AIDS Epi Updates*.

The Centre conducts national surveillance and research on the epidemiology and laboratory science related to HIV/AIDS and other sexually transmitted diseases. As part of this mandate, *HIV/AIDS Epi Updates* are compiled on an annual basis to summarize recent trends and developments related to the HIV epidemic in Canada.

All *Epi Updates* are available at the address noted above and also at our Web site: http://www.phac-aspc.gc.ca/aids-sida/publication/index.html. The *HIV/AIDS Epi Updates* are complementary to other Centre materials, which are also available at the Web site.

Sincerely,

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National HIV Prevalence and Incidence Estimates for 2005

At a Glance

- More Canadians are living with HIV infection: an estimated 58,000 at the end of 2005 compared with 50,000 at the end of 2002.
- An estimated 2,300 to 4,500 new HIV infections occurred in 2005 compared with 2,100 to 4,000 in 2002.

Introduction

This *Epi Update* outlines the estimates of the total number of Canadians who were living with HIV infection at the end of 2005 (prevalence) and the number of new HIV infections in 2005 (incidence), as described in a recent *CCDR* report.[1] Estimates published in this report for the years before 2005 replace all previous estimates that we have published concerning HIV prevalence and incidence in Canada, because new data and methods have permitted an improved analysis of the epidemic and more reliable estimates. National estimates of HIV prevalence and incidence are an integral part of the work carried out by the Centre for Infectious Disease Prevention and Control (CIDPC). They are used as a tool to monitor the HIV epidemic and to help evaluate and guide prevention efforts, and they are part of ongoing risk assessment and management work conducted by the Centre. These estimates inform the work that the Public Health Agency of Canada and other federal departments perform under the *Federal Initiative to Address HIV/AIDS in Canada* and will also be used to guide the activities of all stakeholders in their common efforts to support *Leading Together: Canada Takes Action on HIV/AIDS*. It is anticipated that the next set of national HIV estimates will pertain to the year 2008 and will be produced during 2009.

Methods

Methods to estimate prevalence and incidence at the national level are complex and contain a level of uncertainty.

We used multiple methods to estimate national HIV prevalence and incidence in 2005, including the workbook method,[2] an iterative spreadsheet model,[3] and two statistical modelling methods.[4,5] The workbook method multiplies an estimated prevalence or incidence rate by an estimated population size, the statistical models back-calculate estimates of HIV incidence by relating the timing of HIV positive testing with the timing of HIV infection and testing behaviour, and the iterative spreadsheet model incorporates elements of the other two methods.

The methods were used to generate separate estimates of HIV prevalence and incidence in Ontario, Quebec, British Columbia, and Alberta. These provinces together account for over 85% of the population of Canada and over 95% of reported HIV and AIDS diagnoses. Estimates were further subclassified according to the following exposure categories:

- men who have had sex with men (MSM)
- people who inject drugs (IDU)
- MSM-IDU
- heterosexual/endemic (non-IDU heterosexual with origin in a country where heterosexual sex is the predominant mode of HIV transmission and HIV prevalence is high, primarily countries in sub-Saharan Africa and the Caribbean)[6,7]
- heterosexual/non-endemic (heterosexual contact with a person who is either HIV infected or at risk of HIV, or heterosexual as the only identified risk)
- other (recipients of blood transfusion or clotting factor, perinatal and occupational transmission).

For some exposure category and province combinations, the modelling methods were not able to produce estimates, and in these cases surveillance data were used to partition out the most likely distribution of the provincial estimates among exposure categories. The results of the different methods were averaged to obtain prevalence and incidence estimates specific to exposure category for each of the four provinces.

HIV prevalence and incidence estimates for the remainder of Canada were extrapolated from these four provinces using national HIV surveillance data. The national surveillance data were obtained from the national HIV and AIDS surveillance reporting system[6,7] with enhancements from two sources: the Laboratory Enhancement Study in Ontario,[8] which has more complete information on exposure category of HIV cases, and recently published[9] and unpublished surveillance data from Quebec on exposure category breakdown of cases newly diagnosed with HIV during 2002 to 2005.

National estimates of HIV prevalence and incidence for the years before 2005 were obtained using results from modelling to describe the past distributions of HIV prevalence and incidence relative to the 2005 estimate. Bounds of uncertainty for the national HIV estimates were developed on the basis of a conservative consideration of results from a variety of scenarios.

Estimates of HIV prevalence and incidence among women and Aboriginal persons were derived from the overall estimates obtained from the distributions of reported gender and Aboriginal status by exposure category in the national HIV and AIDS surveillance data.

Results

Prevalence

Current estimates

More people are living with HIV infection (prevalent infections). At the end of 2005, there were an estimated 58,000 (48,000-68,000) people in Canada living with HIV infection (including AIDS), which represents an increase of about 16% from the point estimate of 50,000 at the end of 2002 (Table 1). In terms of exposure category, these prevalent infections in 2005 comprised 29,600 MSM (51% of total), 9,860 IDU (17% of total), 8,620 heterosexual/non-endemic (15% of total), 7,050 heterosexual/endemic (12% of total), 2,250 MSM-IDU (4% of total), and 400 attributed to other exposures (< 1% of total) (Table 1).

Past trends

Prevalent infections (Figure 1) rose steadily during the 1980s, corresponding to the initial rise in HIV infection in the Canadian population, mainly among MSM. This rise reached a plateau in the early to mid-1990s, likely as a result of both increased mortality and effective prevention programs. Prevalent infections began to rise again in the late 1990s because of new treatments enabling individuals infected with HIV to live longer and because of continuing new infections.

Incidence

Current estimates

The number of new HIV infections in Canada in 2005 did not decrease and may have increased slightly compared with 2002. An estimated 2,300 to 4,500 new HIV infections occurred in 2005 as compared with 2,100 to 4,000 in 2002 (Table 2). Examining the estimates by exposure category, MSM continues to account for the greatest number of new infections, 1,100 to 2,000 (45%) as compared with 900 to 1,700 (42%) in 2002 (Table 2). The number of new infections estimated among IDU has decreased from a range of 400 to 700 (19%) in 2002 to 350 to 650 (14%) in 2005. For the

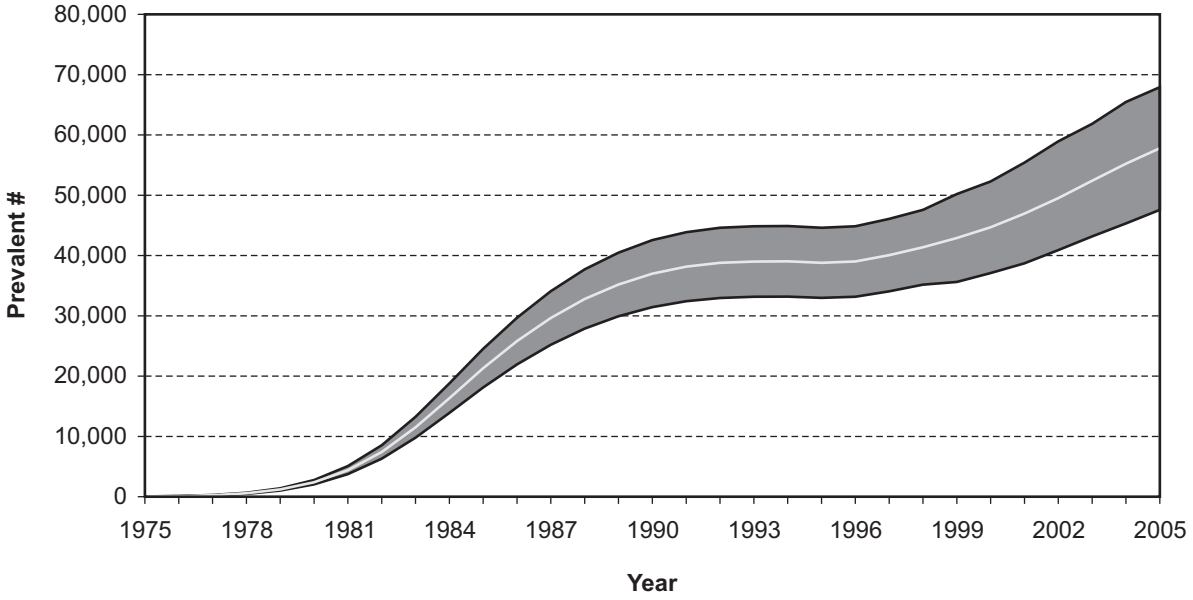
Table 1. Estimated number of prevalent HIV infections in Canada and associated ranges of uncertainty at the end of 2005 and 2002 (point estimates and ranges are rounded), by exposure category

	MSM	MSM-IDU	IDU	Heterosexual/ non-endemic	Heterosexual/ endemic	Other	Total*
2005	29,600 (24,000-35,000)	2,250 (1,500-3,000)	9,860 (7,800-12,000)	8,620 (6,600-10,600)	7,050 (5,200-8,800)	400 (300-500)	58,000 (48,000-68,000)
2002	26,200 (21,000-31,000)	1,900 (1,200-2,600)	8,900 (7,200-10,600)	6,950 (5,200-8,800)	5,680 (4,000-7,300)	350 (250-450)	50,000 (41,000-59,000)

MSM = men who have sex with men; IDU = people who inject drugs; Heterosexual/non-endemic = heterosexual contact with a person who is either HIV infected or at risk of HIV, or heterosexual as the only identified risk; Heterosexual/endemic = origin in a country where HIV is endemic; Other = recipients of blood transfusion or clotting factor, perinatal, and occupational transmission

* Totals were rounded to the nearest 1,000. Unrounded totals were 57,780 for 2005 and 49,980 for 2002, which were used to compute percentages.

Figure 1. Estimated number of prevalent HIV infections in Canada, including range of uncertainty, by year



heterosexual/non-endemic exposure category, the range increased from 450 to 850 (21%) in 2002 to 550 to 950 (21%) in 2005.

Persons from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic. New infections attributed to the heterosexual/endemic exposure category increased slightly from a range of 300 to 600 (15%) in 2002 to 400 to 700 (16%) in 2005, yet according to the 2001 Census approximately 1.5% of the Canadian population were born in an HIV-endemic country.[10] Therefore, the estimated infection rate among individuals from HIV-endemic countries is at least 12.6 times higher than among other Canadians. With the current methods and available data, it is not possible to differentiate infections acquired abroad from those acquired in Canada. CIDPC is currently collaborating with other government departments, provincial/territorial partners, researchers, and community groups to develop methods and obtain data to better understand the current status and trends of HIV infection in this group.

Table 2. Estimated ranges of uncertainty for number of incident HIV infections in Canada in 2005 and 2002 (ranges are rounded), by exposure category

	MSM	MSM-IDU	IDU	Heterosexual/ non-endemic	Heterosexual/ endemic	Other*	Total
2005	1,100-2,000	70-150	350-650	550-950	400-700	< 20	2,300-4,500
2002	900-1,700	60-120	400-700	450-850	300-600	< 20	2,100-4,000

MSM = men who have sex with men; IDU = people who inject drugs; Heterosexual/non-endemic = heterosexual contact with a person who is either HIV infected or at risk of HIV, or heterosexual as the only identified risk; Heterosexual/endemic = origin in a country where HIV is endemic; Other = recipients of blood transfusion or clotting factor, perinatal and occupational transmission

* New infections in the Other category are very few and are primarily due to perinatal transmission.

Past trends

The distribution of new HIV infections by exposure category has changed since the beginning of the HIV epidemic in Canada (Figure 2). The proportion of MSM among new infections steadily declined until 1996 and has increased since then, whereas there was a steady increase in the proportion of IDU among new infections until 1996 and then a decrease. The proportions of new infections attributed to the heterosexual/endemic and non-endemic exposure categories have increased steadily since the beginning of the epidemic.

Figure 3 presents the uncertainty range for estimated HIV incidence over time. New infections peaked during 1984-1985, and this was associated primarily with the MSM population (Figure 2). The number of incident infections decreased steadily after 1985 until the early 1990s and was followed by a slight secondary peak during 1996 and 1997, which was associated with high infection rates in the IDU population (Figure 2). Incident infections may have increased somewhat since the late 1990s, but there is a great deal of uncertainty associated with recent incidence estimates and, if present, this increase is much less than that seen in the early 1980s. At any rate, it can be stated with more certainty that the recent trend in incidence does not appear to be decreasing.

In national HIV surveillance data, new positive HIV test reports increased from the year 2001 to 2002 and then changed very little over the period from 2002 to 2005.[6,7] New diagnoses reported to CIDPC were 2,178 in 2001, 2,494 in 2002, 2,497 in 2003, 2,535 in 2004, and 2,483 in 2005. Some, but likely not all, of this increase between 2001 and subsequent years was due to the new HIV testing policy for immigrants and refugees implemented by Citizenship and Immigration Canada[11] on January 15, 2002.

Trends Among Women

At the end of 2005, there were an estimated 11,800 (10,000 to 13,500) women living with HIV (including AIDS) in Canada, accounting for about 20% of the national total. This represents a 23% increase from the 9,600 estimated for 2002. There were 620 to 1,240 new HIV infections among women in 2005, representing 27% of all new infections. For 2002, it was estimated that 490 to 970 new HIV infections were among women, accounting for about 24% of all new infections. With respect to exposure category, a slightly higher proportion of new infections among women were attributed to the heterosexual category in 2005 than in 2002 (76% versus 74% respectively). The remainder of new infections among women were attributed to IDU.

Trends Among Aboriginal Persons

Aboriginal persons continue to be over-represented in the HIV epidemic in Canada. They make up 3.3% of the Canadian population,[12] and yet an estimated 3,600 to 5,100 Aboriginal persons were living with HIV in Canada in 2005, representing about 7.5% of all prevalent HIV infections. This is higher than the estimated 3,100 to 4,400 for 2002 but represents the same proportion (7.5%). Approximately 200 to 400 of the new HIV infections in 2002 and 2005 respectively occurred in Aboriginal persons, which is about 10% of the total for 2002 and 9% for 2005. Therefore, the overall infection rate among Aboriginal persons is about 2.8 times higher than among non-Aboriginal persons. The distribution of exposure category among newly infected Aboriginal persons in 2005 was 53% IDU, 33%

Figure 2. Estimated exposure category distributions (%) of new HIV infections in Canada, by time period

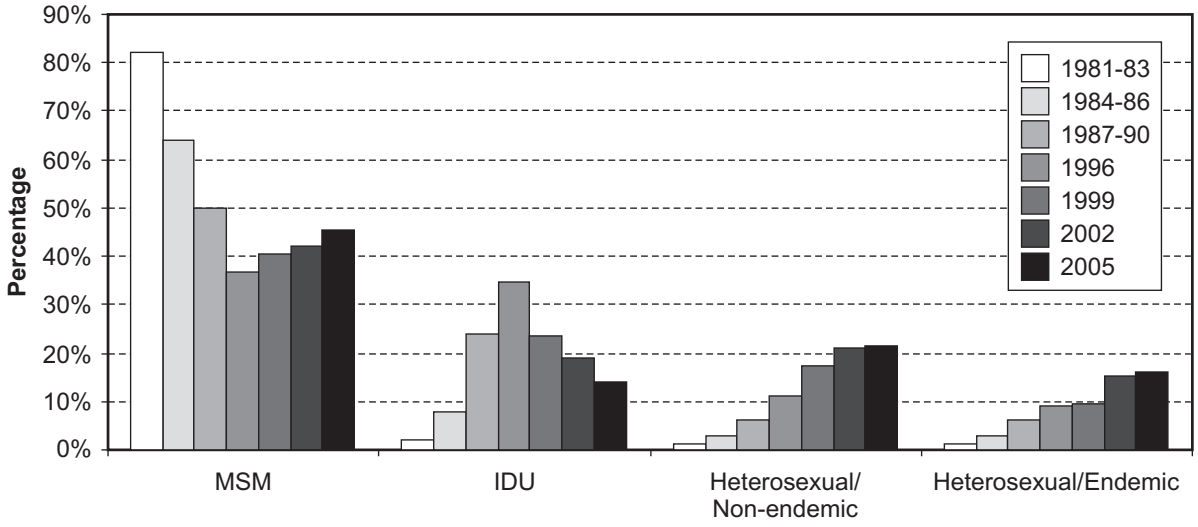
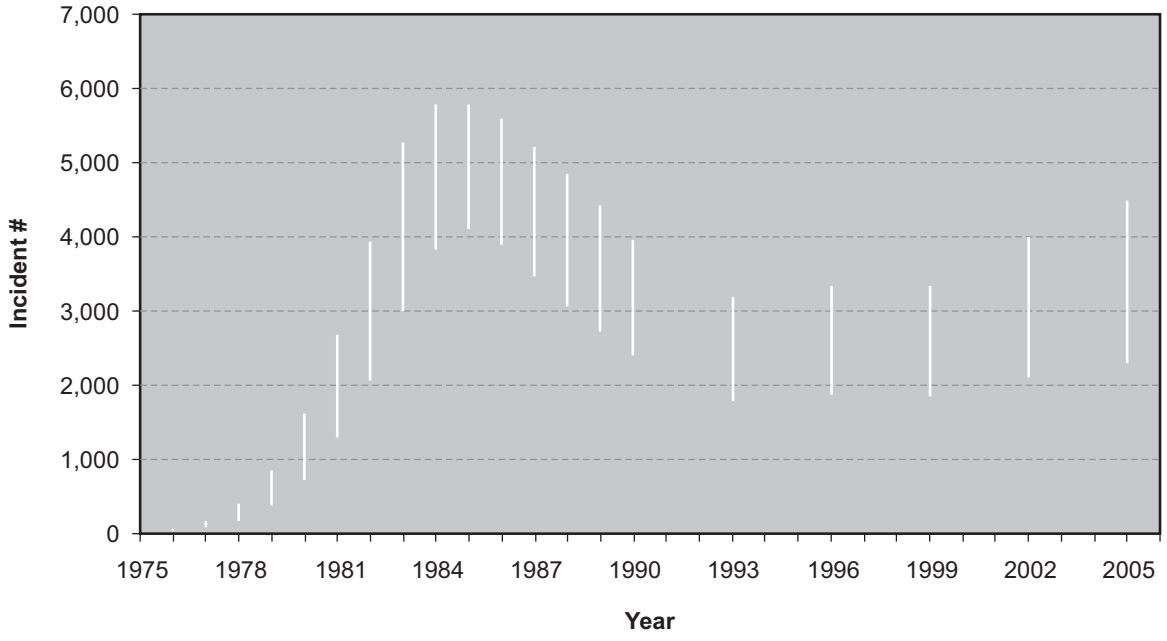


Figure 3. Estimated range of uncertainty (represented by vertical bars) in the number of new HIV infections in Canada, for selected years of infection



heterosexual, 10% MSM, and 3% MSM-IDU, which is unchanged from 2002.

The proportion of new HIV infections in 2005 due to IDU among Aboriginal Canadians (53%) is much higher than among all Canadians (14%). This highlights the uniqueness of the HIV epidemic among Aboriginal persons and underscores the complexity of Canada's HIV epidemic.

Undiagnosed HIV Infections: the Hidden Epidemic

There have been 60,160 positive HIV tests reported to CIDPC since testing began in November 1985 up to December 31, 2005, which translates into about 62,800 after adjustment for underreporting and duplicates. Of these, we further estimate that approximately 20,800 have died. Thus, 42,000 Canadians living with

HIV infection in 2005 have received a diagnosis. Of the estimated prevalent infections in 2005, about 15,800 (11,500 to 19,500) or 27% were unaware of their HIV infection. This compares with an estimated 14,400 (10,700 to 17,900) or 29% who were living with and unaware of their HIV infection in 2002.

The size of this group is especially difficult to estimate because its members are "hidden" to the health care and disease monitoring systems, since they are currently untested. It is important to reach this group, as individuals with undiagnosed infection cannot take advantage of available treatment strategies or appropriate counselling to prevent the further spread of HIV. Currently, it is not possible to further define this hidden group by exposure category or gender, but CIDPC is working to address this issue. For example, among AIDS cases in Canada, persons with a late HIV diagnosis are more likely to belong to a non-White ethnic group and to have been infected by routes other than MSM or IDU (such as by heterosexual activity).[13] Such information would assist in targeting programs to increase awareness of the risk of HIV transmission and improve access to and use of HIV testing.

Limitations

The 2005 estimates differ from previous years in that more emphasis has been placed on a combination of methods. However, the amount of data available was not always sufficient for the modelling to estimate exposure category specific numbers for all provinces; in these cases, HIV and AIDS surveillance data were used to extrapolate the additional numbers. The workbook method was heavily dependent on the representativeness of available data and on the assumptions made for groups when recent data were lacking.

Estimates for the Aboriginal subpopulation relied on ethnic variables in the HIV and AIDS surveillance data that are not completely reported at the national level. Information on risk factors in surveillance data was also incomplete, and this may have led to the misclassification of some cases. Furthermore, insufficient information was available to distinguish infections acquired outside Canada from those acquired within. Therefore, incidence as used in this report refers to a new infection appearing in Canada, through either transmission within Canada or the arrival of an HIV-positive individual. CIDPC is currently working with its partners to obtain data that would allow for the separate modelling of domestically acquired infections and the subsequent addition of newly arrived infections to the estimates.

These national estimates do not necessarily reflect local trends in HIV prevalence and incidence, neither do they address all populations affected by the HIV/AIDS epidemic in Canada (for example, prisoners), and the estimates are not broken down by age.

Comments

The methods used to estimate HIV prevalence and incidence made use of a wide variety of data. Additional sources of surveillance data were available from Ontario and Quebec that provided greater clarity to the characteristics of the epidemic in these provinces. Statistical modelling methods were used for the first time, making optimal use of the national HIV surveillance data. For future estimates, we plan to make increased use of tests to identify recent infections among diagnosed cases and to incorporate more results from targeted studies in high-risk populations. Despite the limitations noted, we believe this is a plausible picture of the state of the epidemic in Canada.

Approximately 58,000 Canadians were estimated to be living with HIV infection. This number will likely increase as new infections continue and survival improves due to new treatments, which will mean increased future care requirements. An estimated 2,300 to 4,500 new infections occurred in Canada in 2005, slightly higher than was estimated for 2002. However, the increase cannot be stated with certainty because of the level of precision associated with the estimates; a firmer conclusion is that overall incidence is not decreasing. This trend applies to the MSM, MSM-IDU, and both heterosexual exposure categories, but incidence in the IDU exposure category appears to be decreasing.

This recent trend among MSM and MSM-IDU is associated with increases in risky sexual behaviour. The causes of this increase are complex and may include decision-making based on false assumptions about a partner's HIV status, dissatisfaction and difficulties with condom use, feelings of marginalization, depression, and the choice to not use condoms as a gesture of commitment to a partner. Additionally, increases in risky sexual behaviour may be facilitated by the use of recreational drugs and, among young MSM, the lack of direct experience with AIDS cases. In the heterosexual exposure category, the observed trend is likely a result

of the general evolution and spread of the epidemic, as well as a recent change in the Citizenship and Immigration Canada policy on testing immigrants and refugees,[11] which has resulted in more diagnoses. The decrease among IDU likely results, at least in part, from effective prevention programming and shifting patterns of drug injecting practices.

Aboriginal people and persons from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic. These findings highlight the need for specific measures to address the unique aspects of the HIV epidemic within certain subpopulations. For example, IDU is the main HIV exposure category among Aboriginal persons, and heterosexual activity is the main risk for women and persons from HIV-endemic countries. There also continues to be a sizeable number of people living with but unaware of their HIV infection. Until these people are tested and their infection diagnosed, they are unable to take advantage of appropriate care and treatment services or to receive counselling to prevent further spread of HIV.

To successfully control the HIV epidemic in Canada, more effective strategies are needed to prevent new infections and provide services for all of the vulnerable populations identified in the *Federal Initiative to Address HIV/AIDS in Canada*. In addition, there is an increasing need to improve the availability and quality of data to better understand and monitor the full scope of the HIV epidemic in this country.

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Prevalent HIV Infections in Canada: More Than a Quarter May Not Be Diagnosed

At a Glance

- There were an estimated 58,000 people living with HIV infection (including AIDS) in Canada at the end of 2005.
- Of these, approximately 15,800 or 27% are not aware of their infection.
- Given the new treatments for HIV, it is more important than ever that all Canadians are able to access HIV testing.

Introduction

This *Epi Update* presents the estimated number of Canadians who were HIV infected but unaware of their infection at the end of 2005. It also summarizes available data on the characteristics of persons tested for HIV in Canada. It is anticipated that the next set of national HIV estimates, which will include an update to the estimate of undiagnosed persons living with HIV, will pertain to the year 2008 and will be produced during 2009.

HIV Testing in Canada

Knowledge of one's HIV status can be useful for several reasons. Counselling received at the time of HIV testing can provide critical information about how to reduce the risk of HIV infection. If an individual is found to be HIV infected, consideration can be given to starting antiretroviral therapy. In the case of pregnant women, treatment can reduce the chances that the infant will be infected, from 35%-40% to 2% or less.[1]

Canadians have had the opportunity to be tested for HIV infection in Canada since the test became available in 1985. Individuals have accessed HIV testing services through either coded or confidential testing at a doctor's office or clinic, or through anonymous testing sites.

Positive HIV test report data are provided by all provinces and territories in Canada to the Centre for Infectious Disease Prevention and Control (CIDPC) and are presented in the most recent surveillance report: *HIV and AIDS in Canada: surveillance report to December 31, 2006.*[2] The reports are based on non-nominal, confidential HIV testing information, and duplicate tests for the same individual are removed as much as possible. The removal of duplicates is necessary to accurately reflect the annual number of new HIV diagnoses. Duplicate removal rates vary by year, province, and type of data (nominal, non-nominal, or anonymous), and in most provinces the ability to remove duplicates has improved significantly since 1995.

HIV-infected but Unaware

It is important to note that data on positive HIV tests represent only those who have tested positive for HIV infection and do not represent all persons who have been infected with HIV, as some who have been infected have not yet come forward for testing.

CIDPC has recently published estimates of HIV prevalence in Canada to the end of 2005[3] (also see first *Epi Update* in this series entitled National HIV Prevalence and Incidence Estimates for 2005). It was estimated that approximately 58,000 (48,000-68,000) Canadians were living with HIV infection (including those living with AIDS) at the end of 2005. This estimate of 58,000 is rounded to the nearest 1,000, but for the purposes of calculating the undiagnosed portion the estimate was rounded to the nearest 100 (i.e. 57,800). This number includes those who are aware of their infection (have had a positive HIV test) and those who are unaware of their infection.

There have been 60,160 positive HIV tests reported to CIDPC since testing began in November 1985 to December 31, 2005, which translates into about 62,800 after adjusting for underreporting and duplicates. Of these, we further estimate that approximately 20,800 have died. Thus, 42,000 Canadians living with HIV infection in 2005 have been given a diagnosis. The difference between the total number who were HIV infected and alive at the end of 2005 (57,800 when rounded to the nearest 100) and the number who were aware of their HIV infection and alive at the end of 2005 (42,000) represents an estimate of the number of persons unaware of their infection (not yet tested positive for HIV) and alive. This difference is 15,800 (11,500-19,500) or about 27% of the estimated number of Canadians living with HIV infection at the end of 2005. This compares with an estimated 14,400 (10,700-17,900) or 29% who were living with and unaware of their HIV infection at the end of 2002.

Targeted studies provide a direct measure of the proportion of individuals whose HIV infection is undiagnosed in various subpopulations. In the most recent phase of the I-Track survey of people who inject drugs conducted at selected centres across Canada (2003-2005), 22.9% reported that their HIV status was negative or unknown, whereas blood testing indicated that they were HIV positive (Surveillance and Risk Assessment Division, CIDPC, I-Track unpublished data, April 2006). A targeted study involving MSM in Montreal indicated that, in 2005, 23% of the men who tested positive for HIV were unaware of their infection.[4] These targeted populations are likely more aware of their risks of infection and thus have higher rates of testing and lower proportions of undiagnosed infection than other subpopulations.

Characteristics of Persons Tested for HIV

A Canada-wide survey conducted in March 2003 of randomly selected individuals above 15 years of age revealed that just over one-quarter (27%) reported ever having been tested for HIV, excluding testing for the purposes of insurance, blood donation, and participation in research.[5] In this survey, women were more likely to have been tested than men (29% versus 24%), and of those who reported having been tested 42% had not been tested in the previous 2 years, 38% had been tested once in the previous 2 years, and 18% had been tested twice or more in the previous 2 years.

The figures from this 2003 survey show that a higher proportion of individuals reported having been tested as compared with the results of a Canada-wide survey conducted in January 1997, when it was found that 18.6% of men and 16.2% of women aged 15 years and older had been tested for HIV (excluding tests for blood donation and insurance purposes).[6,7] Of these, 39% had been tested in the year before the survey, 57% in the previous 2 years, and 43% had had their most recent test more than 2 years before the survey. The results of a 1996 survey showed that, taking into account ancillary testing such as for blood donation or life insurance purposes, 41% of men and 31% of women in Canada had ever been tested for HIV.[8]

National surveys of the general population suggest that those who report risk factors are more likely to be tested:

- Among heterosexuals, those with two or more partners in the previous year were more likely to be tested than those with one partner (50.5% versus 17.4%). Of those who reported having had a sexually transmitted infection (STI) in the previous 5 years, 58% had been tested compared with 17.4% of those who did not report an STI.[6,7] The percentage of Canadians being tested is higher among individuals who report casual partners (45%); this percentage increases with the number of partners, from

30% among those reporting one partner to 41% among those reporting two partners and 51% among those reporting three partners.[5]

- For men, the testing rate was higher among those who had sexual intercourse with men (MSM) (71%), injected drugs (IDU) (62%), received blood or clotting factor between 1978 and 1985 (27%), or had had a partner with a risk factor (IDU, received blood or clotting factor between 1978 and 1985, or came from a country endemic for HIV) (30%).[6,7] For women, testing was higher among those who had received blood or clotting factor between 1978 and 1985 (32%), had had a high-risk partner (38%), or had had sexual intercourse with a man since 1978 (17%).[8]
- Testing was highest among individuals aged 25 to 34 years. Even after all other risk factors are taken into account, those aged 45 years and over were still less likely to be tested than those younger than 45 years.[6-8] In the survey conducted in March 2003, Canadians aged 25-34 years and 35-44 years were more likely to be tested (46% and 35% respectively).[5]
- Targeted studies have shown that a large proportion of individuals in high-risk populations have been tested for HIV, though it is possible that some were tested for the purpose of participation in research. Among MSM surveyed in British Columbia in 2002, the proportion who reported ever having been tested was 89%.[9] This is higher than both the 65% of MSM respondents in a national study in 1991 who indicated that they had been tested for HIV[10] and the 78% of MSM who responded similarly in the Ontario Men's Survey in Ontario in 2002.[11] In the Ontario Men's Survey, a majority of respondents indicated that they had never been tested for HIV because they considered themselves to be at low risk of infection. In the I-Track survey of IDUs conducted at selected centres across Canada in 2002-03, 89.7% of IDU reported having been tested for HIV.[12]
- Although those reporting risk factors such as IDU, multiple partners, or MSM are more likely to be tested, a substantial proportion of individuals reporting risk factors have not been tested recently or have not been tested at all. For example, in the 1997 survey, among those who reported having had more than one partner in the previous year and not having used condoms consistently, 53% of men and 38% of women had never been tested.[5,6]

Comment

Canadians with risk factors for HIV infection are more likely to have been tested for HIV than those without such risk factors. However, there is still a significant proportion of persons with risk factors who have never been tested for HIV. It has been estimated that approximately 15,800 people or 27% of the HIV-infected population are unaware that they are infected. More information is needed about individuals who are at risk of HIV but have not been tested. Given these data and the fact that new treatments are available for HIV infection, it is more important than ever that all Canadians, particularly those at highest risk of infection, be able to access HIV testing.

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HIV Testing and Infection Reporting in Canada

At a Glance

- Nominal, non-nominal, and anonymous HIV tests are available in Canada.
- Although anonymous testing may encourage testing, it is not available in all provinces and territories.
- HIV infection is notifiable in all provinces and territories as of May 1, 2003.

Introduction

There were 20,669 AIDS cases reported to the Public Health Agency of Canada (PHAC) between 1979 and December 31, 2006, and 62,561 positive HIV tests reported between 1985 and the end of December 2006.[1] The positive HIV test results reported to PHAC are from people who test positive for HIV through nominal, non-nominal, or anonymous testing in the provinces and territories and whose results are reported to PHAC by their respective health authority or HIV testing laboratory.

This *Epi Update* summarizes the most current information on the reporting of HIV infection in Canada, including the types of HIV testing available and the year in which HIV infection reporting became notifiable in each province and territory. A notifiable disease is one that is considered to be of such importance to public health that its occurrence is required to be reported to public health authorities. (The terms "notifiable" and "reportable" are used interchangeably when discussing HIV/AIDS reporting in Canada.)

HIV Infection is Notifiable Across Canada

By 2003, positive HIV test results and AIDS diagnoses had been designated as notifiable in all Canadian provinces and territories. In most testing situations, laboratories and physicians are responsible for reporting HIV infection, but this varies by province or territory.

When HIV infection is notifiable, "nominal/name-based" or "non-nominal/non-identifying" information about an individual who tests positive for HIV infection is forwarded to provincial or territorial public health officials. This includes demographic data, such as the person's age and gender, risks associated with the transmission of HIV, and laboratory data, such as the date of the person's first positive HIV test.

HIV infection is not legally notifiable at the national level, yet notification to PHAC is voluntarily undertaken by all provinces and territories. Positive HIV test reports and reported AIDS cases are provided non-nominally to PHAC.

HIV testing patterns within the general population, along with the profile of people being tested, are important for designing and targeting intervention programs[2] and for developing a context for HIV/AIDS surveillance data. In 2003, a general population survey of 2,004 Canadians aged 15 years and older showed that 29% of women and 24% of men had ever been tested for HIV.[3]

Three Types of HIV Testing Available in Canada

Canadians choosing to be tested for the presence of HIV infection may have three different testing options, depending on the province or territory in which testing takes place: **nominal**, **non-nominal**, or **anonymous**.

Nominal/Name-based HIV Testing

- May be carried out at numerous locations, including clinics and offices of health care providers.
- The person ordering the test knows the identity* of the person being tested for HIV.
- The HIV test is ordered using the name of the person being tested.
- Patient information is collected, such as age, gender, city of residence, name of diagnosing health care provider, country of birth, ethnicity, information detailing the HIV-related risk factors of the person being tested, and laboratory data. The amount of information collected varies according to the province/territory.
- If the HIV test result is positive, the person ordering the test is obligated by law to notify public health officials of the positive test result.
- The test result is recorded in the health care record of the person being tested.

Non-nominal/Non-identifying HIV Testing

- Similar to nominal/name-based testing with one exception: the HIV test is ordered using a code or the initials of the person being tested (not including the full or partial name).

Anonymous Testing

- Usually available at specialized clinics, organized and supported by public health departments and by some health care providers.
- The person ordering the HIV test does not know the identity of the person being tested for HIV.
- The HIV test is carried out using a code. The person ordering the HIV test and the laboratory carrying out the testing on the blood sample do not know to whom the code belongs.
- Information such as age, gender, HIV-related risk factors, and the ethnicity of the person being tested for HIV may be collected during anonymous testing, depending on the province or territory in which the test is ordered or on the test site.
- Test results are not recorded on the health care record of the person being tested. It is only the person being tested who may subsequently decide to give his or her name and include the HIV test result in the medical record.

The types of available HIV testing services and HIV infection reporting information across Canada are summarized in Table 1.

Availability of Anonymous HIV Testing (AHT) May Increase Testing

Information regarding the status of anonymous HIV testing in Canada is summarized in Table 2.

As anonymous testing offers the highest degree of confidentiality, it may encourage more people to come forward for HIV testing and counselling.[4]

An evaluation study of AHT in Ontario suggested that AHT provides testing to populations that are not otherwise making use of it.[5]

In Ontario, more than 11,000 HIV tests were performed anonymously in 2005. This represents 2.8% of all HIV tests done that year.[6]

As of March 1995, Quebec reported that 3.6% of the samples analysed by their laboratory were anonymous. In 1997-98, this figure rose to 3.9%. Between 1994 and 1998, over 45% of the anonymous test users declared

* In rare instances, the true identity of the person being tested for HIV may not be known.

Table 1. HIV testing and HIV reporting by province/territory

Province/territory	Type of HIV testing available	Year in which HIV infection became notifiable	Responsibility for reporting of HIV infection	Type of testing reported to the province/territory
British Columbia	N, NN*	2003	L, P, RN**	N, NN
Yukon	N, NN	1995	L, P, RN	N
Northwest Territories	N, NN	1988	L, P, RN	N
Nunavut	N, NN	1999	L, P, RN	N
Alberta	N, NN,***A***	1998	L, P	N
Saskatchewan	N, NN, A	1988	L, P, RN	N, NN
Manitoba	N, NN	1985	L, P	N, NN
Ontario	N, NN, A	1985	L, P, NP, MW, D	N, NN§
Quebec	N, NN, A	2002	L, P	NN
New Brunswick	N, NN, A	1985	L, P, RN	N, NN
Nova Scotia	N, NN, A	1985	L, P	N, NN
Prince Edward Island	N, NN	1988	L, P, RN	N, NN
Newfoundland and Labrador	N, NN, A‡	1987	L, P, RN	N

N = nominal/name-based
A = anonymous
P = physician
MW = midwife
NN = non-nominal/non-identifying
L = laboratory
RN = nurse
D = dentist

* In BC, follow-up and reporting of non-nominal tests is the same as for nominal tests. If a patient tests non-nominally, they remain part of the non-nominal system.

** In BC, all positive cases are reported to HIV Surveillance/British Columbia Centre for Disease Control, which then reports the first positive cases to designated nurses in the health service delivery area where the test was ordered.

*** All positive HIV tests are reported nominally.

§ In Ontario, data from positive HIV tests completed by means of anonymous HIV testing (AHT) are reported non-nominally at the provincial level.

‡ If someone tests positive for HIV through AHT, that individual then becomes part of the nominal/name-based system, in which counselling, follow-up care, and HIV data reporting are all done nominally.

that the anonymity of the test was one of their primary reasons for getting tested.[7]

Several studies in the United States have shown that AHT programs encourage people to be tested for HIV infection, especially those at high risk or those who would not volunteer for testing under nominal/name-based or non-nominal/non-identifying circumstances.[8-10]

Interviews of 835 patients with newly diagnosed AIDS in the United States revealed that the availability of anonymous testing was associated with testing closer to the time of HIV infection and, thus, earlier access to medical care.[11]

New Developments

New issues and developments related to HIV testing and counselling have arisen in recent years. These include rapid testing technologies; provider-initiated testing and counselling; nucleic acid amplification testing; the availability of home testing kits in the United States and United Kingdom; and issues related to human rights, surveillance, delivery of testing and counselling programs, and research.[12,13] PHAC, in collaboration with the Federal/Provincial/Territorial Advisory Committee on HIV/AIDS and a pan-Canadian advisory committee, is currently in the process of developing a Canadian policy framework on HIV testing and counselling, which will include the following components:

Table 2. Status of anonymous HIV testing (AHT) by province/territory

Province/territory	Year in which AHT became available	Number of AHT sites	AHT data reported to CIDPC	Counselling services available
British Columbia	—	—	—	—
Yukon	—	—	—	—
Northwest Territories	—	—	—	—
Nunavut	—	—	—	—
Alberta	1992	3	Yes	Yes
Saskatchewan	1993	3*	Yes	Yes
Manitoba	—	—	—	—
Ontario	1992	50	Yes	Yes
Quebec	1987	60+	No	Yes
New Brunswick	1998	7**	—	Yes
Nova Scotia	1994	2	No	Yes
Prince Edward Island	—	—	—	—
Newfoundland and Labrador†	—	12	Yes‡	Yes‡

* AHT is also available at other sexual health clinics upon request.

** Additional testing sites available in federal/provincial correctional facilities.

† AHT is available upon request but is not part of the official guidelines for the province.

‡ If someone tests positive for HIV infection through AHT, that individual then becomes part of the nominal/name-based system, in which counselling, follow-up care, and HIV data reporting are all done nominally.

- a review of current policies, guidelines, and practices on HIV testing;
- an update of the 1995 Canadian Medical Association/Canadian AIDS Society HIV testing and counselling guidelines;
- a discussion of testing issues related to the most affected or hard-to-reach populations (e.g. gay men, ethnocultural groups, pregnant women);
- an update of the prevention and treatment issues related to HIV testing;
- the completion and publication of guidelines and practices for occupational and non-occupational post-exposure and pre-exposure prophylaxis; and
- an assessment of the efficacy and effectiveness of the policy framework in reaching the hidden epidemic of individuals with undiagnosed HIV infection.[12]

In the evaluation and adoption of HIV testing and counselling approaches entailed in this process it will be critical to ensure that there is a balance between human rights and public health best practices.[13]

Comment

HIV infection is legally notifiable in all provinces and territories; however, each has a different practice for reporting HIV infection. Legislation of HIV infection reporting in all Canadian provinces and territories may increase the number of test results received at PHAC. A change to mandatory reporting of HIV infection in Alberta in 1998 resulted in a significant increase in HIV tests among both men and women.[14] As a result, having HIV notifiable across Canada should allow for the collection of more complete epidemiologic data and more accurate and timely monitoring of the HIV epidemic.

All provinces and territories in Canada offer at least one of three forms of HIV testing: (1) nominal/name-based, (2) non-nominal/non-identifying, and/or (3) anonymous testing. At present, nominal/name-based and non-nominal/non-identifying HIV testing are widely available in Canada; however, anonymous HIV testing is available in only seven provinces. Increased availability and accessibility to different types of HIV testing may allow individuals to choose the testing and

counselling environment in which they feel most comfortable, thereby encouraging more people to be tested and facilitating the targeting of intervention and treatment programs.[15]

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HIV/AIDS Among Youth in Canada

At a Glance

- Youth represent a small proportion of the total number of reported HIV and AIDS cases in Canada. Individuals between the ages of 10 and 24 account for 3.5% of cumulative AIDS cases. For positive HIV test reports, youth between the ages of 15 and 19 account for 1.5% of all reports. In spite of these low proportions, risk behaviour data on young Canadians show the potential for HIV transmission.
- A national study found that approximately 50% to 60% of grade 9 and 11 students think there is a vaccine available to prevent HIV/AIDS. The same survey found that 36% of grade 11 students think that there is a cure for HIV/AIDS.
- Data from targeted studies show that street-involved youth, youth who inject drugs, and young men who have sex with men are particularly vulnerable to HIV.
- A wide range of prevention activities needs to be implemented to help minimize the risk of HIV transmission among youth.

Introduction

HIV and AIDS surveillance data indicate that youth (defined here as people aged 10 to 24 years) represent a small proportion of the total number of reported HIV and AIDS cases in Canada. At a global level, half of all new HIV infections worldwide are in young people aged 15-24.[1]

Within the Canadian context, the time between age 10 and 24 is a time of transition, and the individuals belonging to this age group represent a variety of subpopulations, including pre-teens, teenagers, and young adults. Combined, these groups make up an important part of the population to target for public health education and prevention activities.

In general, youth are vulnerable to HIV infection as a result of many factors, including risky sexual behaviour, substance use (including injecting drug use), and perceptions that HIV is not a threat to them. To adequately profile HIV and AIDS in the youth population it is necessary to supplement current Canadian HIV/AIDS surveillance data with other relevant data sources, such as health surveys, incidence/prevalence studies, and data on sexually transmitted infections (STIs). This *Epi Update* provides the most current HIV/AIDS surveillance data for Canadian youth as well as information on those factors that put Canadian youth at risk of infection with HIV and AIDS.

AIDS Data

As of December 31, 2006, there were 20,669 AIDS cases with information about age reported to the Public Health Agency of Canada (PHAC). Of these, 729 (3.5%) were among youth aged 10 to 24 years.[2]

As seen in Table 1, of the cumulative reported AIDS cases in youth aged 10 to 19 years, almost two-thirds of cases were recipients of blood or blood products. Among youth aged 20 to 24 years of age with AIDS, roughly half the cases were attributed to men who have sex with men (MSM) and 21.1% to heterosexual contact. Heterosexual contact includes sexual contact with a person at risk of HIV, origin from a country where HIV is endemic, and heterosexual contact as the only identified risk.[2]

4

HIV Testing Data[2]

Data received from provincial and territorial HIV testing programs do not allow for the creation of the 10-24 age group. The closest age group that can be constructed for youth is 15 to 29.

As of December 31, 2006, there were 58,981 positive HIV tests with information about age reported to PHAC. Of these, 868 (1.5%) were among youth aged 15 to 19 years, and 14,911 (25.3%) were among individuals aged 20 to 29 years.

In 2006, females accounted for 40.9% of positive HIV test reports among those aged 15 to 29 years (234/572). When compared with other age groups, the proportion of positive HIV test reports attributed to females is highest among youth. Women in other age groups (i.e. 30-39, 40-49, and over 50) account for approximately 18% to 31% of positive HIV tests.

There were 27 reported HIV tests with known exposure category for youth aged 15 to 19 in 2006. In these reports, the most common risk factor category was IDU (accounting for 12 reports) and MSM (five reports), followed by recipient of clotting factor (four reports).

In 2006, MSM, heterosexual contact, and injecting drug use accounted for 36.6%, 22.8%, and 16.8% respectively of reported positive HIV tests with known exposure category among those aged 20 to 29 years.

A cumulative total of 577 positive HIV test reports had been received by December 31, 2006, for individuals less than 15 years of age. Of the 338 cases in this group with known exposure category information, perinatal transmission and exposure to infected blood or blood products accounted for 70.4% of cases.

HIV Incidence and Prevalence Among Youth

HIV prevalence and incidence information, in conjunction with HIV/AIDS surveillance data, are more useful than surveillance data alone for depicting the current magnitude of the HIV epidemic in various population subgroups. To date, a small number of Canadian studies have examined HIV prevalence or incidence among youth, although most research has involved higher-risk populations. A comprehensive inventory of Canadian HIV incidence and prevalence studies as they relate to young adults can be found in the Surveillance and Risk Assessment Division publication *Inventory of HIV Incidence and Prevalence Studies*

Table 1. Number of reported AIDS cases and exposure category distribution for individuals 10 to 24 years of age, in Canada, diagnosed up to December 31, 2006

Category	Age group			
	10-19 years		20-24 years	
Number of cases	104		625	
Percentage of all reported AIDS cases	0.5%		3.0%	
Number of cases with exposure information	92		583	
	Percentage in each exposure category*			
Exposure category	59.8%	Blood and blood products	50.9%	MSM
	13.0%	Heterosexual contact/endemic	21.1%	Heterosexual contact/endemic
	10.9%	MSM	11.8%	IDU
	8.7%	IDU	9.8%	MSM/IDU
	4.3%	MSM/IDU	6.3%	Blood and blood products
	3.3%	Other + perinatal	0%	Other**

* Percentages based on the total number of cases minus those reports for which exposure category was unknown or "not identified". MSM = men who have sex with men, IDU = people who inject drugs.

** Mode of transmission is known but cannot be classified into any of the major exposure categories.

in Canada.[3] The following list represents the highlights of current incidence and prevalence data among youth:

- I-Track is a second-generation surveillance system of intravenous drug use that tracks HIV, hepatitis C, and associated risk behaviours in urban and semi-urban centres across Canada. Using I-Track data collected between 2003 and 2005, the prevalence of HIV among IDU aged 14 to 24 years was calculated as 5.0%.[4]
- In the Vancouver Injection Drug User Study (VIDUS), the cumulative incidence rate of HIV among IDU aged 24 years and younger after 36 months of follow-up was 11.1%.[5]
- Young Aboriginal IDU in British Columbia (BC) have been shown to have a high HIV prevalence rate. Results from the Cedar Project, a prospective study of Aboriginal youth aged 14 to 30 years in Vancouver and Prince George, BC, found an HIV prevalence in 2004 of 19.3% in Vancouver and 9.2% in Prince George among Aboriginal youth who use injection drugs.[6] In a more recent analysis of the Cedar Project data, the prevalence of HIV was significantly higher among those who had been sexually abused (13% vs. 4%, $p < 0.001$)[7] and among female participants (13% vs. 4%, $p < 0.001$).[8]
- Similar results were found in VIDUS in a comparison of Aboriginal and non-Aboriginal youth (aged 24 years and younger). From 1996 to 2003, 20% of Aboriginal youth and 7% of non-Aboriginal youth tested positive at study enrolment. HIV incidence density over the entire follow-up period for Aboriginal and non-Aboriginal youth was 12.6 per 100 person-years (PY) and 3.9 per 100 PY respectively. In a multivariate analysis, factors independently associated with HIV seroconversion among the youth were Aboriginal ethnicity (adjusted relative hazard [ARH] = 2.5) and ≥ 1 daily cocaine injection (ARH = 3.9).[9]
- Further information from the VIDUS study presented in 2003 demonstrated a high prevalence of HIV/hepatitis C (HCV) co-infection. A sample of IDU aged 29 and under had a co-infection rate of 16%, a further 53% were solely HCV positive, and 3% were solely HIV positive.[10]
- In the Montreal Street Youth Cohort study, participants between 14 and 25 years old have been observed since January 1995. HIV prevalence at study entry in the cohort was 1.4% (14 of 1,013 subjects). HIV incidence up to September 2000 was 0.69 per 100 PY.[9] Among MSM participating in the Montreal Street Youth Cohort study in 2000 the prevalence of HIV was 4.9%, and the incidence was 1.2 per 100 PY.[11,12]
- A study focusing on MSM aged 16 to 30 (Omega cohort in Montreal) found that in 2004 those MSM under 30 years of age had a slightly higher incidence rate, of 0.70 per 100 PY, compared with 0.57 per 100 PY for MSM aged 30 years and older.[13]
- In Vancouver, the Vanguard study observes young MSM (under 30 years of age) for HIV infection and risk behaviours. Results published in 2003 showed that the incidence of HIV was reported to be 1.9 per 100 PY.[14]
- The Enhanced Surveillance of Canadian Street Youth (E-SYS) is a national, multicentre, cross-sectional surveillance system of street youth aged 15 to 24 years in Canada. Of the youth tested in 2001, 0.96% were HIV positive; in 2003, 0.66% were positive. The rates differed by age category (younger youth 15-19 years, older youth 20-24 years): in 2001, most HIV infections among street youth were seen in older youth (0.3% vs. 2.3% respectively). In 2003, all HIV infections were among older youth.[15]

Risk Behaviour Data Among Youth: Findings from Two Canadian Surveys

In 2005, the Canadian Association for Adolescent Health (CAAH) and Ipsos conducted a national online survey of adolescents aged 14 to 17. The sample of 1,171 adolescents was generated by Ipsos-Reid's Canadian Consumer Online Panel. The panel is made up of 150,000 randomly selected households, representing Canada's Internet population. Below are some key findings from this survey.[16]

- Twenty-seven percent reported being sexually active.
- Those who were sexually active had an average of three sexual partners. As well, of the sexually active adolescents, 24% did not use a condom the last time they had sex; 38% engaged in casual sex; 16% reported that their partner had other sexual partners while dating them; and half the condom users re-

ported never checking after sex to see whether their condoms had remained intact.

- Ninety percent of adolescents claimed to be very or somewhat knowledgeable about sex and sexual health. However, the survey found a number of misconceptions regarding common STIs. For example, only 21% knew that cancer was a possible consequence of infection with human papillomavirus.
- Almost two-thirds (62%) faced obstacles or barriers in getting answers to their questions on sexual health, such as their own discomfort in talking about sexual health information.

In 2002, the Canadian Youth, Sexual Health and HIV/AIDS Study (CYSHHAS) was conducted to provide a contemporary picture of the sexual behaviour of adolescents and to increase understanding of the factors that contribute to their sexual health, with a focus on HIV/AIDS. Administered in all provinces and territories (with the exception of Nunavut), the CYSHHAS surveyed 11,074 students in grades 7, 9, and 11 (approximate ages 12, 14, and 16). This is the first Canada-wide study to assess adolescent sexual health since the Canada Youth and AIDS Study (CYAS) in 1989.[17] The following information summarizes some key findings from the CYSHHAS.

- Almost one-quarter (23%) of grade 9 boys and 19% of grade 9 girls reported having had vaginal sexual intercourse. By grade 11, this figure had increased to 40% of boys and 46% of girls.
- When compared with the 1989 CYAS, the proportion of students who had had sexual intercourse, across all grade levels, had decreased.
- Sexually active youth are using condoms, but the proportion doing so decreases with increasing age.
- A large proportion of grade 9 students (78%) reported the use of contraception that included a condom the last time they had sex. Among grade 11 students, this proportion decreased to 71%, the most apparent decline occurring among females: 75% of grade 9 females reported using a contraceptive measure that included condoms, and 64% of grade 11 females reported using such measures.
- CYSHHAS students are generally knowledgeable about transmission of and protection from HIV/AIDS, but knowledge gains need to be made.
- Most students were able to correctly identify the means of transmission of HIV, such as sharing needles, having unprotected sexual intercourse, or having multiple sexual partners, but were less knowledgeable about the increased risk of transmission associated with men who have unprotected sex with men.
- Over two-thirds of grade 9 students and just under half of grade 11 students thought that there is a vaccine available to prevent HIV/AIDS, and a substantial number believed that HIV/AIDS can be cured if treated early. Approximately two-thirds of grade 7 students, half of grade 9 students, and one-third of grade 11 students did not know that there is no cure for HIV/AIDS. These findings suggest that there may be a false sense of complacency about the disease among today's youth.
- There have been few HIV/AIDS knowledge gains since 1989.

The results of these surveys complement the HIV/AIDS surveillance data presented in this *Epi Update*, since positive HIV test reports and AIDS cases alone cannot provide information about the behaviours that put youth at risk of HIV. Limitations of the surveys must be considered when interpreting the findings. The CAAH survey represented a sample of youth who had Internet access in their homes, and the CYSHHAS represented a sample of youth who attend school across Canada. These surveys cannot be generalized to high-risk groups of youth who are less likely to have Internet access or to attend school.

Behaviour Among Higher Risk Populations: An Ongoing Concern

High-risk youth (such as street-involved youth) engage in a variety of behaviours, such as sex trade involvement, low rates of condom use, and injecting drug use, that put them at increased risk of infection with HIV/AIDS. There are a number of Canadian studies that provide information on HIV/AIDS prevalence in high-risk youth and the behaviours that put this population at risk of HIV/AIDS.

- In the At-Risk Youth Study, a cohort study of street-involved Vancouver youth who had used illegal drugs, 6% of the study's participants reported sex trade work as a source of income, a behaviour elevating their risk of contracting HIV.[18]

- In a 2001 study of young gay and bisexual men aged 15 to 30 in Vancouver, 16% of the study subjects reported selling sex for money or drugs. HIV prevalence among those who had engaged in prostitution was significantly higher than among those who had not (7.3% vs. 1.1%), and incidence was higher as well (4.7 per 100 PY vs. 0.9 per 100 PY).[19]
- In an ongoing study of Montreal street youth, only 13.2% of participants reported always using condoms during vaginal intercourse, and only 32.4% reported always using condoms during anal intercourse.[20] Of the 542 male participants recruited in this study from 2001 to 2003, 27.7% reported involvement in survival sex (prostitution). Of the youth reporting anal sex with a male client, 26.7% had unprotected anal sex. For all types of activities (vaginal, oral, or anal sex), the proportions reporting unprotected sex were always higher with non-commercial sexual partners.[21]
- More than 95% of street youth surveyed by E-SYS during the 1999 to 2003 cycles reported being sexually active. The average number of sexual partners was 23 and 22 for male and female street youth respectively. Roughly 50% of street youth reported not using condoms at their last sexual encounter.[15]

Research reveals that levels of injecting drug use and injecting risk behaviours among youth, particularly those who are street-involved, require ongoing assessment:

- Data from a Montreal cohort study of street youth, conducted between 2001 and 2005, were used to examine factors contributing to drug initiation among street youth. The incidence rate of drug injecting was 4.8 per 100 PY. Predictors of initiation into drug injection included daily alcohol use in the previous month (adjusted hazard ratio [AHR] = 2.6), heroin (AHR = 4.2) and crack/cocaine (AHR = 2.3) use in the previous 6 months, and prostitution (AHR = 3.1) in the previous 6 months. A high self-efficacy score was found to have a protective effect with regard to initiation into injection drug use.[22]
- The At-Risk Youth Study, a cohort study of street-involved Vancouver youth who had used illegal drugs, was conducted between September 2005 and 2006. Forty-two percent of participants reported having injected drugs. Factors and outcomes associated with injecting included age > 22 (adjusted odds ratio [AOR] = 1.9); hepatitis C infection (AOR = 24.3); a history of sex work (AOR = 2.2); a history of incarceration (AOR = 1.8); having dropped out of high school (AOR = 1.7); downtown eastside residence (AOR = 1.6); and age > 15 years at first witnessing a drug injection (AOR = 1.8).[23] In this same study, 21% of participants had either lent or borrowed a syringe in the previous 6 months.[24]
- In Vancouver, the Maka Project examined youth involved in sex work and concluded that members of this population were 4 times more likely (OR = 4.5) than their adult counterparts to have borrowed used syringes during the previous 6 months.[25]
- In VIDUS, of those aged 29 years and younger at baseline, 38% had initiated injection drug use at age 16 or younger. These young initiators were more likely to be female (AOR = 1.63), to be involved in sex work (AOR = 1.61), to engage in binge drug use (AOR = 1.45), to have ever been in juvenile detention or jail (AOR = 1.78), and to be HIV positive (OR = 2.6).[26]
- In the Cedar Project in 2004, Aboriginal youth who used injection drugs and were living in Prince George were more likely to report daily use of cocaine (60% vs. 42%; $p = 0.052$) and to borrow syringes (24% vs. 13%; $p = 0.013$) than Aboriginal youth living in Vancouver.[6]
- In 2003, 22.3% of youth recruited for E-SYS reported that they had injected drugs in their lifetime, and of these 31% reported borrowing injection equipment from someone else.[15]
- In data collected from 2003 to 2005 through I-Track, 40.5% of IDU youth aged 14 to 24 years injected themselves with used needles and 61.9% with used equipment.[4]

Sexually Transmitted Infections: An Indicator of Unprotected Sex

Risk data for youth demonstrate unprotected sexual activity. The extent of this activity is further captured in rates of chlamydia and gonorrhea. PHAC data show that reported chlamydia cases are concentrated in the under-30 population in both sexes. In 2004, this age group accounted for over 80% of all reported chlamydia cases. Similarly, young females (15-24 years) accounted for about 70% of all gonorrhea cases reported in women in 2004, and while gonorrhea cases were distributed across a wide range of ages among

men those most affected were in the 20 to 29 year age group.[27]

Comment

HIV/AIDS is affecting many subgroups of the Canadian population, including youth. Although the limited data available suggest that HIV prevalence is currently low among youth, sexual risk behaviour and STI data clearly indicate that the potential for HIV transmission remains significant among young Canadians.

The finding from the CYSHHAS that a substantial number of youth believe there is a vaccine to prevent HIV/AIDS and that the disease can be cured if treated early is worrisome. Such knowledge gaps need to be addressed by public health education and prevention programs.

More incidence and prevalence information as well as trend data on HIV-related risk behaviours are needed in order to guide and evaluate prevention programs for young Canadians. Epidemiologic and behavioural data for high-risk youth, such as street youth, are also needed to assess fully the risk of HIV transmission in Canada's youth population.

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HIV/AIDS *Epi Update*
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HIV/AIDS Among Women in Canada

At a Glance

- In Canada, a total of 1,866 AIDS cases and 9,569 positive HIV tests were reported in adult women up to December 31, 2006.
- Women represent an increasing proportion of those with positive HIV test reports in Canada and in 2006 accounted for 27.8% of such reports.
- Heterosexual contact and injecting drug use are the two main risk factors for HIV infection in women.

Introduction

The recent face of the HIV/AIDS epidemic in Canada has changed from what was seen in the early years — a disease that primarily affected men who have sex with men (MSM) — to one that increasingly affects other groups, including heterosexuals and people who inject drugs (IDU). As a result, the number and percentage of women living with HIV/AIDS are increasing. This report updates the status of HIV and AIDS among adult women (15 years and older) in Canada up to December 31, 2006.

AIDS Surveillance Data

In Canada, 20,426 cumulative AIDS cases in adults with reported gender were reported to the Public Health Agency of Canada (PHAC) up to December 31, 2006. Of these, 1,866 (9.1%) were women. The proportion of all reported adult AIDS cases occurring in women has increased over time, from 7.0% in the pre-1997 period to 24.2% in 2006.[1]

Of all cumulative reported AIDS cases in women up to December 31, 2006, 66.9 % were attributed to heterosexual contact,* 24.7% to injecting drug use, and 8.4% to receipt of blood or blood products, occupational exposure, or "other."[1]

AIDS has a significant impact on Aboriginal women. Between 1979 and 2006, of all AIDS cases reported with ethnic status information females represented 26.5% of cases in Aboriginal persons and 9.1% of cases in non-Aboriginal persons.[2]

HIV Surveillance Data

Data from provincial and territorial HIV testing programs indicate that a total of 9,569 positive HIV test reports had been reported in adult women up to December 31, 2006.[1] This number does not include those who are infected with HIV but are unaware of their infection or choose not to be tested.

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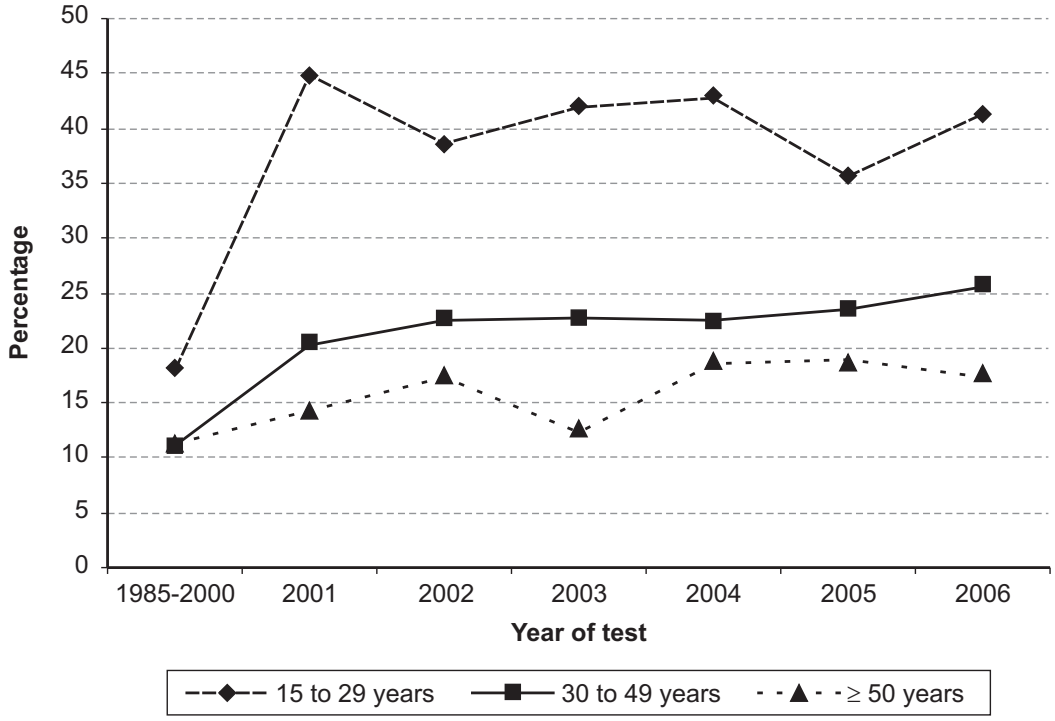
* Heterosexual category includes three subcategories: sexual contact with a person who is either HIV infected or at increased risk of HIV infection, origin from a country where HIV is endemic, and sex with a person of the opposite sex as the only identified risk.

Figure 1. Percent of all positive HIV test reports accounted for by women by age group and year of test, 1985-2006



Women account for a growing proportion of positive HIV tests reports in Canada. The proportion of females has shown a steady rise over time, increasing from 11.3% of reports with known gender in the 1985-1996 period to 27.8% of adult positive HIV test reports in 2006.[1]

The proportion of positive HIV test reports accounted for by women varies considerably by age and is highest among young adults. Females continue to account for a substantial proportion of positive HIV test reports in the 15-29 year age group, representing 36% to 45% of all tests among those with known age between 2001 and 2006 (Figure 1).

Among women, the primary exposure categories associated with newly diagnosed HIV infection are heterosexual contact and injecting drug use (Table 1). The proportion of positive HIV test reports in women attributed to heterosexual contact has increased over time, from 47.9% for the 1985-2000 period to a peak of 65.6% in 2003 and 61.1% in 2006. The proportion attributed to injecting drug use has decreased from the 1985-2000 period, when it accounted for 40.4% of all positive test reports among women, to 30.7% in 2006 (Table 1).[1] The issue of injecting drug use is discussed in greater detail in the two chapters of this *Epi Updates* publication entitled HIV/AIDS Among People Who Inject Drugs in Canada and Risk Behaviours Among People Who Inject Drugs in Canada.

In the Canadian Aboriginal population affected by the HIV epidemic, females account for almost half of positive test reports with ethnic status information. Data reported between 1998 and 2006 demonstrate that females represented 48.1% of all positive HIV test reports among Aboriginal persons versus 20.7% among non-Aboriginal persons.[2]

HIV Prevalence and Incidence Estimates Show That More Women Are Living with HIV/AIDS

The national HIV prevalence (total number living with HIV) estimates indicate that the number of women in Canada living with HIV, including those with AIDS, continues to grow. By the end of 2005, an estimated 11,800 (10,000-13,500) women were living with HIV, accounting for about 20% of the national total.[3] This represents an increase of 23% from the 9,600 estimated at the end of 2002.

Data from positive HIV test reports (as summarized in the HIV Surveillance Data section) do not provide the

Table 1. Percentage of positive HIV tests among adult females by exposure category and year of test, Canada, 1985-2006

	Exposure category (%)		
Year	Heterosexual contact*	Injecting drug use	Blood and blood products
1985-2000	47.9	40.4	6.5
2001	63.9	31.1	1.4
2002	58.5	36.7	1.4
2003	65.6	25.5	2.6
2004	64.4	30.9	1.6
2005	57.3	35.1	2.3
2006	61.1	30.7	0.9
Total	53.4	37.0	4.6

* Heterosexual category includes three subcategories: sexual contact with a person who is either HIV infected or at increased risk of HIV infection, origin from a country where HIV is endemic, and sex with a member of the opposite sex as the only identified risk.

complete picture of the annual number of new HIV infections, since only a proportion of those newly infected are tested in the same year. Furthermore, not all HIV tests reported in a given year are from cases infected in that year. The estimated number of new infections (incidence) among women has increased slightly since 2002, when women accounted for 24% of new infections. In 2005, women represented 27% of all new HIV infections or an estimated 620 to 1,240 out of the estimated total of 2,300 to 4,500 new infections in Canada. With respect to the distribution of exposure category among newly infected women, a slightly higher proportion was attributed to the heterosexual category in 2005 than in 2002 (76% vs. 74%, respectively).[3] The remainder of new infections among women were attributed to injecting drug use.

HIV Among Pregnant Women and Women of Childbearing Age

HIV testing during pregnancy is an option available to women across Canada; however, physician guidelines and/or recommendations encouraging informed decisions regarding HIV testing during pregnancy vary by province and territory. These are discussed in detail in the *Epi Update* entitled Perinatal Transmission of HIV.

HIV prevalence studies involving pregnant women can provide an important source of information on the prevalence rate of HIV in the general heterosexual population. Prenatal seroprevalence studies in Canada report estimated rates of HIV infection ranging from 2/10,000 to 9/10,000 pregnant women.[4-8]

Anonymous, unlinked seroprevalence studies across the country show that large metropolitan areas report the highest rates of HIV infection among pregnant women (4.7/10,000 for Vancouver vs. 3.4/10,000 for the rest of British Columbia [BC] in 1994[9] and 15.3/10,000 for Montreal vs. 5.2/10,000 for the province of Quebec in 1990[10]). Even provinces without large metropolitan areas have indicated significant rates (for example, 4.1/10,000 in New Brunswick for 1994-96[11]). An ongoing study of pregnant Aboriginal women in BC reported an HIV prevalence rate of 31.3 per 10,000 pregnancies in 2000-2002 (JD Martin, Programs Medical Officer, Pacific Region, First Nations and Inuit Health Branch, Health Canada: personal communication).

The Alberta universal prenatal HIV screening program reported an HIV infection rate of 33/10,000 pregnancies in 2000.[5] The HIV screening program employs an "opt-out" approach, the intent being that HIV testing is performed for all pregnant women unless the woman specifically declines testing. The Alberta program has achieved testing rates for HIV among pregnant women of greater than 95% each year since 2000, the highest of any program in North America.[12]

In Ontario, prenatal screening for HIV is carried out by the Ministry of Health and Long-Term Care. A study of pregnant women was conducted between January 1992 and September 2005. Overall, 259 pregnant women tested HIV positive (3.7/10,000), and in 192 of these the infection was newly diagnosed.[13] A 2002 anonymous seroprevalence study included 33,624 pregnancies never tested for HIV: 21 were HIV positive, for a rate of

6.2/10,000, as compared with 3.1/10,000 among women who had previously been tested.[13]

The BC Centre for Disease Control conducted an anonymous antenatal study to determine HIV seroprevalence in BC in 2003. In 1992, the antenatal seroprevalence there was 4.95/10,000 (95% confidence interval [CI] 2.5-9.4), and this had increased to 9.0/10,000 (95% CI 6.0-17.0) by 2003. During this same period, the number of pregnancies managed at the provincial clinic for HIV-positive women increased from 11 per annum to 27 per annum.[4]

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Risk Factors and Challenges

While HIV/AIDS affects both women and men, broad-based social and economic conditions that fuel the HIV/AIDS epidemic, such as poverty, marginalization, gender power inequalities, and violence, increase the vulnerability of women to HIV infection.[14] Social inequalities lie at the heart of HIV risk for women,[15] and forces outside women's control may reduce their ability to protect themselves against HIV infection.

Results from research carried out by the Cedar Project, an observational study of Aboriginal youth (14-30 years of age) in BC who use injection and/or non-injection drugs, showed that, of 543 participants, 69% of females and 31% of males reported previous sexual abuse. A history of sexual abuse was found to be associated with attempted suicide (adjusted odds ratio [AOR]: 2.1, 95% CI: 1.4-3.0) and receiving payment for sex (AOR: 3.7, 95% CI: 2.5-5.4). Participants who reported a history of sexual abuse were almost three times more likely to be HIV-positive than participants with no sexual abuse history (AOR: 2.8, 95% CI: 1.4-5.8).[16]

In another study from the Cedar Project, conducted between October 2003 and July 2005, a significantly higher HIV prevalence was noted among female compared with male Aboriginals (13.1% vs. 4.3%). The researchers note that the higher prevalence among females was likely accounted for by differences in drug use patterns, severity of addiction, and sexual vulnerabilities.[17]

A study carried out in Toronto, Ontario, involving adolescents in the child welfare system found that females, but not males, who had experienced childhood sexual abuse were more likely to subsequently engage in sexual risk behaviours.[18]

Researchers with the Vancouver Injection Drug Users Study (VIDUS) found that 72% of the 520 female IDU in the study had worked as sex trade workers.[19] Findings from Phase I of I-Track, an ongoing study involving IDU in several sites across Canada, indicate that approximately one-third of female IDU reported engaging in sex trade work and, of these, 20% did not always use condoms with their male client partners. Approximately 29% of women reported that they never used condoms with their casual partners, and condom use was infrequent with regular partners.[20] Male clients may offer sex trade workers more money if they perform sexual acts without condoms, and men may threaten violence if sex trade workers or partners insist on condom use. As noted by Zierler and Krieger,[15] when women refrain from asking their male partner to use a condom during sex because of fear of his reaction, it is gender inequality that is driving their risk of HIV infection.

An analysis of the VIDUS cohort by Spittal et al.[21] found that requiring assistance with injecting drugs was an independent predictor of HIV seroconversion for women but not men. The authors explain this as a consequence of an unequal distribution of power and control in gender relations and note the challenge for harm reduction initiatives presented by the lack of control exercised by female IDU. They also noted that between May 1996 and December 2000 the HIV incidence rate among female IDU was approximately 40% higher than among male IDU.

A previous history of injecting drug use is consistently found more frequently among female than male inmates in federal and provincial prisons in Canada.[22] It has also been reported that during incarceration in Canadian federal prisons for women, one in four women engages in unprotected sex, and one in five uses intravenous drugs.[23] Of those federally incarcerated in Canada, the prevalence of HIV infection in 2001 was 4.7% among women and 1.7% among men.[24]

Comment

Women in Canada, especially IDU and women with high-risk sexual partners, are increasingly becoming infected with HIV, and women now account for more than one-quarter of new positive HIV test reports. The changing face of HIV/AIDS in Canada necessitates that data on the trends, risk factors, and geographic differences in HIV/AIDS in Canadian women should be used to develop and target gender-specific prevention and care initiatives and programs. These programs should address both sex-

ual and injecting risk behaviours, as well as the intersection between the two and the underlying factors that put women at increased risk of HIV infection.

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HIV/AIDS Among Older Canadians

At a Glance

- As of December 31, 2006, 12.2% (2,525) of all reported AIDS cases were persons 50 years of age or older.
- The proportion of annual positive HIV test reports among those aged 50 years or older increased from 7.6% for the 1985-1998 period to a high of 13.8% in 2006.
- Sexual contact is the major risk factor for HIV infection in older Canadians. In 2006, the MSM category accounted for 35.1% and the heterosexual contact exposure category for 31.6% of positive HIV test reports in those 50 years of age or older.
- Men account for most of the reported AIDS cases and positive HIV test reports among older Canadians: 90.3% and 82.4%, respectively.

Introduction

HIV/AIDS is generally believed to be a young person's disease and, consequently, little focus has been given to the issue of HIV/AIDS in older Canadians. It should be noted that the age range for "older" is subjective, and the lower age limit for this category in the literature varies between 40 years and 55 years of age. For the purpose of this *Epi Update*, older individuals will be defined as those aged 50 years or older.

In this population it is important to consider that the HIV/AIDS epidemic actually affects two groups: those who became infected at the age of 50 years or older and those who were infected with HIV at younger ages but are now living longer before progression to AIDS. Throughout much of the Western world, access to highly active antiretroviral therapy and other treatment options has improved the likelihood of surviving into old age for people who contract HIV, and this fact may contribute to a higher HIV prevalence in this population.[1] Monitoring of HIV surveillance data in this age group is necessary on an ongoing basis.

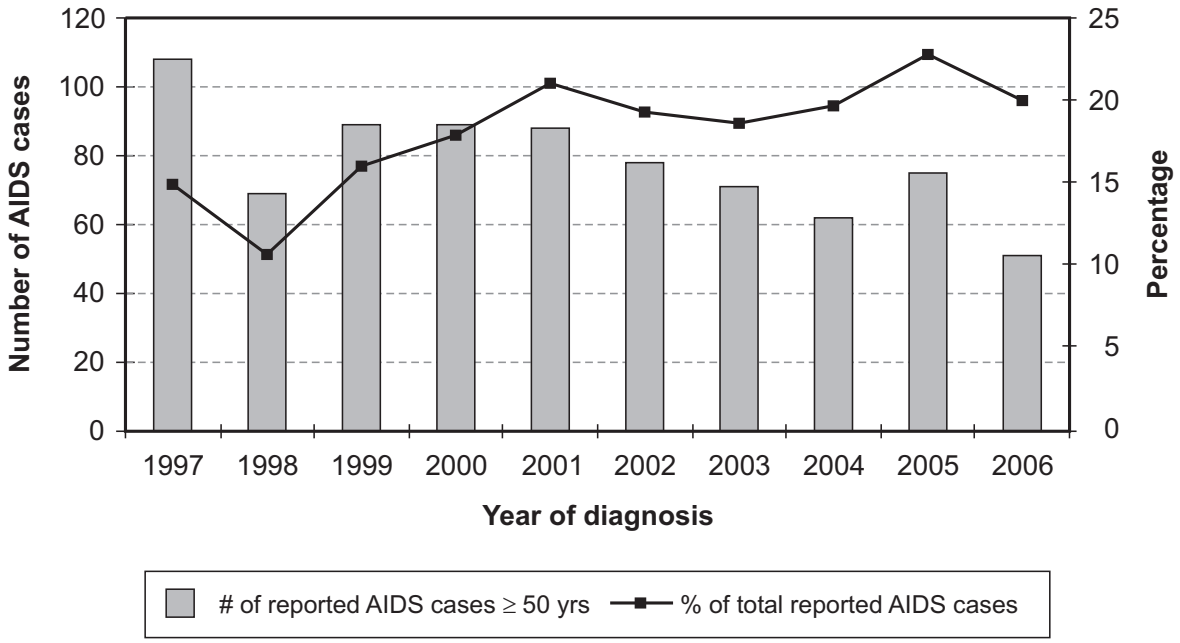
AIDS Case Report Data

As of December 31, 2006, 20,667 AIDS cases with age information were reported to the Public Health Agency of Canada (PHAC). Of these reports, 2,525 (12.2%) were among persons 50 years of age or older.[2]

Figure 1 shows the number of reported AIDS cases and the proportion among those aged 50 years or more. The overall trend is toward an increase in the proportion of AIDS cases among older Canadians with some year-to-year variability due to small numbers.

An increasing trend has been observed in the United States,[3] where the proportion of new AIDS cases among individuals aged 50 years or older increased over time to a high of approximately 14% in 1999. Mack and Ory[3] suggest that this increase could be due to the following factors: an actual increase in new AIDS cases, better case reporting of the older population than earlier in the epidemic, or

Figure 1. Number of reported AIDS cases among persons 50 years and older and percentage of all reported AIDS cases by year (1997-2006)*



* Quebec AIDS data have not been available since June 30, 2003.

delayed progression to AIDS because antiretroviral therapy prolongs the period from HIV infection to AIDS.

According to the Centers for Disease Control and Prevention, the number of adults in the United States aged 50 years and older with HIV/AIDS increased from 65,655 cases in 2001 to 104,260 cases in 2004, an increase of 59% in only 3 years.[4]

Table 1 shows the distribution of exposure categories for all reported AIDS cases among older Canadians up to December 31, 2006. Men who have sex with men (MSM) made up the majority of reported cases among those aged 50-59 years and 60 years and older.

The Changing AIDS Epidemic

Figure 2 displays the proportion of reported AIDS diagnoses by exposure category and year of diagnosis among those aged 50 years or older. Although Quebec AIDS data have not been available since June 30, 2003, and Ontario AIDS data by exposure category have not been available since June 30, 2005, the overall trends show a decrease in the proportion of AIDS cases attributed to MSM and increases for both the heterosexual contact and injecting drug use exposure categories.

Positive HIV Test Reports

Data from provincial and territorial HIV testing programs in Canada indicate that 5,275 positive HIV tests with information on age were reported among persons 50 years or older up to December 31, 2006.[2] The proportion of annual positive HIV test reports in this age group has risen from 7.6 % between 1985 and 1998 to a high of 13.8% in 2006.

Table 2 summarizes the exposure categories associated with positive HIV test reports in 2006 among adults 50 years or older. Approximately two-thirds of positive HIV test reports in this age group with exposure category information were attributable to MSM (35.1%) and heterosexual contact (31.6%).

Men Account for Most of the AIDS and HIV Cases Among Older Canadians

Among those 50 years of age or older, men account for the majority of positive HIV tests and AIDS cases reported to PHAC. Of the 2,525 cumulative AIDS cases with known age and gender, men accounted for 90.3%. Of the cumulative positive HIV test reports with

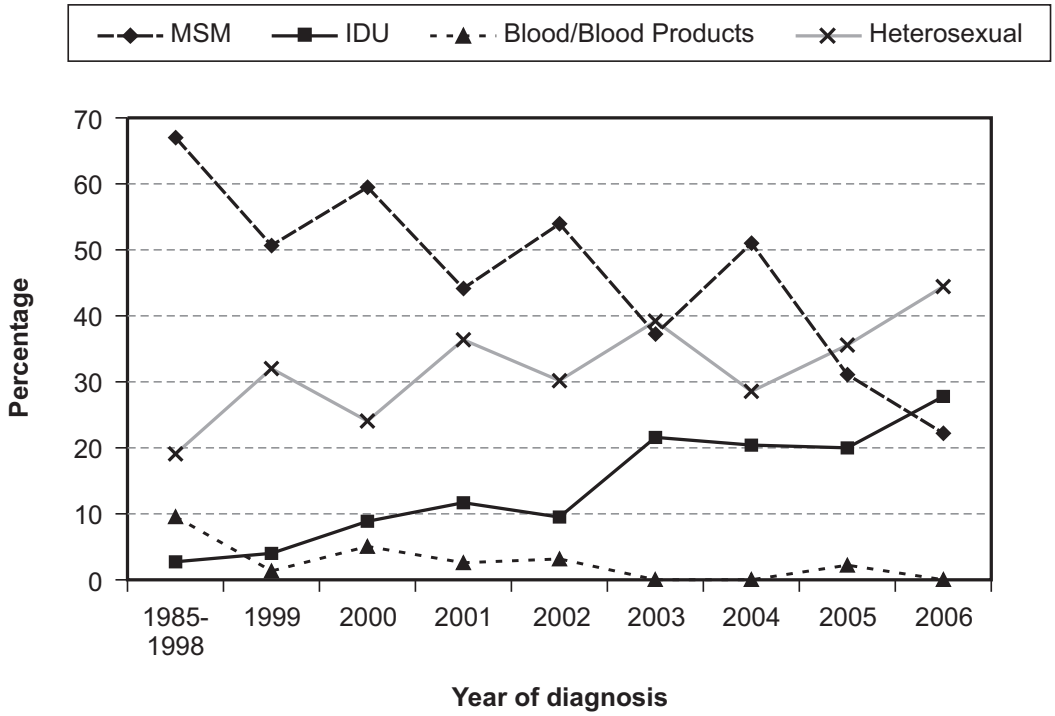
Table 1. Distribution of exposure categories among AIDS cases reported up to December 31, 2006, for individuals 50 years of age or older in Canada

	Age group	
	50-59 years	**≥ 60 years**
Number of cases	1,852	673
Percentage of all reported AIDS cases	9.0	3.3
Number of cases with exposure information	1,659	594
Exposure category*	**Percentage in each exposure category****	
MSM	67.4	50.7
MSM/IDU	2.4	0.7
IDU	5.8	2.2
Recipient of blood/blood products	5.3	15.8
Heterosexual contact	18.8	30.1
Occupational and Other	0.3	0.5

* As a result of recent changes in the reporting of AIDS cases in Ontario, exposure category was not available for cases reported since June 30, 2005, and these cases were categorized as exposure category not reported. MSM = men who have sex with men; IDU = people who inject drugs; heterosexual contact = sexual contact with a person infected with or at risk of HIV, origin from a country where HIV is endemic, and heterosexual contact as the only identified risk; Other = mode of transmission is known but cannot be classified into any of the major exposure categories.

** Percentages based on the total number of cases minus those reports for which exposure category was unknown or "not identified".

Figure 2. Proportion of reported AIDS diagnoses by exposure category and year of diagnosis among persons 50 years and older*



* Quebec AIDS data have not been available since June 30, 2003, and Ontario AIDS data by exposure category have not been available since June 30, 2005.

Table 2. Distribution of exposure categories among individuals in Canada aged 50 years or older with positive HIV tests reported between January 1, 2006, and December 31, 2006

	Age 50 and older
Number of cases	350
Number of cases with exposure information	171
Exposure category*	**Percentage in each exposure category****
MSM	35.1
MSM/IDU	1.8
IDU	18.7
Recipients of blood/blood products	2.9
Heterosexual contact	31.6
Occupational and other	9.9

* MSM = men who have sex with men; IDU = people who inject drugs; heterosexual contact = origin in an HIV-endemic country, sexual contact with a person infected or at risk, or no identified risk other than heterosexual contact; Other = mode of transmission is known but cannot be classified into any of the major exposure categories.

** Percentages based on total number of cases minus those reports for which exposure category was unknown or "not identified".

known age and gender information, men accounted for 82.4% of the 5,275 reports.

In 2006, the gender distribution among those 50 years of age or older (82.0% male) contrasted with that of other age groups, in which men accounted for 58.7% of positive HIV test reports in adults aged 15 to 29 years and 69.0% in the 30-39 year age group. The over-representation of men in the older age group means that the observed trends in exposure category data (as summarized in Figure 2) are largely influenced by the male population. It also has implications for the ability to conduct detailed monitoring of exposure category information among older females because of sample size.

More Information Needed: Older Adults and Risk Behaviours, and Knowledge of HIV/AIDS

Healthy sexual relationships continue to be an important part of life for the majority of older adults. The availability of sexual partners and health status may be more important factors than age in determining sexual activity.[5]

- In a global study on sexual attitudes and behaviours, in which 1,000 Canadians aged 40-80 years were polled, 76% reported having had sexual intercourse in the previous 12 months; of these, 68% reported having intercourse more than once per week. [6]
- In another international study of adults aged 45 years and older (n = 1,384), 51.7% of men and 55.1% of women who reported having a sexual partner (n = 949) revealed that they had had sexual intercourse once per week or more during the previous 6 months.[5]

Although surveillance data for Canada suggest that sexual contact is the major risk factor for HIV infection among older adults, very little research has been conducted on risky sexual behaviour in this group. However, some survey information is available:

- In a 22-site survey of HIV-positive women in British Columbia (BC) aged 45 years or older, 41% had been sexually active in the previous 6 months. Of these, however, only 28% reported that they always used birth control, and only 13.2% chose birth control methods in order to prevent sexually transmitted infections, including HIV.[7]
- Table 3 shows selected sexual risk behaviours among respondents aged 45 years and older compared with those aged 20-44 years from the Canadian HIV/AIDS Attitudinal Survey conducted in 2003.[8] While sexual risk behaviours were reportedly lower among older participants, they were not insubstantial.

Because older adults have generally not been considered a vulnerable population, HIV prevention programs have not usually targeted this age group. As a result, older adults may not be aware of HIV prevention methods or of behaviours that put them at risk of HIV infection:

- In a US study[9] of 514 women over the age of 50, researchers found that although 84% of women correctly identified unprotected heterosexual sex as a moderate- to high-risk activity, women frequently answered questions related to the effectiveness of condoms and abstinence incorrectly. Only 13% identified condoms as very effective in the preven-

Table 3. High-risk sexual behaviours among Canadians aged 20-44 years compared with those aged 45 years and over, HIV/AIDS Attitudinal Survey 2003[8]

Age category, years	Never practise safe sex†*	3+ sexual partners in previous year**
20-44	19%	3%
45+	15%	1%

* As a percentage of those whose sexual partner in the previous 12 months was casual.

† Safe sex refers to sexual practices that lower the risk of sexually transmitted infections, including HIV.

** As a percentage of those who were sexually active in the previous 12 months.

tion of HIV, whereas 18% said they were not at all effective. Almost half (44%) of the women said that abstinence was not at all or somewhat effective.

- In another US study,[10] of women aged 58-93 years, only 28% of those who had been sexually active in the previous 10 years reported that they had used a condom at their last sexual event. No married respondents reported using a condom. African-American women were more likely than white women to report condom use, although the difference had only borderline statistical significance (55.6% vs. 13.3%, $p = 0.06$).
- A 2003 survey of 2,004 Canadians aged 15 years and over reported that seniors are generally misinformed about modes of HIV transmission. Twenty percent of seniors cited a sneeze or a cough as a likely transmission route. This same study also reported that seniors perceive HIV/AIDS as being mostly a gay person's disease (35%), a Third World disease (41%), and a drug users' disease (29%).[11]
- In a 1996 US-based study, 14.7% of the respondents aged 50 to 64 years as compared with 6.3% of respondents aged 18 to 49 years did not know whether condoms were effective in preventing HIV infection.[12]

Many sexually active older adults who are no longer concerned with contraception may be less inclined to use condoms. In addition, because of the thinning of vaginal and anal membranes that occurs during the aging process, older adults may experience more tearing during sexual contact, making them even more susceptible to infection.[4]

Research about risk behaviours among older adults who inject drugs tends to be sparse:

- In a US study[13] comparing 1,508 older drug users (IDU and crack/cocaine smokers over 50 years of age) with 1,515 younger drug users (50 years or younger), older drug users were found to be less likely to have had sex in the prior month, but those who had had sex reported as much risky behaviour as their younger counterparts. Older drug users were found to be significantly less risky in their needle-sharing practices than younger drug users.

HIV Testing Patterns

- In Canada, between 1996 and 2005 over 50% of reported AIDS diagnoses in those aged over 45 years were made within 12 months after the first HIV-positive test.[14]
- One US study conducted between 2002 and 2004 concluded that older patients were more likely to be given a diagnosis during hospitalization and more likely to have an AIDS diagnosis at the time HIV was diagnosed. This suggests that older adults are less likely to be tested for HIV as outpatients because they have lower perceived risk of HIV infection by both themselves and their health care providers.[15]
- A study examining HIV testing behaviour among clients at seven rural Aboriginal health and AIDS service organizations in British Columbia found that study participants over 40 years of age were significantly less likely to undergo HIV testing than younger participants.[16]
- Two cross-sectional, general population surveys conducted in 1996[17]and 2003[8] demonstrate that lifetime testing among those aged 55 years and older is less than at other ages (Table 4). Nonetheless, it is encouraging that between 1996 and 2003, overall lifetime testing appeared to be increasing. It must be noted, however, that although results from these surveys have been weighted to reflect population demographics, the differences in sampling methodologies between the two surveys may account for some of the differences.

Table 4. Lifetime testing for HIV

	1996 National Population Health Survey[17]	2003 HIV/AIDS Attitudinal Survey[8]
Age category, years	**Percentage of lifetime HIV testing**	
20-44	21.7	39.2
45-54	11.4	26.1
55-64	6.5	15.0
65+	3.2	7.3

Comment

The distribution of age among positive HIV tests and AIDS cases reported to PHAC shows that there has been a shift over time towards an older age group. More epidemiologic and behavioural data are needed to better understand the HIV/AIDS situation among older adults in order to inform prevention and care programs. Population-based surveys should continue to include questions for all age groups regarding condom use and number of sexual partners, as well as HIV testing behaviours.

Attitudes and knowledge regarding HIV/AIDS should be studied among those aged 50 years and older in order to assess the potential misconceptions or knowledge gaps that older adults may have with regard to HIV transmission and prevention. Given that the main risk factor for transmission of HIV among older adults is sexual contact, research on the sexual risk behaviours of older Canadians needs to be supported.

As our society ages and persons with HIV/AIDS live longer as a result of improved medical treatment, it is likely that HIV/AIDS among older adults will become a broader issue. While older adults have historically been excluded from many aspects of HIV/AIDS policy and programming, the available data show that this should not be the case. The data presented here should help dispel any assumption that older adults are not at risk of HIV infection.

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Perinatal Transmission of HIV

At a Glance

- The HIV prevalence rate among pregnant women in Canada between 1994 and 2006 ranged from approximately 2 per 10,000 to 9 per 10,000.
- The use of antiretroviral therapy by HIV-positive pregnant women is increasing.
- Antiretroviral therapy is effective in reducing the risk of mother-to-child transmission of HIV.
- All women should have access to prenatal care that includes an offer of HIV testing.

Introduction

In the absence of any intervention, an estimated 15% to 30% of women with HIV infection will transmit the infection during pregnancy and delivery, and 10% to 20% through breast milk, to their newborn child.[1] Transmission of HIV from an HIV-infected pregnant woman to her newborn child is known as either mother-to-child, perinatal, or vertical HIV transmission. HIV infection of the child can occur during gestation (in utero), during delivery (when the fetus makes contact with maternal blood and mucosa in the birth canal), or after delivery (through breast milk). In this *Epi Update*, the status of perinatal HIV transmission in Canada and HIV testing recommendations for pregnant women are discussed.

Positive HIV Test Reports

Between 1985 and the end of December 2006, there were 58,404 positive HIV tests among adults reported to the Public Health Agency of Canada (PHAC), including 9,569 (16.8% of all records with reported gender) among women. Of the adult women with positive HIV test reports and reported age, 71.9% were between 15 and 39 years of age.[2]

HIV Infection Among Pregnant Women

HIV prevalence studies involving data from the testing of pregnant women indicate rates for Canada that range from approximately 2 per 10,000 to 9 per 10,000 pregnant women, although rates are not available for all provinces/territories, and data for some provinces have not been updated for more than 10 years. Rates for selected provinces are illustrated in Table 1.

Table 1. HIV prevalence among pregnant women in Canada

Province	HIV prevalence/ 10,000 pregnant women	Year
British Columbia	9.0	2003[3]
Alberta	3.3	2000[4]
Manitoba	3.2	1994-1995[5]
Ontario	2.3	2006[6]
Quebec	5.2	1990[7]

In Ontario, a total of 105 infants born between 1984 and 2001 were confirmed as being HIV infected. Almost 56% of the HIV-positive mothers reported that their risk factor for HIV infection was being from an HIV-endemic country (a country in which the predominant means of HIV transmission is heterosexual contact). Another 32% reported non-endemic heterosexual contact, and 9% reported injecting drug use.[8]

In Quebec, between July 1997 and June 2001, nearly 60% of the 209 HIV-infected pregnant women were born in an HIV-endemic country. Of these women, 73 (34.9%) were African and 52 (24.9%) were Haitian.[9]

A study in British Columbia (BC) conducted between 2000 and 2003, in which blood samples from 5,242 pregnant Aboriginal women were tested for HIV, found seven times as many HIV-positive women as would be expected in the general population.[10]

Transmission of HIV from Mother to Infant

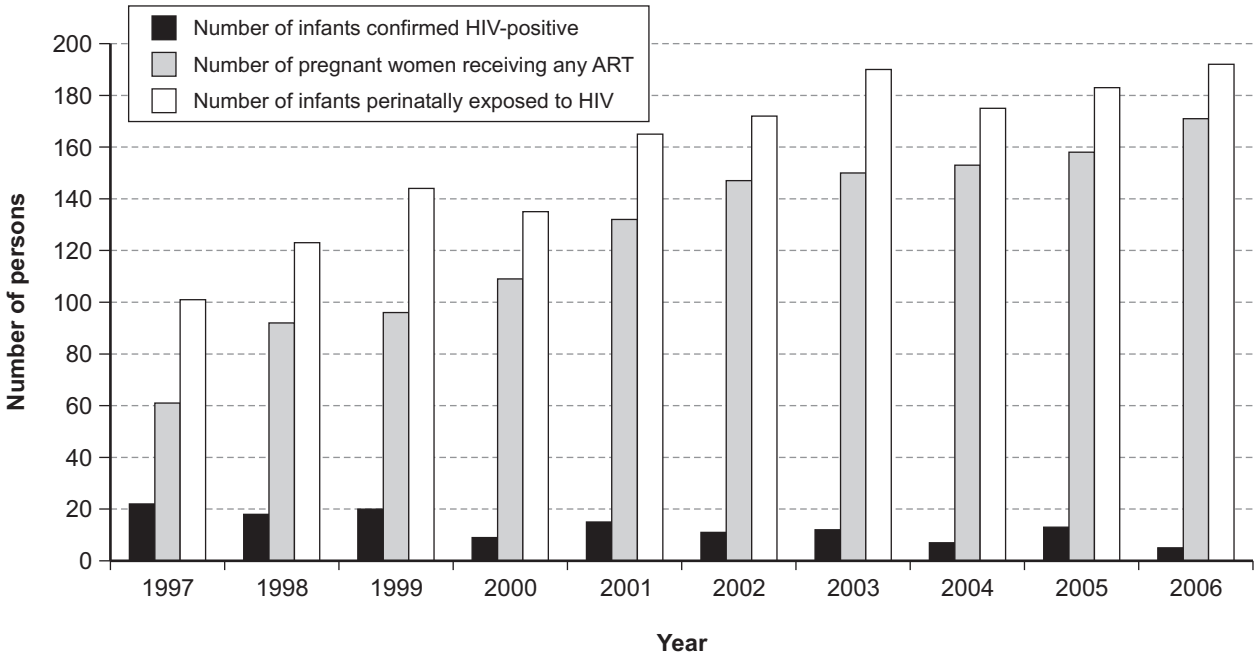
According to the Canadian Pediatric AIDS Research Group (CPARG), the annual number of perinatally HIV-exposed infants increased from a range of about 50 to 70 per year in the early 1990s to 192 in 2006 (Figure 1).[2] Of the reported 2,358 infants who were perinatally exposed to HIV between 1984 and 2006, 492 have been confirmed as infected. An additional 73 have an infection status that has not been confirmed (this includes indeterminate serostatus, died or lost to follow-up). The remaining 1,793 infants have been confirmed as not infected with HIV.

The Canadian Perinatal HIV Surveillance Project (CPHSP), an initiative of CPARG, has collected data since 1990 on children born to HIV-positive women. Among 426 HIV-positive children followed since 1990, 69 died of AIDS, 16 died of non-HIV-related causes, and 46 were lost to follow-up. No child has died of HIV-related causes since 2000. The median age of the 295 HIV-positive children currently in care is 11.9 years (range: 1.1-22.6 years).[11]

Data from CPHSP also demonstrate that while the number of HIV-positive children seen during the 2000-2005 period has decreased compared with 1994-1999 (106 versus 185), an increasing proportion were born in HIV-endemic countries (41.5% versus 17.3%).[11]

In the United States, the estimated number of infants born with HIV decreased from 1,650 in 1991 to fewer than 240 in 2005.[12]

Figure 1. Reported number of infants perinatally exposed to HIV, number of pregnant women receiving antiretroviral therapy (ART), and the number of infants with confirmed HIV infection, 1997-2006



Provincial/Territorial Prenatal HIV Screening Recommendations

In all Canadian provinces and territories, HIV testing of pregnant women remains ultimately the choice of the woman, although jurisdictions differ in their prenatal testing approaches. In some provinces and territories, women must specifically consent to be tested for HIV ("opt-in" testing), whereas in others they are automatically tested unless they specifically ask not to be ("opt-out" testing). Guidelines and/or recommendations for HIV testing of pregnant women have been developed in each province and territory to encourage informed decision-making. A summary of the various prenatal HIV testing approaches in Canada is provided in Table 2.

A 2-year chart review of pregnant women, which began 8 months after universal prenatal counselling and vertical transmission guidelines were put into place in Ontario, indicated that perinatal transmission was continuing. As a result, the study authors concluded that existing guidelines were not being fully adopted and suggested that to further decrease perinatal transmission, Ontario should include HIV testing as a routine prenatal test under an opt-out strategy, ensuring that women are advised that they may refuse testing.[13]

Table 2. Prenatal HIV testing approaches across Canada and year of implementation/ recommendation*

Province/territory	Testing approach	Year
British Columbia	HIV testing is offered as part of routine prenatal care with informed consent and pre- and post-test counselling.	1994
Yukon	HIV testing of pregnant women is strongly recommended and testing of sex partner is also encouraged.	1994
Northwest Territories	Prenatal HIV testing was introduced in 1993 as an opt-in program, and in 1998 became integrated with routine prenatal care, although women have the opportunity to opt out and decline testing.	1993, revised 1998
Nunavut**	Same policy as Northwest Territories	1999
Alberta	HIV screening is part of routine prenatal blood tests for all women in Alberta, and HIV testing is done unless the woman declines to be tested (opt-out policy).	1998
Saskatchewan	Consent is obtained before any testing is done and appropriate pre- and post-test counselling are provided.	1999
Manitoba	The current practice in Manitoba is to offer prenatal HIV antibody testing as an opt-out policy. HIV antibody testing may be offered to pregnant clients nominally or non-nominally by medical doctors, extended practice nurses or midwives.	2002
Ontario	It is recommended that health care professionals offer HIV testing to all pregnant women as part of prenatal care, with informed consent and appropriate pre- and post-test counselling.	1998
Quebec	HIV screening is part of routine prenatal blood tests for all women, and HIV testing is done unless the woman declines to be tested.	2002
New Brunswick	Physicians are to routinely encourage all pregnant women to be tested for HIV with appropriate pre- and post-test counselling and informed consent. Pregnant women can opt out of HIV screening if they wish.	1999 2005
Nova Scotia	HIV testing is offered to all pregnant women with the other prenatal tests in the first trimester. Women who decline testing in the first trimester or who are known to engage in high-risk activities are to be offered testing again during the latter stages of pregnancy.	1998
Prince Edward Island	HIV testing is recommended for all pregnant women and is offered at the first prenatal visit.	1999
Newfoundland and Labrador	HIV testing is part of routine prenatal screening and is done unless the woman declines.	1997

*As supplied by provincial/territorial HIV/AIDS data coordinators.

**Nunavut became a new territory in April 1999 after separating from the Northwest Territories.

More recently, a clinical study in Toronto reported that HIV testing acceptance rates are influenced by the screening strategy used. The authors found that by using an opt-out strategy in their clinic, testing acceptance rates were higher than the provincial average. The authors recommend that an opt-out strategy be considered in all jurisdictions.[14]

A study of HIV screening in Nova Scotia revealed that a substantial proportion of women are still not receiving testing. The prenatal testing rate for HIV in Nova Scotia is comparable with that of other provinces that use an opt-in approach but is lower than in provinces that use an opt-out approach. Ontario and BC both use an opt-in approach and have reported testing rates of 72% and 76%, respectively. Alberta and Newfoundland have adopted an opt-out approach and have much higher testing rates, at 98% and 94%, respectively.[15]

Canadian Women Can Access Prenatal HIV Screening Programs

Data from prenatal HIV screening programs can provide important information on the effectiveness of prenatal HIV screening recommendations. Data from several provinces are provided below.

BC: In 1995, about 55% of pregnant women in BC were tested for HIV. This percentage was estimated to be up to 80% in 1999, 60% through routine prenatal testing and 20% through groups identified as being at high risk. Between October 1, 2003, and October 31, 2004, 83% of pregnant women in BC for whom prenatal blood work was carried out had an HIV test as part of that testing (Elsie Wong, BC Field Surveillance Officer, Public Health Agency of Canada: personal communication, April 2006).

Alberta: The vast majority of pregnant women in Alberta are receiving HIV testing as part of prenatal care. The Alberta Provincial Laboratory for Public Health reports that 4.1% of all specimens submitted for prenatal screening in 2003 were not tested for HIV because the woman had opted-out of HIV screening. This proportion decreased to 3.6% in 2004 and 3.5% in 2005 (Dr. Bonita Lee, Alberta Provincial Laboratory for Public Health: personal communication, April 2006). A retrospective analysis of births to 115 HIV-positive women in northern Alberta between 1999 and 2006 found that in 55 of the women HIV had been newly diagnosed during routine prenatal screening.[16]

Manitoba: As of January 2005, approximately 60% of women seeking prenatal care in Manitoba were tested for HIV (Trina Larsen, Manitoba Health: personal communication, January 2005). Manitoba Health is evaluating the introduction of the opt-out testing policy and the impact it has had on testing pregnant women for HIV.

Ontario: HIV testing of pregnant women gradually increased from 46.4% in 1999 (40.6% during the pregnancy and 5.8% previously) to 93.4% during 2006 (88.6% during the pregnancy and 4.8% previously).[6]

Quebec: A recent study examined changes in medical practice regarding prenatal HIV testing in Ste-Justine Hospital, the referral centre for the province of Quebec, after the 1997 implementation of the HIV screening strategy during pregnancy. The program consists of universal counselling and offers HIV testing to all pregnant women. The study found that the percentage of HIV tests offered to pregnant women was 61.8% in 2001.[9] Of the 58 HIV-positive pregnant women seen at this hospital in 2002, 33 were given a diagnosis of HIV before pregnancy and 20 during pregnancy.[17] In the first 6 months of 2003, 47 HIV-positive pregnant women were seen at Ste-Justine Hospital: eight women had received an HIV diagnosis before their pregnancy and 39 during pregnancy.[17]

Newfoundland and Labrador: Since the 1997 implementation of Newfoundland and Labrador's policy of testing pregnant women unless the woman declines, 94% of all pregnant women have been tested. The last case of perinatal transmission was reported in 1998 (Cathy O'Keefe, Department of Health and Community Services: personal communication, April 2006).

Northwest Territories: The opt-out program in the NWT was assessed in 2001, 2002, and 2003. In 2001, one community did not screen all patients because of misinterpretation of the opt-out process. There is no evidence that prenatal women are declining HIV testing. Since 2002, all prenatal women have been screened for HIV (Wanda White, Health and Social Services: personal communication, April 2006).

Antiretroviral Treatment Can Reduce the Likelihood of Transmission of HIV from Mother to Infant during Pregnancy

The introduction of antiretroviral therapy (ART) for pregnant women has markedly improved the likelihood of success in preventing the transmission of HIV from mother to child.

The CPARG data displayed earlier in Figure 1 demonstrate that as more women receive ART, fewer children become infected with HIV. In fact, the proportion of pregnant women in Canada receiving ART has increased steadily in the last 10 years, from 60% in 1997 to 89% in 2006. Meanwhile, the HIV infection rate of perinatally HIV-exposed infants has decreased significantly over time, from 22% in 1997 to 3% in 2006.[2]

CPHSP data also indicate that from 1990 to 2005, of cases in which ART was used prophylactically, only 2% of infants became infected, as compared with 14% of cases in which such therapy was not administered.[18]

In Quebec, at Ste-Justine Pediatric Hospital, the use of zidovudine (AZT) reduced the likelihood of mother-to-infant HIV transmission from 28.3% among mother-infant pairs who had not received any AZT to 3.8% among mother-infant pairs who had received partial or full AZT therapy.[19]

A study carried out between 1993 and 1999 on AZT use in BC found a reduction in the HIV vertical transmission rate from 28% in untreated women-infant pairs to 13% in partially treated pairs and 0% in completely treated pairs.[20]

More recently, Zuk and colleagues' retrospective analysis[16] of births to HIV-positive women in Alberta found that 84% of the women received ART during pregnancy, and 25% of the newborns were delivered by caesarean section. The sole HIV-positive infant was born to a woman who had received no prenatal care and whose HIV infection was not diagnosed until 5 days post-partum.

A cohort of pregnant women who received highly active antiretroviral therapy (HAART) in BC between 1997 and 2005 were retrospectively assessed by van Schalkwyk and colleagues.[21] Of the 114 mother-infant pairs evaluated at the time of delivery, 80% had achieved viral suppression, and the mother-to-child transmission rate was 0%.

Canadian Prenatal HIV Screening Programs Are Valuable

Screening pregnant women for HIV clearly represents an important opportunity to prevent perinatal transmission of HIV to infants. It has been estimated that if such programs screened 90% of pregnant women across Canada, there would be a 65% reduction in the number of HIV-infected infants (compared with no prenatal testing and assuming that 24% of untreated pregnancies and 6% of treated pregnancies result in HIV-infected infants).[22]

Comment

The proportion of positive HIV test reports in Canada attributed to women is on the rise. As a result, as more women become infected with HIV the risk of perinatal transmission will increase. Given this and the fact that perinatal infections are preventable, it is important that all pregnant women, and women considering pregnancy, have access to prenatal care that includes the offer of HIV testing, HAART availability, as well as appropriate counselling and care.

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HIV/AIDS Among Aboriginal Persons in Canada: A Continuing Concern

At a Glance

- Aboriginal people remain over-represented in the HIV/AIDS epidemic in Canada.
- Among Aboriginal Canadians, the proportion of new HIV infections in 2005 attributed to IDU (53%) was much higher than among all Canadians (14%).
- HIV/AIDS has a significant impact on Aboriginal women. During 1998-2006, women represented 48.1% of all positive HIV test reports among Aboriginal persons as compared with 20.7% of reports among non-Aboriginal persons.
- Aboriginal persons with a diagnosis of HIV tend to be younger than non-Aboriginal persons. Almost a third (32.4%) of the positive HIV test reports from Aboriginal persons from 1998 to the end of 2006 were younger than 30 years as compared with 21.0% of this age among infected non-Aboriginal persons.

Introduction

In Canada, Aboriginal populations are very diverse, with communities that reflect variations in historical backgrounds, language, and cultural traditions (First Nations, Inuit, and Métis). According to data on self-identified ethnicity from the 2001 Census, Aboriginal persons make up 3.3% of Canada (i.e. 976,305 of 29,639,030).[1] Unfortunately, these communities are disproportionately affected by many social, economic, and behavioural factors, such as high rates of poverty, substance abuse, sexually transmitted infections, and limited access to, or use of, health care services, all of which increase their vulnerability to HIV infection.

An adequate description of the HIV/AIDS epidemic among Aboriginal persons in Canada requires accurate and complete access to ethnicity data about AIDS cases and positive HIV test reports. With respect to ethnicity data on AIDS cases, 79.1% of all AIDS cases reported between 1979 and December 31, 2006, include these data. For positive HIV test reports from 1998 to the end of 2006, ethnicity data were reported for 29.2% of records and are not available for all provinces and territories. Provinces and territories that report ethnic information with their HIV reports are British Columbia, Yukon Territory, Alberta, Northwest Territories, Nunavut, Saskatchewan, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. As a result, only data from these provinces and territories are used when examining positive HIV test data on Aboriginal persons.

Data on self-identified ethnicity from the 2001 Census indicate that in provinces/territories able to provide ethnic information with their positive HIV test reports Aboriginal persons make up 6.0% of the population overall, with concentrations in the Territories[1] (for Yukon, Northwest Territories, and Nunavut, 22.9%, 50.5%, and 85.4% of the respective populations) and other western provinces,[1] such as Saskatchewan (13.5%) and Manitoba (13.6%). Fortunately, ethnic information on positive HIV test reports is well reported for all of these provinces. However, the 2001 Census data also indicate that Ontario and Quebec, provinces that do not provide ethnic information, account for 27.4% of Canadians who self-identify as Aboriginal (i.e. 267,715 of 976,305), and this represents

1.5% of the population of these provinces (i.e. 267,715 of 18,411,125).[1]

This report updates current information on the status of the HIV/AIDS epidemic among Aboriginal persons in Canada. When Canadian HIV and AIDS surveillance data are summarized, Aboriginal persons are identified as First Nations, Inuit, and Métis. The category *Aboriginal Unspecified* is also used if no further details are known.

National HIV and AIDS surveillance data that appear in this document are from both (a) *HIV and AIDS in Canada: Surveillance Report to December 31, 2006*[2] and (b) unpublished data from the Surveillance and Risk Assessment Division, Centre for Infectious Disease Prevention and Control (CIDPC), Public Health Agency of Canada.

Aboriginal Persons Make Up a Growing Percentage of HIV Reports and AIDS Cases

A steady rise has been seen in the proportion of reported AIDS cases and positive HIV test reports among Aboriginal persons in Canada in recent years.

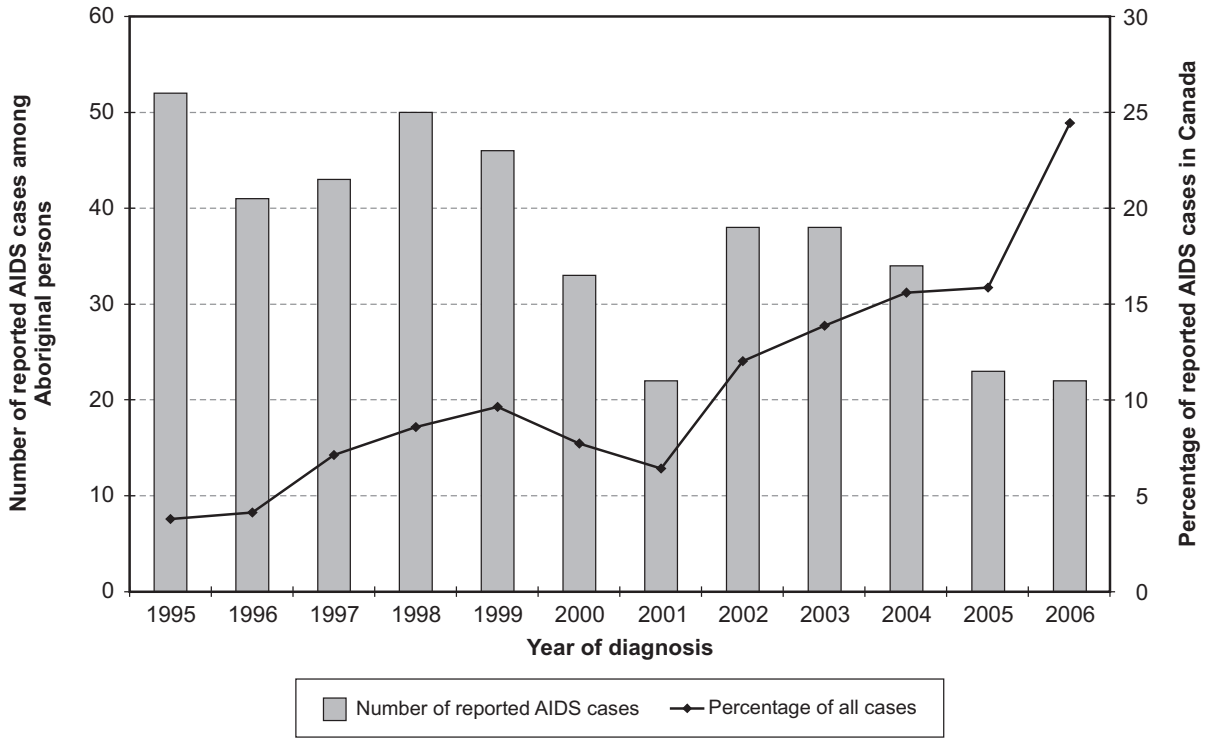
AIDS Surveillance Data

Between 1979 and December 31, 2006, there were 20,669 AIDS cases reported to CIDPC. Of these, 16,349 (79.1%) included information on ethnicity, of which 605 were reported to be Aboriginal persons (3.7%).

In 2006, ethnicity data were available for 35.3% of AIDS cases. This decline in data completeness was in part due to an information technology application change in the province of Ontario, where information on ethnicity and exposure category was not available for AIDS cases reported in 2006. When interpreting data for 2006, caution must be used because of small numbers.

- Before 1995, there were 10,509 reported AIDS cases with information on ethnicity, and 163 of these, or 1.6%, were Aboriginal persons. This proportion steadily increased to 9.6% in 1999 before a decline was noted. In 2002, the proportion increased to 12.0% and has steadily increased since. Although there are some data limitations associated with data from Ontario and Quebec for more recent years, by 2006 Aboriginal persons accounted for 24.4% of the total reported AIDS cases for which ethnicity was known (Figure 1).

Figure 1. Reported AIDS cases in the Aboriginal community of Canada



* Quebec AIDS data have not been available since June 30, 2003, and Ontario AIDS data by exposure category and ethnicity were not available for the second half of 2005 or for 2006.

HIV Surveillance Data

- Between 1998 and the end of December 2006, there were 21,435 positive HIV tests reported to CIDPC, 6,253 (29.2%) of which contained information on ethnicity. Of these 6,253 there were 1,458 positive tests reports identified as from Aboriginal persons (23.3%). As ethnicity data for positive HIV test reports have only been available since 1998, comparisons are only possible for this limited period of time.
- Figure 2 shows that since 1998, the proportion of positive HIV test reports attributed to Aboriginal persons has remained steady, at just over 20%. Of the 647 positive HIV tests reported for 1998 from provinces and territories with ethnicity reporting, 123 were among Aboriginal persons, representing 19.0% of such tests reported in that period. This proportion was 24.5% (178/728) in 2002, after which a slight decrease was noted. However, in 2006 the proportion of positive HIV test reports attributed to Aboriginal persons was 27.3% among the provinces and territories reporting ethnicity information with their HIV reports.

Injecting Drug Use Continues to Be a Key Mode of Transmission in the Aboriginal Community

People who inject drugs (IDU) continue to represent a significant exposure category in the Canadian HIV epidemic. Trends observed in surveillance data suggest that injecting drug use is a particularly important risk factor for HIV and AIDS transmission among Aboriginal persons.

As Table 1 indicates, there are notable differences between Aboriginal and non-Aboriginal reported AIDS cases and positive HIV test reports with respect to exposure category. Although the proportion attributed to heterosexual exposure† is similar, Aboriginal persons have a higher proportion of reports attributed to IDU and a smaller proportion to MSM (men who have sex with men).

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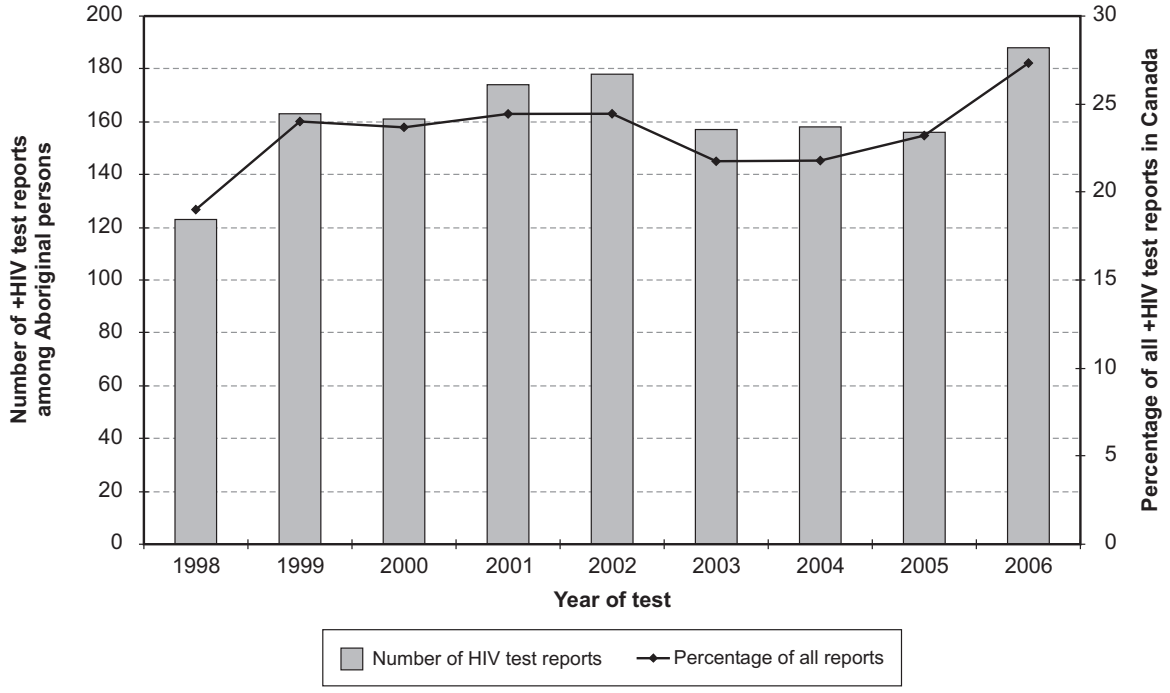
Figure 2. Positive HIV test reports in the Aboriginal community in Canada for provinces and territories that report ethnicity for HIV*



* For positive HIV test reports, the data are from provinces/territories with reported ethnicity (BC, YT, AB, NT, NU, SK, MB, NB, NS, PEI, NL).

† The heterosexual exposure category includes persons born in a country where HIV is endemic, persons who report heterosexual contact with a person who is either HIV infected or at increased risk of HIV infection, and persons who report heterosexual contact as the only risk factor.

Table 1. Comparison of selected exposure categories for reported AIDS cases and positive HIV* test reports among Aboriginal and non-Aboriginal persons

	Aboriginal	Non-Aboriginal
	n = number of cases with available information on exposure category	
AIDS (1979-2006)	***n* = 576**	***n* = 15,275**
IDU	39.9%	7.0%
MSM/IDU	6.9%	4.4%
MSM	30.6%	69.2%
Heterosexual	19.4%	15.5%
HIV (1998-2006)	***n* = 1,407**	***n* = 4,633**
IDU	58.8%	24.8%
MSM/IDU	3.6%	2.7%
MSM	6.8%	38.9%
Heterosexual	29.4%	31.5%

IDU = people who inject drugs, MSM = men who have sex with men, MSM/IDU = individuals both MSM and IDU.

* For positive HIV test reports, the data are from provinces/territories with reported ethnicity (BC, YT, AB, NT, NU, SK, MB, NB, NS, PEI, NL).

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AIDS Surveillance Data

- Of reported AIDS cases with known exposure, the proportion of Aboriginal cases attributed to injecting drug use has dramatically increased over time, from 18.0% before 1995 to 47.2% during 1995-2000 and 50.3% during 2001-2006.
- Of the 576 reported AIDS cases with known exposure category among Aboriginal persons between 1979 and December 31, 2006, there were 424 male cases and 151 female cases (information on gender missing for one case). Of female reports, 62.3 % were attributed to IDU and 35.1% to heterosexual exposure, whereas among male reports 41.3% were attributed to MSM, 32.1% to IDU, and 13.9% to heterosexual exposure. Figures 3a and 3b display how these cases were distributed by exposure category.

HIV Surveillance Data

- A review of positive HIV test reports with exposure category information between 1998 and 2006 indicates that injecting drug use was the most common identified route of transmission, at 58.8%, among Aboriginal persons.
- Of the 1,404 positive HIV test reports with known exposure category (information on gender missing for four cases) reported among Aboriginal persons between 1998 and December 31, 2006, there were 732 male cases and 672 female cases. Figure 3c displays how reports among males are distributed by exposure category. Of female reports (summarized in Figure 3d), 64.4 % were attributed to IDU and 34.1% to heterosexual exposure, proportions similar to those for reported AIDS cases. For male reports, 13.0% were attributed to MSM, 53.7% to IDU, and 25.3% to heterosexual exposure.

Data from Targeted Studies

- Aboriginal people are over-represented in the IDU population and are at even higher risk than other members of this high-risk population.
- Results from Phase I of the I-Track survey (Surveillance and Risk Assessment Division, CIDPC, unpublished data, 2006) showed that 41.9% of the study participants identified themselves as being of Aboriginal ethnic background. Most of these were from Regina, where 87.2% of the study population were Aboriginal, followed by Edmonton at 70.3% and Winnipeg at 69.6%. The proportion of Aboriginal IDU in the remaining study population ranged from 5.5% among the SurvUDI participants in Quebec to 27.3% in Sudbury.

A 2000 study of IDU in Regina indicated that of the 255 participants 90% identified themselves as an Aboriginal person.[3]

Figure 3a. Distribution of exposure categories among reported AIDS cases of Aboriginal males (*n* = 424), November 1979-December 31, 2006

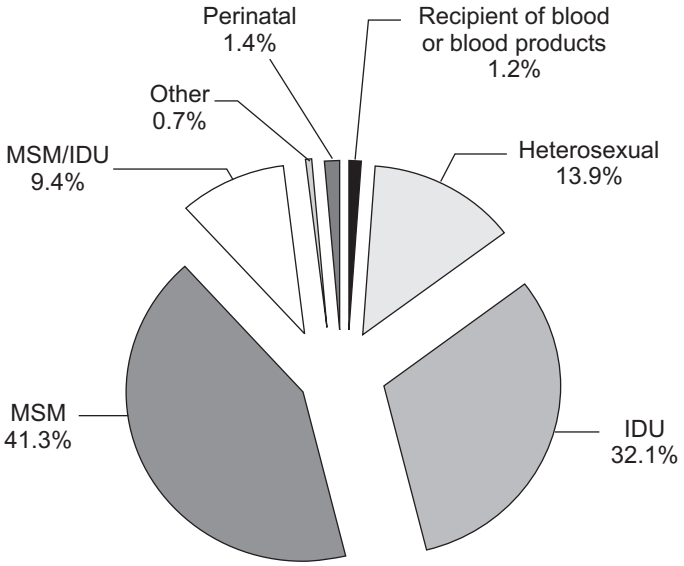
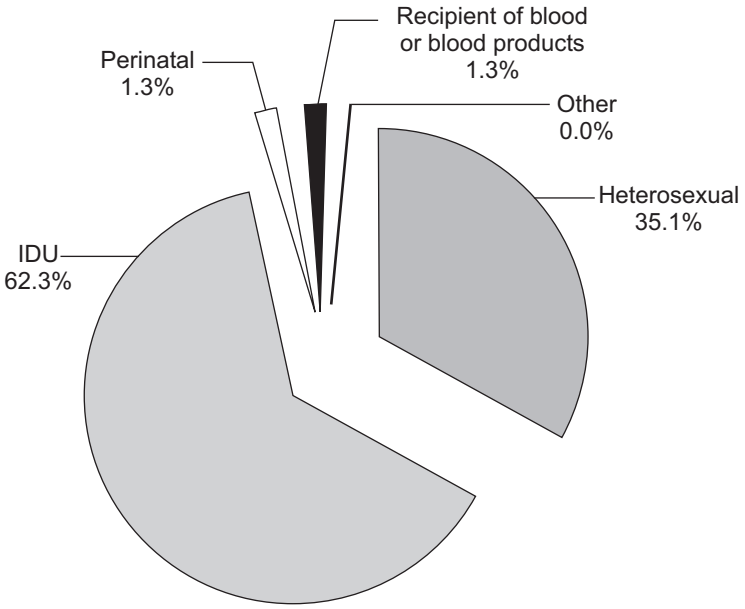


Figure 3b. Distribution of exposure categories among reported AIDS cases of Aboriginal females (*n* = 151), November 1979-December 31, 2006



In a study of Calgary's Needle Exchange Program, most participants were White (75%), but Aboriginal persons were the second highest ethnic group, representing 20% of total participants.[4]

In Vancouver, the prevalence of HIV among Aboriginal IDU was considerably higher than among their non-Aboriginal counterparts, and half of the Aboriginal drug user population were women, which was considerably higher than in the non-Aboriginal population.[5]

The Vancouver Injection Drug Users Study (VIDUS) is an open cohort of IDU. Of the 1,400 recruited between May 1996 and May 2000, 25% were Aboriginal persons, more than half of whom were female (54% female, 46% male). In contrast, females accounted for 29% of non-Aboriginal participants.[6]

Figure 3c. Distribution of exposure categories among positive HIV test reports of Aboriginal males (*n* = 732), January 1998-December 31, 2006

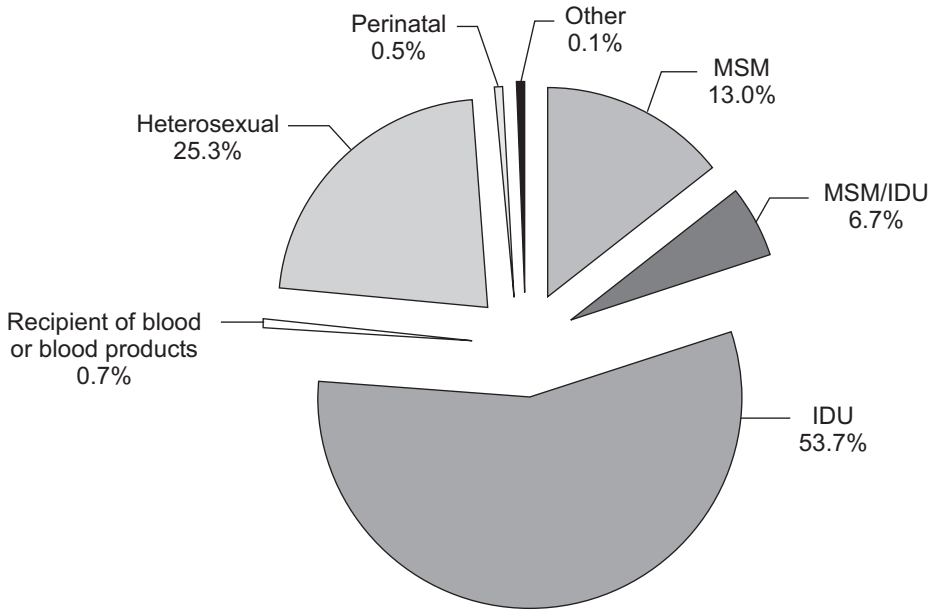
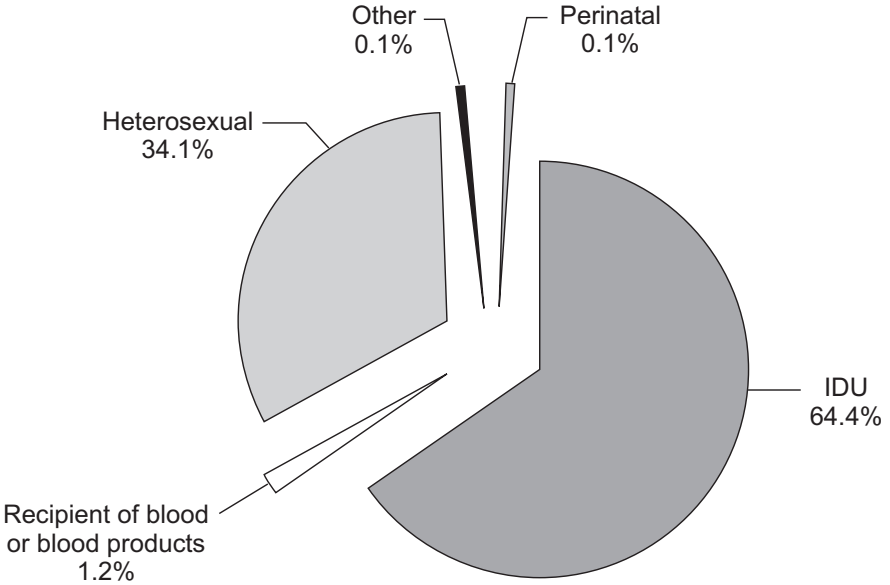


Figure 3d. Distribution of exposure categories among positive HIV test reports of Aboriginal females (*n* = 672), January 1998-December 31, 2006



In a further analysis of the VIDUS study, investigators found that Aboriginal status was significantly associated with new HIV infection in both men and women[7] and also in study participants 24 years of age or younger.[8]

VIDUS reported that, as of December 2001, 19.1% of Aboriginal participants had seroconverted compared with 9.6% of persons who identified themselves as non-Aboriginal.[9] In a 2003 publication, investigators concluded that, in Vancouver, Aboriginal IDU were becoming HIV positive at twice the rate of non-Aboriginal IDU.[5]

Of 910 MSM surveyed in Vancouver between 1995 and 2000, 106 (12%) had injected drugs in the previous year. MSM/IDU were younger than MSM and more likely to be HIV-seropositive, Aboriginal, economically disadvantaged, engaged in the trade of sex for money and drugs, and to report having female partners.[10]

HIV/AIDS Has a Significant Impact on Aboriginal Women

- In contrast to HIV and AIDS cases in the non-Aboriginal population, females make up a comparatively large part of the Aboriginal HIV epidemic. Table 2 shows the distribution of gender in positive HIV test reports and reported AIDS cases for Aboriginal and non-Aboriginal persons. Females represent 48.1% of all positive HIV test reports from 1998 to the end of 2006 among Aboriginal persons, as compared with 20.7% of reports among non-Aboriginal persons.

AIDS Surveillance Data

- Before 1995, females represented 12.3% of reported AIDS cases among Aboriginal persons (20/163), and the proportion has ranged from 17.3% in 1995 to a peak of 50.0% in 2006. Since 2001, it has been above 27.0% every year to 2006.

HIV Surveillance Data

- Among Aboriginal persons, the proportion of positive HIV test reports attributed to females has fluctuated from 39.9% to 59.4% from 1998 to the end of 2006. The proportion has been 50% or higher since 2004, with a high of 59.4% (92/155) in 2005.

Data from Targeted Studies

Pregnant women infected with HIV are at risk of transmitting the virus to their unborn child. Data from some sites in western Canada have shown that a high proportion of HIV-infected pregnant women who deliver are Aboriginal. Of all pediatric centres across Canada where children and HIV-infected mothers were followed between 1995 and 1997, 19% of the women seen (49/259) were Aboriginal women.[11] Of 32 HIV-infected women who delivered in northern Alberta or the Northwest Territories in 1996-98, 29 (91%) were Aboriginal.[12]

In a prenatal HIV screening program study conducted in Alberta of 38,712 pregnant women, 36,163 (93.4%) were non-First Nations and 2,549 (6.6%) were First Nations. A total of 593 (1.5%) pregnant women declined HIV testing: 538 (1.5%) of all non-First Nations women and 55 (2.2%) of all First Nations women. Overall, the pregnant women of First Nations were on average about twice as likely to decline HIV testing as non-First Nations pregnant women, particularly when they were under the care of male practitioners.[13]

Despite high numbers of Aboriginal women seen at HIV clinics and pediatric centres, there was encouraging news that, during the period 1995 to 1997, pregnant Aboriginal women were as likely to be taking antiretroviral therapy (62%) as pregnant White women (66%) and pregnant Black women (63%).[14]

In a 2001 study of antiretroviral therapy in a cohort of HIV-positive pregnant women recruited at seven sites in Ontario, Manitoba, and Saskatchewan, 20% of women were Aboriginal. Late use of antiretroviral therapy (in third trimester or intrapartum) was unequally distributed by ethnic status, occurring in 38% of Aboriginal, 27% of Black and 9% of White women.[15]

Of the infants known to have contracted HIV through perinatal transmission in British Columbia between 1994 and 1999, 50% were Aboriginal.[16]

A 3-year study (2000-2003) was conducted in British Columbia by the Chief's Health Committee of the First Nations Summit in partnership with Health Canada and the Canadian Blood Services, during which blood samples were taken from 5,242 pregnant Aboriginal women. A total of 15 tested positive for HIV for a prev-

Table 2. Comparison of gender of reported AIDS cases and positive HIV* test reports among Aboriginal and non-Aboriginal persons

	Aboriginal	Non-Aboriginal
	n = number of cases with available information on gender	
AIDS (1979-2006)	***n* = 604**	***n* = 15,741**
Female	26.5%	9.1%
HIV (1998-2006)	***n* = 1,454**	***n* = 4,784**
Female	48.1%	20.7%

* For positive HIV test reports, the data are from provinces/territories with reported ethnicity (BC, YT, AB, NT, NU, SK, MB, NB, NS, PEI, NL).

alence rate of approximately 30 per 10,000.[17] This is about three times higher than the rate of 9 per 10,000 seen in a study of the general population of women in BC who had prenatal testing during 2003.[18]

Aboriginal Persons Receiving a Diagnosis of HIV Tend to be Younger than Non-Aboriginal Persons

HIV and AIDS among young persons in Aboriginal communities is an increasing concern. Understanding the epidemic in this group well help to target early intervention strategies appropriately; however, it is important that caution be used when reviewing proportions by age group, as they can change considerably with the addition of only a few cases, particularly when total numbers are small, such as with youth (aged less than 30 years).

As indicated in Table 3, among new positive HIV test reports and reported AIDS diagnoses, Aboriginal cases tended to be younger than non-Aboriginal cases.

AIDS Surveillance Data

MSM and IDU each accounted for approximately a third of AIDS cases reported from 1979 to the end of 2006 among Aboriginal persons younger than 30 years of age. At 34.7%, IDU represented the largest proportion of cases, and this was followed closely by MSM at 30.6% and then heterosexual exposure at 14.5%. A similar pattern was observed among Aboriginal persons aged 30 to 39. The distribution of AIDS reports by exposure category differed with older age groups, as heterosexual exposure accounted for a larger proportion of reports. Among Aboriginal persons aged 40 to 49, IDU accounted for 44.9% of reports, heterosexual exposure for 27.9%, and MSM for 21.3%. Among Aboriginal persons aged 50 years or more, heterosexual exposure accounted for 43.2% of reports, IDU for 27.3%, and MSM for 25.0%.

HIV Surveillance Data

Those aged less than 40 years accounted for 70.1% of HIV test reports among Aboriginal persons from 1998 to the end of 2006 (Table 3). The proportion among Aboriginal persons aged less than 30 years was 32.4%, versus 21.0% among non-Aboriginal persons, and of these reports IDU accounted for 59.0%, heterosexual exposure for 27.9%, and MSM for 7.4%. Similar distributions were noted for test reports among Aboriginal persons aged 30 to 49, IDU accounting for 60.9%, het-

Table 3. Comparison of age at time of diagnosis for reported AIDS cases and at time of test for positive HIV* test reports among Aboriginal and non-Aboriginal persons

	Aboriginal	Non-Aboriginal
	n = number of cases with available information on age	
AIDS (1979-December 31, 2006)	***n* = 605**	***n* = 15,744**
< 20 years	1.5%	1.5%
20-29 years	19.5%	14.6%
30-39 years	46.6%	43.6%
40-49 years	24.1%	28.4%
50+ years	8.3%	11.9%
HIV (1998-December 31, 2006)	***n* = 1,457**	***n* = 4,793**
< 20 years	4.7%	1.5%
20-29 years	27.7%	19.5%
30-39 years	37.7%	36.9%
40-49 years	23.1%	27.6%
50+ years	6.8%	14.4%

* For positive HIV test reports, the data are from provinces/territories with reported ethnicity (BC, YT, AB, NT, NU, SK, MB, NB, NS, PEI, NL).

erosexual exposure for 28.6%, and MSM for 5.9%. In the age group 50+, the distribution of HIV reports changes somewhat, heterosexual exposure accounting for 44.1%, IDU for 38.7%, and MSM for 11.8%.

Data from Targeted Studies

A study of risk factors among 232 young (less than 25 years) IDU in Vancouver found that 9 of 16 (56%) of the incident cases were Aboriginal.[9]

The Cedar Project is an observational study of Aboriginal youth living in Vancouver and Prince George, British Columbia. Eligibility criteria include age 14-30 and self-reported use of non-injection or injection drugs at least once in the month prior to enrolment. A total of 543 participants were recruited between September 2003 and July 2005, of whom 300 resided in Vancouver and 243 lived in Prince George. At enrolment 400 participants (74%) reported having had an HIV test during their lifetime, of whom 183 (46%) were tested regularly. Overall, 46 (8%) of 543 participants tested HIV positive. The findings of this study are significant in that they may be used by policy makers to design and implement culturally appropriate HIV testing programs for this high-risk population.[19]

HIV/AIDS Surveillance Data in Canada's Three Aboriginal Communities

When compared with the burden of infection in a non-Aboriginal community, the number of positive HIV test reports and reported AIDS cases in Aboriginal communities may appear small; however, it is important to understand that these are individuals, and every new diagnosis has a significant impact on the Aboriginal community. Caution should be used when reviewing community proportions, as they can change considerably with the addition of only a few cases, particularly when total numbers are small.

AIDS Surveillance Data

According to the 2001 Census, 62% of Aboriginal Canadians self-identified as First Nations, 30% as Métis, 5% as Inuit, and another 3% were from multiple communities.[1] Of 605 Aboriginal AIDS cases reported up to December 31, 2006, 73.1% or 442 were First Nations, 7.3% or 44 were Métis, 3.6% or 22 were Inuit, and 16.0% or 97 were in the category Aboriginal Unspecified.

The data on reported AIDS cases in terms of IDU, females, and youth in specific Aboriginal communities and in the Aboriginal Unspecified category are summarized below. Further details regarding gender and selected age and exposure category distribution are shown in Table 4.

First Nations: Among First Nations persons who self-identified in the AIDS case reports, 45.2% of cases were attributed to injecting drug use (188/416). Females represented 27.4% of cases (121/441), compared with 9.1% of reported cases among non-Aboriginal persons, and youth (younger than 30 years) accounted for 20.6% (91/442), compared with 16.1% of reported cases among non-Aboriginal persons with this information.

Métis: Among persons who self-identified as Métis in the AIDS case reports, 48.8% of cases (21/43) were attributed to MSM and 27.9% (12/43) to IDU. Few cases were female (4/44 or 9.1 %), but this percentage was comparable with the 9.1% of reported cases among female non-Aboriginal persons. It was noted that 31.8% of reported AIDS cases among the Métis (14/44) were individuals younger than 30 years, compared with 16.1% of reported cases among non-Aboriginal persons with this information.

Inuit: The most common exposure categories among Inuit persons were IDU and heterosexual exposure, both accounting for 31.8% of reports (7/22). A notable proportion of cases were female (9/22 or 40.9%), compared with 9.1% of reported cases among non-Aboriginal persons, and youth (younger than 30 years) represented 31.8% (7/22) of cases compared with 16.1% of reported cases among non-Aboriginal persons with this information.

Aboriginal Unspecified: The MSM exposure category accounted for the largest proportion of cases among those for whom the Aboriginal community was unspecified, at 37.9% (36/95), and both the heterosexual and IDU exposure categories accounted for large proportions at 28.4% (27/95) and 24.2% (23/95) respectively. Females made up 26.8% of cases (26/97), compared with 9.1% of reported cases among non-Aboriginal persons, and youth (younger than 30 years) made up 15.5% of cases in this group (15/97) compared with 16.1% of reported cases among non-Aboriginal persons with this information.

Table 4. Gender and selected age and exposure categories of reported AIDS cases in Aboriginal groups in Canada between 1979 and December 31, 2006

	First Nations	Inuit	Métis	Aboriginal, unspecified
	n = number of cases with available information			
Gender	***n* = 441**	***n* = 22**	***n* = 44**	***n* = 97**
Female	27.4%	40.9%	9.1%	26.8%
Age (years)	***n* = 442**	***n* = 22**	***n* = 44**	***n* = 97**
< 20 years	1.4%	0.0%	2.3%	2.1%
20-29 years	19.2%	31.8%	29.5%	13.4%
30-39 years	45.7%	54.5%	45.5%	49.5%
40-49 years	24.4%	9.1%	20.5%	27.8%
50 years or older	9.3%	4.5%	2.3%	7.2%
Exposure category	***n* = 416**	***n* = 22**	***n* = 43**	***n* = 95**
MSM	27.2%	27.3%	48.8%	37.9%
MSM/IDU	7.5%	4.5%	4.7%	6.3%
IDU	45.2%	31.8%	27.9%	24.2%
Heterosexual	17.3%	31.8%	14.0%	28.4%

*MSM = men who have sex with men, IDU = people who inject drugs

Proportion of Aboriginal Persons Among Estimated HIV Prevalent and Incident Infections at the National Level

National HIV surveillance data may understate the magnitude of the HIV epidemic because such data are subject to reporting delays, underreporting, and changing patterns in HIV testing behaviours (those who come forward for testing); surveillance data also do not include individuals who remain untested and undiagnosed. Since HIV is a chronic infection with a long incubation period, many newly infected persons may only receive a diagnosis in the years after infection. Consequently, the number of new HIV positive tests reported to CIDPC in a given year does not estimate the new HIV infections that occurred in that year because many will have been infected in earlier years.

Since surveillance data can only describe the diagnosed portion of the epidemic, modelling and additional sources of information are required to describe the epidemic among Canadians with both diagnosed and undiagnosed infection. The methods used to estimate the total number of people living with HIV (prevalence) and the number newly infected with HIV (incidence) at the national level bring together all available data, including national HIV surveillance data.

- Aboriginal persons continue to be over-represented in the HIV epidemic in Canada. They represent 3.3% of the Canadian population,[1] and yet an estimated 3,600 to 5,100 Aboriginal persons were living with HIV (including AIDS) in Canada in 2005, representing about 7.5% of all prevalent HIV infections.[20] This is higher than the estimated number of 3,100-4,400 for 2002 but represents the same proportion (7.5%).
- Aboriginal persons accounted for approximately 200 to 400 of the new HIV infections in 2002 and 2005, which is about 9% of the total for 2005 and 10% for 2002. Therefore, the overall infection rate among Aboriginal persons is about 2.8 times higher than among non-Aboriginal persons.[20]
- The estimated distribution of exposure category of prevalent and incident infections among Aboriginal persons in 2005 is indicated in Table 5. The proportion of new HIV infections in 2005 due to IDU among Aboriginal Canadians (53%) is much higher than among all Canadians (14%).[20] This highlights the uniqueness of the HIV epidemic among Aboriginal persons and underscores the complexity of Canada's HIV epidemic.

Table 5. Distribution of exposure category for estimated prevalent and incident HIV infections among Aboriginal persons in Canada, 2005

Exposure category	Prevalent infections (*n* = 3,600-5,100)	Incident infections (*n* = 200-400)
IDU	56%	53%
Heterosexual contact	26%	33%
MSM	11%	10%
MSM/IDU	6%	3%

*IDU = people who inject drugs, MSM = men who have sex with men

Comment

Aboriginal HIV and AIDS surveillance data are incomplete for several reasons. The primary one is the incomplete information on ethnicity in current surveillance data. Information on ethnicity has not been available for 20.9% of all reported AIDS cases obtained since 1979. Ethnicity data for positive HIV test reports have only been available since 1998. Furthermore, 70.8% of positive HIV test reports between 1998 and 2006 lack these data. Other reasons include interprovincial variations in reporting ethnicity, misclassification of ethnic status, and delays in reporting. Positive HIV test reports and reported AIDS cases represent only those infected individuals who came forward for testing or who received an AIDS diagnosis and were subsequently reported to the Public Health Agency of Canada. As a result, the surveillance numbers in this report do not represent the total number of Aboriginal persons who are infected with HIV or whose AIDS has been diagnosed.

Despite these limitations, evidence suggests that the HIV epidemic in the Aboriginal community shows no sign of abating. Injecting drug use is currently the most common mode of HIV transmission among Aboriginal persons, Aboriginal women make up a large part of the HIV epidemic in their community, and Aboriginal persons appear to be infected at a younger age than non-Aboriginals. This indicates the different characteristics of the HIV epidemic among Aboriginal persons and emphasizes the complexity of Canada's HIV epidemic. Better data on HIV/AIDS epidemiology and HIV testing among Aboriginal persons in Canada are needed to guide prevention and control strategies. In addition, it is vital to conduct further research to increase our understanding of the specific impact HIV has on Aboriginal persons.

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HIV/AIDS Among MSM in Canada

At a Glance

- In Canada, MSM account for 76.1% of cumulative reported AIDS cases among adult males.
- MSM have accounted for 68.1% of positive HIV test reports among adult males since testing began in 1985 to the present.
- The estimated number of new HIV infections among MSM in 2005 did not decrease and may have increased slightly compared with 2002.

Introduction

In Canada, the HIV/AIDS epidemic has had a tremendous impact on men who have sex with men (MSM). Even though the toll of the epidemic no longer affects them to the same extent as in the early to mid-1980s, this group still accounts for the largest number of reported HIV and AIDS diagnoses. Recent data on HIV incidence and risk behaviours suggest that MSM continue to be at risk of HIV infection and other sexually transmitted infections (STIs). This report updates the current information on the status of HIV and AIDS among MSM in Canada.

AIDS Surveillance Data

- As of December 31, 2006, the Public Health Agency of Canada (PHAC) reported a cumulative total of 20,669 AIDS cases. Of the 18,560 adult male AIDS cases, 76.1% were attributed to MSM and an additional 4.7% were attributed to the MSM who also reported being injecting drug users (MSM/IDU).[1]
- Of AIDS cases reported to PHAC there has been a steady decrease in the proportion of adult male cases attributed to MSM. Before 2001, the MSM exposure category accounted for 78.1% of adult male AIDS cases, and this had decreased to 44.5% in 2003. In 2004 and 2005, the proportion remained steady at roughly 45%, and in 2006 it dropped to 37.7%.[1]
- The proportion of reported adult male AIDS cases attributed to MSM/IDU has remained relatively steady, varying between 2.7% and 6.3% during the last 5 years.[1]

HIV Surveillance Data

- While AIDS data provide information on HIV infection that occurred about 10 years in the past, HIV data provide a picture of more recent infections. Positive HIV test reports sent from each province and territory are collated and synthesized at the national level by PHAC. These reports show that before 2001, 72.1% of positive HIV test reports among adult males were attributed to MSM. In 2001, this proportion was 48.6%, then increased to roughly 57% in 2004-2005. A slight decrease occurred in 2006, when the proportion dropped to 53.2%.

MSM Continue to Account for the Greatest Number of Prevalent and Incident HIV Infections

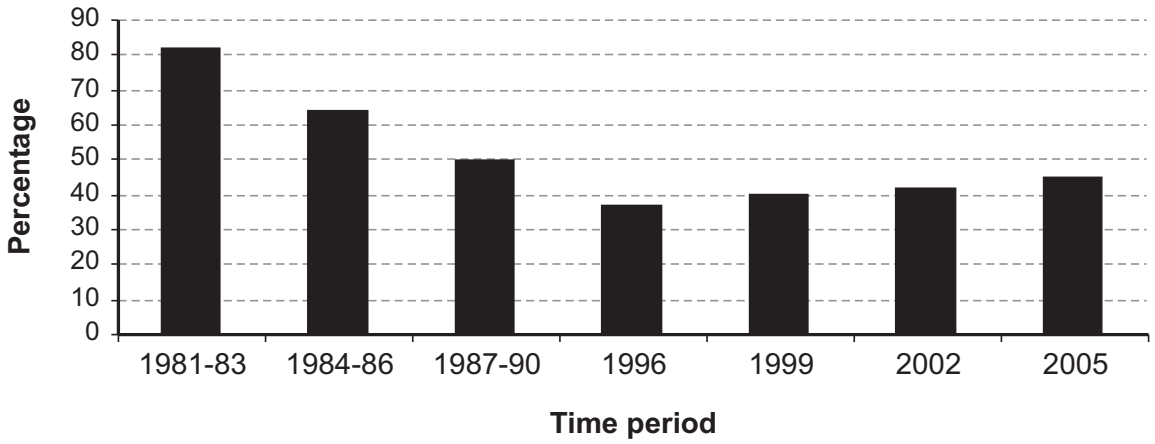
- The 2005 national estimates of HIV prevalence (number living with HIV) and incidence (number newly infected in a year) indicate that MSM continue to be the most affected group. At the end of 2005, an estimated 58,000 (48,000-68,000) people in Canada were living with HIV infection (including AIDS), and of these 51% or 29,600 infections were estimated to be among MSM. The largest absolute increase in prevalent infections in 2005 was in the MSM exposure category, with 3,400 more prevalent infections than in 2002 (13% relative increase). The combined exposure category MSM/IDU was estimated to account for 4% of the total prevalent infections in both 2005 and 2002.[2]
- The number of new HIV infections in Canada in 2005 did not decrease and may have increased slightly compared with 2002. An estimated 2,300 to 4,500 new HIV infections occurred in 2005, and MSM accounted for the greatest number of these new infections, 1,100 to 2,000 (45% of the total) as compared with 900 to 1,700 (42% of the total) in 2002.[2] As shown in Figure 1, the proportion of MSM among new infections steadily declined until 1996 and has increased since then.
- Estimates from Ontario mirror those found by PHAC. Using data from a variety of sources, including HIV serodiagnoses, the Laboratory Enhancement Study (LES), and other studies, the Ontario HIV Monitoring Unit estimated a sharp increase in HIV incidence among MSM from 1977 to 1984, then a decrease to the lowest point in 1996, and an increase since: HIV incidence was estimated at 1.1% in 2005, compared with an incidence rate of 0.66% in 1996. HIV prevalence also increased over the study period, from 12.8% in 1997 to 16.8% in 2005.[3]

Recent Increases in Incidence Rates Noted in Some Parts of Canada

The results of several studies with varying methodologies from Ontario, Quebec, and British Columbia all point to a similar trend of recent increases in the incidence of HIV among MSM.

- In an analysis of MSM undergoing repeat HIV testing in Ontario during the 1993-2003 period, the overall incidence rate was 0.97 per 100 person-years (PY). Incidence declined in the pre-HAART (highly active antiretroviral treatment) era (1993-1996) and climbed again post-HAART (1997-2003). Incidence was highest in Toronto, followed by Ottawa, and was lowest in other regions of Ontario.[4]
- The LES, using the detuned assay, found that the HIV incidence among MSM has not decreased since 2001. In 2006, in Ontario, the adjusted HIV incidence (per 100 PY) was 1.14.[5]
- The Polaris HIV Seroconversion Study was an Ontario open cohort study initiated in 1998. This study found an incidence of 1.78 per 100 PY among 173 HIV-negative MSM followed up between June 1998 and January 2004.[6] An analysis of a subsample of 183 men in the Polaris study between 1998 and 2001 was carried out to identify risk factors for

Figure 1. Distribution (%) of estimated new HIV infections among MSM, by time period



recent HIV infection: receptive anal sex without condoms (odds ratio [OR] = 4.4, p = 0.01) and delayed application of condoms (OR = 5.8, p = 001) were associated with recent seroconversion.[7]

- In Quebec, the Omega Cohort Study provided information on the incidence and psychosocial determinants of HIV infection among MSM living in Montreal. From October 1996 to August 2003, the overall incidence was 0.62 per 100 PY. It increased non-significantly from 0.43 to 0.83 per 100 PY in the last 3 years of the study.[8] The main risk factor for HIV seroconversion was unprotected anal sex. Risky oral sex had a borderline significant association with seroconversion.[9]
- In British Columbia, results from the Vanguard Project, a prospective cohort of young gay and bisexual men in Vancouver, indicated that the annual rate of new HIV infections among men who reported not injecting drugs increased from a range of 0.42-0.96 per 100 PY between 1997 and 2001 to 1.53 and 2.36 per 100 PY in 2002 and 2003 respectively.[10] Trends in the proportion of MSM testing positive were also analysed, and a sustained increase from 2000 to 2003 was found in the percentage of positive HIV-1 tests among non-IDU MSM who came forward for HIV testing.[10]

Prevalence Rates Among MSM: Past and Present

During the first decade of the epidemic, data (self-reported or test data) from surveys carried out directly with MSM showed a very high prevalence rate: 23% to 32% in Vancouver,[11,12] 27% to 57% in Toronto,[11,13] and 20% to 25% in Montreal.[11,14] More recent surveys using similar methods show a decline in the prevalence of HIV among MSM. As described below, prevalence rates in cities across Canada now range from 7% to 12%.

- For example, the 2005 Nova Scotia Sex Now survey conducted during Halifax's Gay Pride Festival found an HIV prevalence rate of 11.1% in its sample of 310 participants.[15]
- The Ontario Men's Survey conducted in 2002 in 13 regions of the province found a prevalence of 9.4% (12.7% in Toronto, 4.9% in Ottawa, 7.7% in southern Ontario, and 3.7% in northern Ontario). These prevalence rates exclude men who reported never having had sex with another man, who did not provide a saliva sample, or whose laboratory results were inconclusive.[16]
- ARGUS 2005 is the first of planned biennial surveys of Montreal MSM to monitor HIV, hepatitis C, and related risk behaviours. The survey is part of the national, second-generation surveillance project (M-Track) of PHAC. This survey found a prevalence of 12.4%.[17]
- The 2002 Sex Now survey in British Columbia reported an overall prevalence of 12.9% with a higher proportion of HIV-positive men among residents of Vancouver.[18] When the Sex Now survey was repeated in 2004, a slightly lower prevalence, of 11%, was found.[19]

Studies and Surveys of MSM

Several large studies have provided a wealth of information on the incidence and prevalence of HIV and HIV-related risk behaviours in Canada:

ARGUS 2005: A cross-sectional survey of 1,957 Montreal MSM to monitor HIV, HCV, and related risk behaviours, conducted in 2005. The survey is part of M-Track, PHAC's second-generation surveillance project.

Omega Cohort Study: A cohort study (1996-2003) on the incidence and psychosocial determinants of HIV infection among MSM living in Montreal. Participants completed a questionnaire and were tested for HIV every 6 months.

Ontario Men's Survey: A cross-sectional socio-behavioural and HIV prevalence study of 5,080 self-identified gay and bisexual men in 13 regions across Ontario, conducted in 2003.

Polaris HIV Seroconversion Study: An ongoing, longitudinal cohort study of seroconverters and HIV-negative controls in Ontario, initiated in 1998.

Vanguard Project: A cohort study (1995-2003) of HIV in gay and bisexual men, ages 15 to 30, in the Greater Vancouver area of British Columbia. Participants completed questionnaires and were tested for HIV either annually or every 6 months.

Sex Now: A survey of gay and other MSM in several sites across British Columbia, conducted in 2002 (N = 1,854) and 2004 (N = 2,690). A Sex Now survey was also conducted in Halifax (N = 310) in 2005.

- Higher prevalence rates are seen among MSM who are also IDU. In the I-Track surveillance system, which captures behavioural and HIV prevalence data among IDU across Canada, data collected at seven sites across the country from 2003 to 2005 showed that more than a third (34.8%) of MSM/IDU were HIV positive.[20]

Continuing Risk Behaviour Among MSM

Recent data on risk behaviours suggest that MSM continue to be at considerable risk of HIV infection and other STIs by engaging in risk behaviours, such as unprotected anal intercourse (UAI) with partners of unknown serostatus. While differences in the methods used and the way in which risk behaviours are defined make it difficult to compare survey data over time, cohort studies in Montreal and Vancouver have found increases in risk behaviours during the late 1990s and early 2000s.

- In the 2005 Nova Scotia Sex Now survey, 20.2% of participants had engaged in risky sexual practices in the previous year, defined as any UAI with an individual whose HIV status was not known.[15]
- In the Ontario Men's Survey, nearly 40% of the participants reported at least one event of UAI with another man in the previous year, whereas nearly 35% of the participants reported that they had never experienced unprotected insertive anal intercourse.[16] With respect to casual sex, 57.1% reported sex with at least one casual male partner, and 16.0% reported at least one instance of UAI with a casual partner in the previous 3 months.[16]
- Delayed application of condoms was identified as a possible source of HIV transmission in the Polaris cohort study. In the Ontario Men's Survey, 52.4% reported at least one episode of delayed application. Of these, 27.8% reported safer sexual practices, indicating that while a substantial number of men report safer sexual practices, they are also engaging in this risk behaviour.[21]
- A brief questionnaire was completed by 327 HIV-positive and HIV-negative MSM enrolled in cohort studies in Toronto and Vancouver in June 2004. Fifty-nine percent reported having UAI with partners of unknown serostatus. The last such encounter was more recent among HIV-positive than HIV-negative men (a median of 1 month vs. a median of 12 months). Those who reported UAI with partners of unknown serostatus were more likely to agree to the statement that an HIV-negative partner would ask about the need to wear a condom before insertive UAI.[22]
- In the ARGUS 2005 survey, 21% of respondents reported having UAI with a casual partner at least once in the previous 6 months. Twenty-eight percent of participants with self-reported negative or unknown HIV status had had at least one episode of UAI with a partner who was HIV positive or whose serostatus was unknown; 9% had intentionally sought unprotected anal sex with a casual partner (barebacking).[23] In an analysis of ARGUS participants who were HIV negative or of unknown status and had had sex with a non-couple partner, with no exchange of money, 12% of all participants reported UAI at their last sexual encounter.[24]
- In a trend analysis of the Omega Cohort Study data, UAI increased with regular seroconcordant partners (OR: 1.04) and any type of partner (OR: 1.03). There was also a non-negligible increase in UAI with casual partners (OR: 1.03).[25]
- In another Montreal-based study, 346 HIV-positive MSM were recruited for a study of HIV treatment-related perceptions of sexual risk behaviours. Thirty-four percent of participants reported at least one instance of UAI in the preceding 6 months.[26]
- With respect to relapse to risky behaviours, available data indicate that 10% of the Montreal cohort and 26% to 30% of the Vancouver cohort who reported safe sex at baseline disclosed relapse to unprotected anal sex at follow-up 6 to 12 months later.[27,28]
- The 2004 Sex Now survey in BC found that while the majority of participants reported practising safe sex, 25% reported unprotected sex with a partner of unknown serostatus in the previous year.[19] This was similar to the finding of the 2002 Sex Now survey, i.e. 27% of participants reported unprotected sex with a partner of unknown serostatus in the previous year.[19]
- Between May 1995 and September 2001, an increasing number of participants in the Vanguard Project reported unprotected insertive (relative risk: 3.5) and receptive (relative risk: 5.1) anal sex with an

HIV-positive partner; this increase in UAI was associated with seroconversion.[29] In the same study, during the period from September 2001 to December 2003, it was observed that the majority of seroconversions occurred in the small minority (15%) of those who reported serodiscordant receptive UAI.[30]

Correlates and Causes of Risky Behaviours Among MSM

As described below, the causes of ongoing risk behaviours among MSM are complex. Relationships between risk behaviours and a variety of factors have been found, including condom and erectile difficulties, stressful events, drug use, having a greater number of partners, and the increased use of public cruising sites. Little or no association has been found between risk behaviours and macrosocial factors (i.e. educational attainment, employment status, socio-professional categories, income).

- Data from the 2005 Nova Scotia Sex Now survey found no relation between income, education, age, ethnicity, relationship status, or drug use (with the exception of marijuana) and risky sexual practices. Moderate associations were found between increased number of partners, negotiated relationships, increased use of public cruising sites, and rates of risky sexual practice in the previous year.[15]
- In-depth interviews with 102 high-risk gay and bisexual men revealed that unprotected sex was the result of a variety of circumstances, including condom and erectile difficulties, momentary lapses, depression, and stressful events, and was a by-product of strategies of disclosure and use of intuition to gauge safety.[31]
- The Polaris study, an open cohort of MSM in Ontario, examined the association between stressful relationship events and HIV risk behaviour, and found that those who experienced such events were more likely to engage in UAI with a regular partner (OR 3.1, $p = 0.002$).[32]
- Data from the Ontario Men's Survey were used to explore risk behaviours among subcommunities of MSM in Ontario. Those who socialized with "leather men", "bears", older men, gay men, or HIV-positive men were more likely to report UAI in the previous year.[33] In the same study, it was found that men who received non-monetary resources for sex, in comparison with men who received money for sex, were more likely to be HIV positive, have a history of gonorrhea, and to have used cannabis, tranquillizers, or cocaine in the previous year.[34]
- An analysis of ARGUS participants' last sexual encounters found that recreational drug use 2 hours before or during sex (OR. 2.2) and having a strong interest in developing an emotional relationship with the partner (OR. 2.1) were significant correlates of HIV-related risk behaviours.[24]
- In a separate analysis of ARGUS data, latent class analysis was used to derive substance use classes. Three patterns of substance use were found, and two of these patterns were significantly associated with at-risk sexual behaviours such as barebacking and group sex ($p < 0.001$).[35]
- Data gathered from MSM participating in MAYA, on ongoing longitudinal study of people living with HIV in Montreal, found that risk taking (UAI) was linked with the serostatus of their partners. Twenty-two percent had engaged in UAI in the previous 6 months with an HIV-negative regular partner. This proportion doubled with a regular partner of an unknown serostatus, and a further increase was noted with a positive regular partner.[36]
- Using data collected through the Omega Cohort Study, the association between macrosocial factors (i.e. educational attainment, employment status, socio-professional categories, income) and UAI was examined. Two-way analysis of variance showed that MSM with lower educational attainment had more UAI with risky partners ($F = 5.67$, $p < 0.001$). Other macrosocial factors showed little association with UAI.[37]
- In a separate analysis of Omega Cohort Study participants, individual and macrosocial factors and their association with risk behaviours were explored. A number of individual factors were significantly associated with UAI, such as being a sexual-sensation seeker and being more likely to have sex with a regular or a casual partner in a bathhouse; none of the macrosocial factors was significant.[38]
- In a 2004 on-line questionnaire completed by gay and bisexual French-speaking Quebec men, 66.7% reported a face-to-face encounter with a man they had met on-line. Of these, 21.9% reported at least

one episode of UAI with a sexual partner whom they had met on-line. Compared with those who reported face-to-face encounters and no UAI with a man they had met in this way, these men scored higher on a measure of sensation seeking, made more intense use of the Internet for sexual purposes, and attributed more positive repercussions to this activity.[39]

- Data from the Vanguard Project and the Omega Cohort Study were combined and analysed to compare the sexual behaviours of HIV-positive and HIV-negative gay and bisexual men aged 16 to 30 years. High-risk behaviour among MSM in both cities was associated with nitrite inhalant use, and sex in public and commercial sex venues. Independent determinants of risk-taking among men in both cities were the use of poppers (Vancouver: OR 2.1, Montreal: OR 2.9) and having sex in a bathhouse (Vancouver: OR 1.9, Montreal OR 1.8). In Vancouver, having sex in a bar (OR: 1.8) and having at least 20 casual partners in the previous year (OR: 1.7) were associated with high-risk sex. Among men in Montreal, having a casual partner (OR: 3.0) and having at least two regular partners in the previous year (OR: 3.0) were independently associated with high-risk sexual behaviour.[40]

- Data from the Vanguard Project and the Omega Cohort Study were also combined to examine the effect of ethnicity on HIV risk-taking behaviour. Four ethnicity/race categories were formed: White born in Canada (WBIC), White born outside of Canada (WBOC), non-White born in Canada (NBIC), and non-White born outside of Canada (NBOC). WBOC were most likely to report unprotected sex with seropositive partners and unprotected sex while travelling.[41]
- In the Vancouver Vanguard Project, the increase in UAI with casual partners observed from 1997 to 2002 was found to be independent of an increase seen in the use of crystal methamphetamine.[42] In a separate analysis using data from the same cohort, the use of methamphetamine was specifically associated with receptive UAI with casual partners.[43]
- From the cross-sectional data collected between 2002 and 2003 in the Vanguard Project, use of ketamine, GHB (gamma butyrolactone), ecstasy, and Viagra within 2 hours of encounters was found to be associated with UAI with casual partners of unknown HIV status.[44] Also in an analysis of data from the Vanguard Project, men reporting nitrite inhalant use ("poppers") during sexual relations were more likely to have casual partners, have greater numbers of casual partners whose HIV serostatus was positive or unknown, and to have anal intercourse with casual partners. However, use of poppers was not associated with unprotected anal intercourse with casual partners.[45]
- In the 2004 Sex Now survey conducted in BC, men who reported having had UAI with a partner of unknown serostatus were more likely to also report the following: they felt pressured to have unprotected sex (OR = 3.6); they broke an agreement with a partner (OR = 3.3); they did not care at the time (OR = 3.2); they engaged in high-volume sex (OR = 2.7); and they used crystal meth (OR = 2.6). This survey also found that age was not related to UAI with a partner of unknown serostatus; that men who had 10 or more partners per year were more likely to engage in UAI with a partner of unknown serostatus; and that men who used certain venues (e.g. baths, Internet, sex party, phone-line, or parks) were more likely to report having had UAI with a partner of unknown serostatus.[19]
- The recent rise in rates of reportable STI in Canada may also be used as a marker of unsafe sexual behaviour. The elimination of infectious syphilis, the least commonly reported bacterial STI in Canada, was seen as an imminent goal as recently as 1996; however, national infectious syphilis rates (preliminary) were almost nine times higher in 2004 than they were in 1997 (3.5/100,000 vs. 0.4/100,000 respectively).[46] Despite limitations of surveillance data in assessing the risk behaviours of reported cases, this increase is disproportionately higher among males, who accounted for 88% of all reported cases in 2004.[46] Similarly, a review of the gonorrhea surveillance data in Canada reveals that reported cases of gonorrhoea among men increased by 106% between 1997 and 2004 (compared with a 76% increase among females).[46] Lymphogranuloma venereum (LGV) is a sexually transmitted infection that until recently was rare in industrialized countries. However, starting in 2003, cases in MSM have been reported in Europe, the United States, and Canada. As of November 1, 2006, there were 85 cases of LGV reported to PHAC. All reported cases have been male, and most cases reported recent sex, often

unprotected with male partners, which occurred primarily in bathhouses.[47] The rising rates of syphilis, the increase in gonorrhea rate, and the emergence of LGV in Canada further support the suggestion of an increase in unprotected sexual encounters among MSM.

Comment

A number of biases must be taken into account when interpreting the results noted here. HIV diagnostic data are limited to persons who present themselves for testing, and so trends in these numbers may be influenced by testing patterns or improved ability to remove duplicate tests. In addition, identifying information that accompanies HIV testing data is sometimes incomplete or inaccurate, and this may limit the usefulness of HIV incidence estimates. Results of cohort studies are limited by selection biases, loss to follow-up, and problems with generalizability.

Despite these limitations, available data suggest that there was an increase nationally in new HIV infections among MSM in the late 1990s, and although this increase may not have continued, overall incidence does not appear to have decreased since then. There is also a continued and perhaps increasing presence of high-risk behaviours among MSM across the country. This high-risk behaviour among MSM is also noted elsewhere. For example, increases have been seen in HIV-associated risk behaviours and/or STIs among MSM in the United States,[48-49] United Kingdom,[50] and Sydney, Australia.[51]

Several hypotheses have been explored in an effort to explain these increases in HIV-associated risk behaviours, including alcohol/drug use,[24,36,44] feelings of complacency or optimism related to the success of antiretroviral therapy,[52] false reassurance upon learning of an HIV-negative result, misconceptions about a partner's HIV status, a lack of direct experience of the AIDS epidemic in the younger generation of gay men, a desire to escape the rigorous norms and standards required for a lifetime of safe sex,[53] and the impact of Internet chat rooms as a risky environment.[19,40]

The increase in new infections among MSM and the number of MSM living with HIV underscore the need for innovative prevention programs to reduce the spread of HIV and STIs in the gay community. These programs should not only focus on those who are not yet infected but also on those who are HIV positive. Risk behaviour measured over time and in different settings that reflect urban and rural areas of Canada, as well as diverse populations, would be useful to better characterize the epidemic among MSM and to support effective prevention and care programs.

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HIV/AIDS Among People Who Inject Drugs in Canada

At a Glance

- Injecting drug use accounted for 8.0% of cumulative adult AIDS cases and 17.0% of cumulative adult positive HIV test reports up to December 31, 2006.
- The 2005 national HIV estimates indicate that the proportion of new HIV infections attributed to injecting drug use decreased from 19% in 2002 to 14% in 2005.
- The estimated number of new HIV infections among IDU in 2005 (350-650) remains unacceptably high.
- An enhanced surveillance system, I-Track, has been under way at sentinel sites across Canada to monitor HIV-associated risk behaviours, and HIV and HCV prevalence among IDU.

Introduction

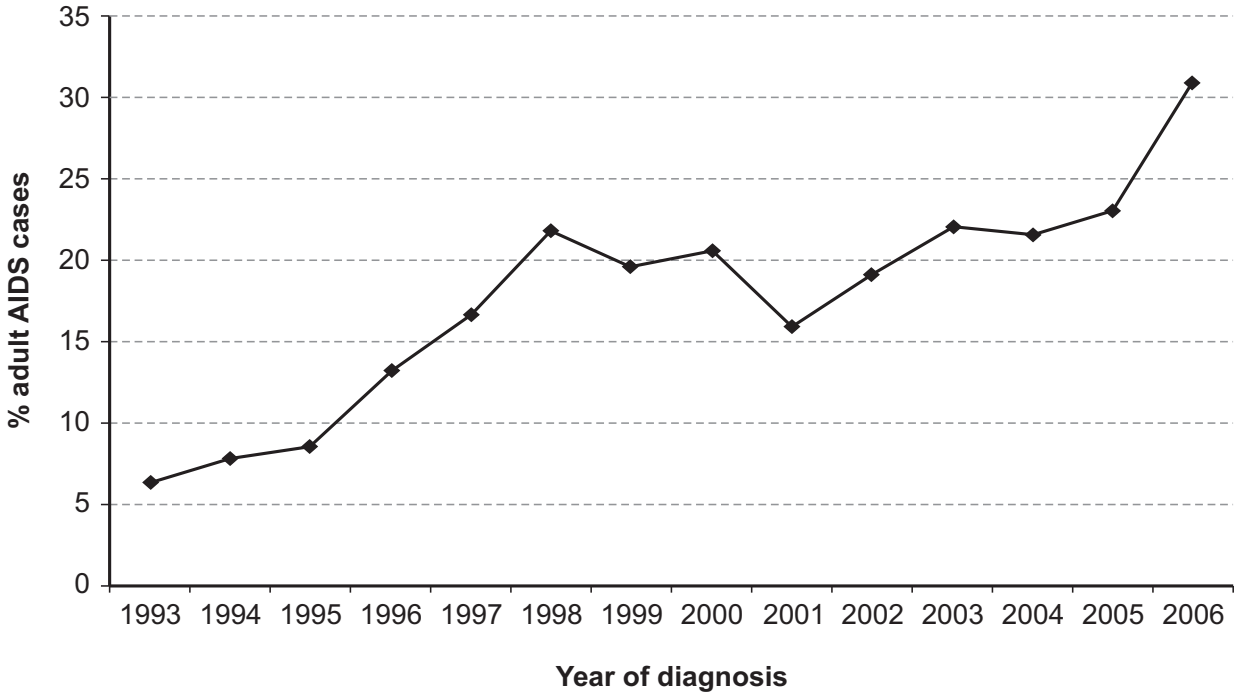
In the early 1980s, the Canadian HIV epidemic was concentrated among men who have sex with men (MSM). By the early to mid-1990s, there was a change toward increasing transmission among people who inject drugs (IDU), and by 1996 approximately 35% of new HIV infections that occurred in Canada that year were among IDU.[1] The current national HIV estimates indicate that the proportion of new infections among IDU had decreased to 14% of all new infections in 2005 (350-650 of a total of 2,300-4,500 new infections).[1] A similar trend has occurred in the adult positive HIV tests reported to the Public Health Agency of Canada (PHAC): surveillance data as of December 31, 2006, indicate that in 2006, 19.3% of these tests were attributed to IDU, down from a peak of just over 33% in 1996 and 1997.[2] This *Epi Update* presents information on the status of HIV/AIDS among IDU in Canada.

AIDS Surveillance Data[2]

Injecting Drug Use Remains a Significant Exposure Category Among AIDS Cases

- As of December 31, 2006, there have been 20,669 AIDS cases reported to PHAC since the early 1980s (includes cases reported up to June 30, 2003, from Quebec, but data on the number of reported AIDS cases from Quebec after that date were not available; data from Ontario on the exposure category of cases reported since the second half of 2005 were not available). Of the 19,154 cumulative adult AIDS cases with known exposure category, 8.0% (1,536) were attributed to injecting drug use and, of these, 72.7% were males. An additional 4.3% (830) were attributed to MSM who also inject drugs (MSM/IDU).
- There was a rise in the proportion of IDU among reported adult AIDS cases from 6.3% in 1993 to 21.9% in 1998. From there it dropped to a low of 15.9% in 2001 before increasing steadily to 23.0% in 2005. From 2005 to 2006 the proportion of IDU among reported adult AIDS cases increased to 30.9% (Figure 1).

Figure 1. Proportion of adult AIDS cases attributed to IDU, by year of diagnosis 1993-2006



When interpreting the results presented in this section, it should be remembered that AIDS cases represent trends in HIV infections that occurred approximately 10 years earlier and that the number of AIDS cases reported in recent years is low, which complicates the interpretation of recent trends.

- The proportion of adult male AIDS cases attributed to IDU steadily increased from 4.0% in 1992 to a peak of 21.8% in 2003, and later decreased to 14.7% in 2005. This has been followed by an increase to 31.1% in 2006.
- Females represent 27.3% of the total cumulative adult AIDS cases attributed to IDU for which exposure category and gender were reported. The proportion increased steadily from 19.3% in 1992 to a peak of 47.4% in 1998. It dropped to 23.2% in 2003, and trends since then are especially difficult to interpret because of the small number of reported cases.

10

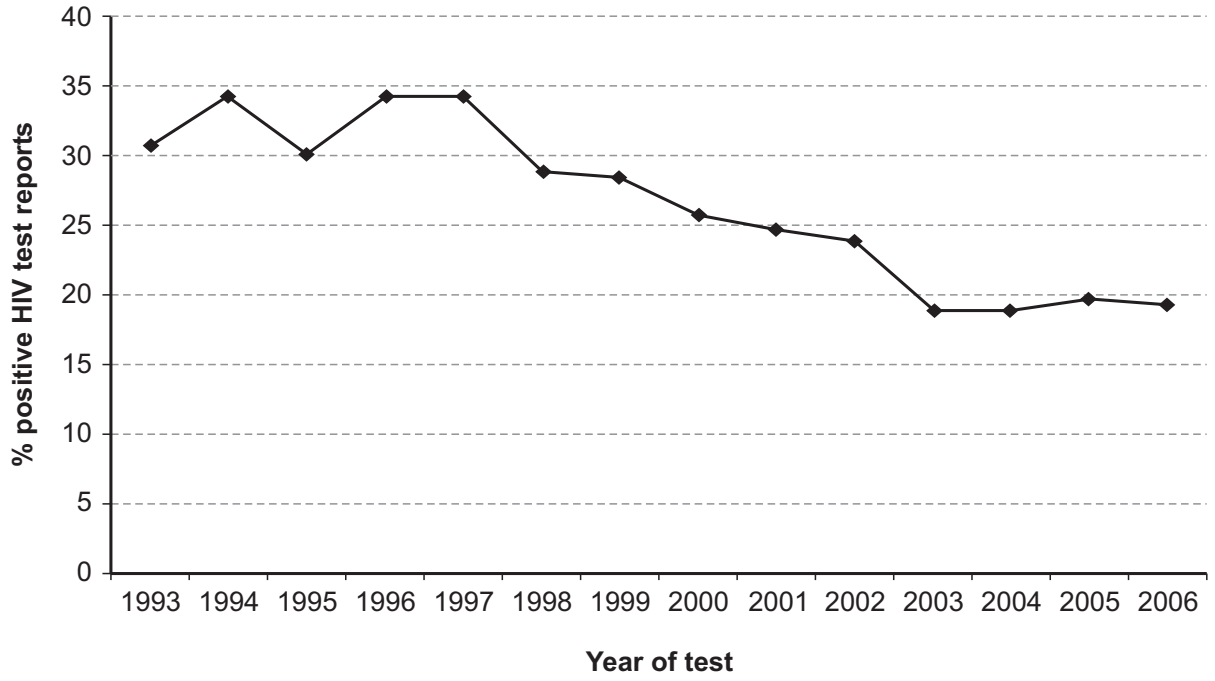
HIV Surveillance Data[2]

Proportion of Adult HIV Positive Test Reports among IDU Continues Gradual Decline

While AIDS data provide information on HIV infections that occurred about 10 years in the past, HIV data provide a picture of more recent infections.

- Of the 31,197 cumulative positive HIV tests in adults reported to PHAC with exposure category information since reporting began in 1985 to December 31, 2006, 17.0% were attributable to injecting drug use (67.5% of the positive HIV reports with known gender in the exposure category of IDU were males). An additional 2.3% were attributed to MSM/IDU.
- Figure 2 shows the proportion of adult positive HIV tests attributed to injecting drug use by year of test, to the end of 2006. This proportion has gradually decreased from 24.6% in 2001 to 19.3% in 2006.
- The proportion of positive HIV test reports in adult females that could be attributed to IDU was 31.1% in 2001, and this showed a decline in the following years to 25.5% in 2003 before increasing again by 2006 to 30.7%. The proportion in adult males attributable to IDU has shown a steady decrease from a high of 22.4% in 2001 to 15.4% in 2006.

Figure 2. Proportion of adult positive HIV reports attributed to IDU, by year of test 1993-2006



- Of positive HIV tests reported between January 1, 2006, and December 31, 2006, for which age and risk information was available, the highest proportion in the IDU category occurred in those aged 30-39 years (35.7%), followed by those aged 40-49 years (24.9%).

Studies Confirm That HIV Prevalence and Incidence Remain Unacceptably High at Sentinel Sites Across Canada

In response to a need for ongoing monitoring of HIV prevalence and incidence rates as well as risk behaviours in IDU populations from across the country, an enhanced surveillance system of HIV- and hepatitis C (HCV)-associated risk behaviour, I-Track, has been established by the Public Health Agency of Canada at sentinel sites across Canada. This has been achieved through collaboration with provincial, regional, and local health authorities, community-based organizations, and researchers. A pilot study of the I-Track surveillance system was undertaken between October 2002 and August 2003, when a total of 1,062 IDU were surveyed in Victoria, Regina, Sudbury, Toronto, and as part of the SurvUDI network (which includes Ottawa and nine sites in the province of Quebec).[3] Since then, Phase I of I-Track was completed between October 2003 and May 2005 with the addition of Edmonton and Winnipeg. A total of 3,031 IDU participated in Phase I of I-Track. Phase II has been completed in Victoria, Sudbury, Toronto, Kingston, and throughout the SurvUDI network. Remaining Phase II surveys are planned in Regina, Edmonton, and Winnipeg along with two new sites: Thunder Bay and Prince George. Selected findings from Phase I of I-Track are reported below, as well as those reported by other studies of IDU in Canada.

10

HIV and HCV Prevalence Among IDU

- HIV prevalence at participating I-Track sites is quite variable,[4,5] ranging in the pilot study from a low of 1.2% in Regina in 2002-03 to a high of 19.6% at sites in the SurvUDI network (2003-04).[3] In Phase I of I-Track surveys, the prevalence of HIV has ranged from 2.9% in Regina to 23.8% in Edmonton.[5] The HIV prevalence at I-Track sites is given in Table 1.
- Open since September 2003, Vancouver's supervised injection site recruited a cohort of IDU who used the facility from December 2003 to April 2005 to participate in the Insite Cohort Study. Of the 1,007 subjects, 17% were HIV positive.[10]
- In a cohort study, 203 participants were recruited into low-threshold methadone programs at two sites in Ontario by December 2003. The HIV prevalence at the time of entry was found to be 7%. Of those who were HIV positive, 84% knew their

Table 1. HIV prevalence (%) at selected centres and years

	Other studies				I-Track			
	1986-90	1992-94	1997-98	2000	2002	2003	2004	2005
Edmonton								23.8[5]
SurvUDI network*						19.6[3]	17.3[5]	
Regina				2.0[6]	1.2[4]			2.9[5]
Sudbury					10.1[4]		12.2[5]	
Toronto		5.5[7]	8.6[7]			5.1[4]	7.6[5]	
Victoria					16.0[4]	15.4[5]		12.5[8]
Winnipeg	2.3[9]		12.6[9]					13.1[5]

*Nine recruitment sites in the province of Quebec, as well as Ottawa, Ontario

serostatus and 77% were co-infected with HCV. The HCV prevalence was 48%.[11]

- HCV prevalence was high throughout all Phase I of I-Track sentinel sites and ranged from 61.8% in Winnipeg to 68.5% in Sudbury and Victoria.[5] In the SurvUDI network between 2003 and 2006, HCV prevalence was estimated to be 62.2%.[12]
- The HIV and HCV co-infection rate at the four participating sites (Regina, Sudbury, Toronto, and Victoria) was found to be 7.8% overall in the I-Track pilot phase[4] and 11.7% across seven sentinel sites in Phase I.[5]
- The SurvUDI network has been conducting surveillance since 1995 in recruitment centres that provide needle exchange services and other prevention programs to IDU in the province of Quebec and in Ottawa, Ontario. HIV prevalence for the overall network increased significantly from 11.3% in 1995 to 14.4% in 2002, followed by a gradual decline to 9.8% in 2005.[12] In 2005, HIV prevalence in Montreal, Ottawa, and Quebec City was found to be 13.6%, 8.0%, and 7.1% respectively.[12]
- In a study from Quebec City on differences in risk behaviour between users of needle exchange programs (NEP) and detoxification centre participants, the prevalence of HIV among NEP users was 12.1% vs. 9.1% for the detoxification centre participants.[13]

HIV and HCV Incidence Among IDU

- Results indicate that HIV incidence among repeat service attendees in the SurvUDI network decreased from 5.1 per 100 person-years (PY) in 1995 to a range of 2.2-3.0 per 100 PY during 2001 to 2004 and then decreased to 2.8 per 100 PY in 2005.[12] Overall incidence from 1995 to 2006 was 2.5 per 100 PY in Quebec City, 3.9 per 100 PY in Montreal, 4.0 per 100 PY in Ottawa and the Outaouais, 1.4 per 100 PY in semi-urban sites, and 3.2 per 100 PY for the overall SurvUDI network.[12]
- The POLARIS study investigated HIV incidence according to risk category among repeat testers in Ontario's diagnostic HIV testing database during the period 1992-2000. HIV incidence among IDU decreased from 0.64 per 100 PY in 1992 to 0.14 per 100 PY in 2000.[14]
- A study examining trends in HIV incidence in Ontario according to recent infections among new HIV diagnoses (identified using the serological testing algorithm for recent HIV seroconversion or STARHS assay) found that HIV incidence during a 3-year period (October 1999 to December 2002) among IDU was 0.23 per 100 PY. The incidence during the same period was 0.25 per 100 PY in Toronto, 0.71 per 100 PY in Ottawa, and 0.15 per 100 PY elsewhere in Ontario.[15,16] Over time, HIV incidence among IDU in Ontario appeared to decrease.[14] The estimated incidence of HIV in Ontario in 2003 based on the detuned assay was 0.09 per 100 PY in Toronto, 0.29 per 100 PY in Ottawa, and 0.13 per 100 PY in other regions of Ontario.[17]
- Results from the Vancouver Injection Drug User Study (VIDUS) showed that HIV incidence was 1.5 per 100 PY in 2000, down from 10.3 in 1997 and 3.2 in 1999.[18] In the VIDUS cohort enrolled between

May 1996 and May 2003 the cumulative incidence at 64 months after enrolment was 14%.[19]

- HIV incidence rates were estimated from pooling participants who had had at least one HIV test between 1992 and 2003 from three large prospective Vancouver cohort studies, the VIDUS study, the CHASE Project, and the SEOSI cohort. Incidence was found to be 0.2 per 100 PY in 1992, which increased to 2.3 per 100 PY in 1995 and decreased from 2.1 per 100 PY in 2000 to 1.3 per 100 PY in 2003.[20]
- Further research from VIDUS compared cumulative HIV incidence among daily NEP users and non-daily NEP users. Daily NEP users had a higher 48-month cumulative incidence rate, at 18.1%, as compared with 10.7% among non-daily NEP users.[21]
- In a study in Ottawa, HCV incidence was found to be 25.0 per 100 PY.[22] In the SurvUDI network, the incidence of HCV during the period from 1997 to 2006 was 27.5 per 100 PY.[12]
- Research from the St. Luc cohort in Montreal revealed an overall HIV incidence rate of 2.6 per 100 PY from 1992 to 2004. The rate was at its highest in 1997, at 2.5 per 100 PY, and at its lowest in both 1998 and 2001, at 1.6 per 100 PY. For 2004 the rate was 1.8 per 100 PY.[23]

IDU component of national HIV estimates

- Of the estimated 58,000 persons living with HIV in Canada in 2005, about 9,860 (17%) were IDU. This compares with an estimate of 8,900 IDU living with HIV infection in 2002.[1]
- An estimated 350-650 new HIV infections occurred among IDU in 2005, which represents about 14% of the estimated total of 2,300-4,500 new infections.[1] This is slightly less than the estimated 400-700 new infections (19% of total) among IDU in 2002. Although this difference is hard to interpret given the broad ranges of uncertainty associated with the incidence estimates, it is suggestive of a decrease that is consistent with the other data presented in this *Epi Update*. Possible reasons for such a decrease include the adoption of safer injecting practices among IDU, shifting patterns of drug use, and effective prevention programming.

Women, Youth and Aboriginal IDU Are Particularly at Risk of HIV Infection

Women

- Since 1996, approximately one-quarter to one-half of new HIV test reports among women have been attributed to injecting drug use. The latest national HIV estimates published by PHAC indicate that of the estimated 620 to 1,240 new infections among women in 2005, 24% were attributed to injecting drug use.[1]
- Findings from the VIDUS study in Vancouver show that during the period May 1996 to December 2000, HIV incidence rates among female IDU in Vancouver were about 40% higher than those among male IDU (16.6% vs. 11.7% respectively).[24]

Youth

- Results from Phase I of I-Track indicate that 25.5% of males and 29.9% of females reported initiation of injecting at the age of 16 years or younger.[5]
- High HIV incidence rates were found among young IDU when the VIDUS study in Vancouver examined rates of HIV positivity among IDU participants who were 24 years of age and younger. HIV incidence rates in this age group were 2.96 and 5.69 per 100 PY among males and females respectively,[25] compared with an overall incidence rate of 1.5 per 100 PY in 2000.[18] This study also found that among young IDU (age 13-24 years), HIV prevalence was associated with female sex, history of sexual abuse, engaging in survival sex, injecting heroin daily, injecting speedballs daily, and having numerous lifetime sexual partners.[26]
- The HIV incidence among street youth in the Montreal Street Youth Cohort Study was 0.69 per 100 PY as of September 2000. Injecting drug use was the strongest predictor of HIV seroconversion (becoming HIV positive).[27]
- Enhanced Surveillance of Canadian Street Youth (E-SYS) is a national, multi-centre, cross-sectional surveillance system that monitors sexually transmitted infections, bloodborne pathogens, behaviours and risk determinants among Canadian street youth aged 15-24 years. Approximately one-fifth of street youth surveyed in the 1999, 2001, and 2003 cycles of E-SYS had ever injected drugs in their lifetime (20.8%, 18.4%, and 22.3% respectively).[28] The

HIV prevalence among street youth who injected drugs in the E-SYS was observed to be 0.6%, 2.9%, and 1.0% in 1999, 2001, and 2003 respectively. Further, young IDU accounted for 66.7%, 60.0%, and 37.5% of HIV-positive street youth in 1999, 2001, and 2003 respectively, despite constituting only 20.1%, 17.2%, and 21.2% of the street youth population in each of those years (Sexual Health and STI Section, Community Acquired Infections, Centre for Infectious Disease Prevention and Control: personal communication, 2006).

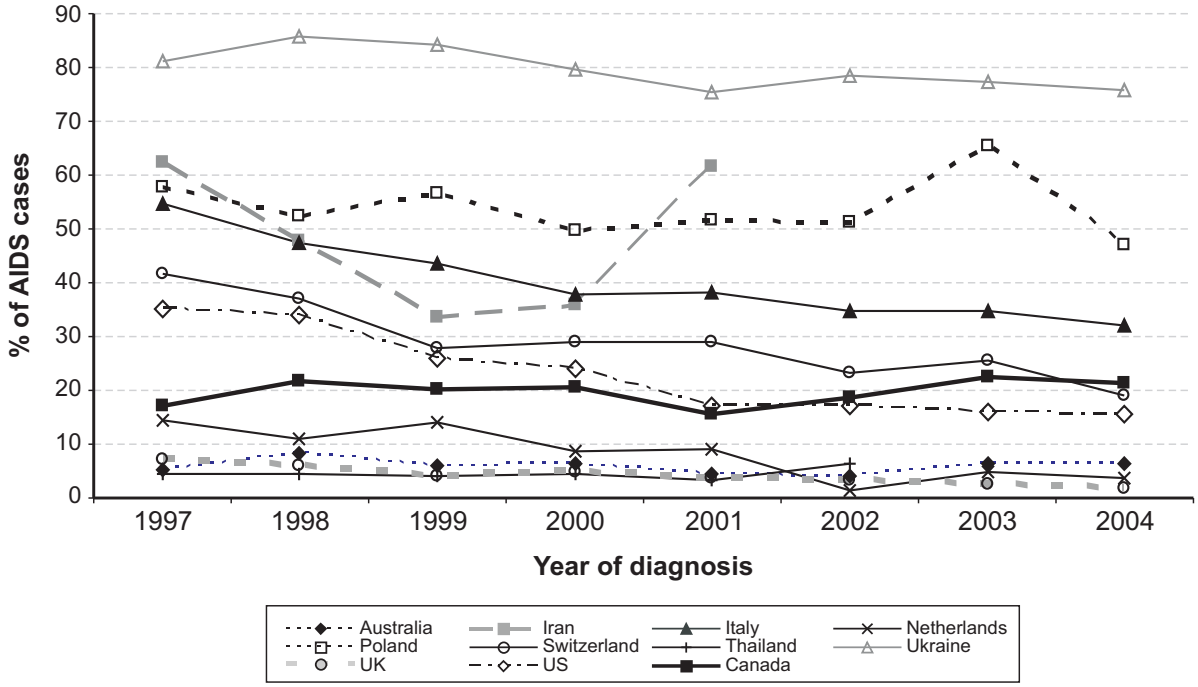
Aboriginal persons

- Aboriginal persons are overrepresented in many IDU populations, and a larger proportion of Aboriginal HIV and AIDS cases are attributed to IDU than non-Aboriginal cases.[29] The 2005 national HIV estimates indicate that 53% of all new HIV infections among Aboriginal people in 2005 were attributable to injecting drug use, a proportion considerably higher than the 14% of overall new infections in this category.[1]
- Results from I-Track Phase I showed that 41.9% of the study participants self-identified as Aboriginal. Most of these were from Regina, where 87.2% were Aboriginal, followed by Edmonton and Winnipeg, where 70.3% and 69.6% of participants were Aboriginal. The proportion of Aboriginal IDU in the remaining sentinel sites ranged from 5.5% in the SurvUDI network to 27.3% in Sudbury.[5]
- An analysis comparing the seroconversion rates of Aboriginal IDU with those of non-Aboriginal IDU recruited between 1996 and 2000 for the VIDUS study in Vancouver found that Aboriginal IDU were seroconverting at twice the rate of non-Aboriginal IDU.[30]
- After 48 months of follow-up through the VIDUS study, Aboriginal youth aged 24 years and younger who inject drugs were found to be more than 4 times as likely to be infected with HIV at enrolment and more than twice as likely to become infected with HIV during the follow-up than were non-Aboriginal youth who inject drugs.[31]
- In a nested case-control study of VIDUS participants who were 24 years of age or younger at enrolment, cases were more likely to be Aboriginal, to have had more than 20 lifetime sexual partners, to inject cocaine daily, and to use crack cocaine daily.[32]
- The CHASE project is a prospective study in which residents of the Vancouver's Downtown Eastside are recruited. In a subset of the CHASE cohort that consisted of IDU, Aboriginal ethnicity was associated with HIV prevalence at baseline.[33]
- In a study of the recently opened safe injection facility in Vancouver, 19% of the study participants who were users of the facility were Aboriginal, and Aboriginal ethnicity was significantly associated with HIV seropositive status (odds ratio 2.7, $p < 0.001$).[10]
- In the Cedar Project, a study in Vancouver and Prince George, Aboriginal youth (14-30 years of age) were surveyed about HIV prevalence and risk behaviours, including injecting drug use. Overall HIV prevalence was 3.8% in Prince George and 12.6% in Vancouver. Among injecting Aboriginal youth, HIV prevalence was 7.2% in Prince George and 17.4% in Vancouver.[34]

International trends

A report published by UNAIDS and the World Health Organization (WHO) in December 2006 indicated that an estimated 39.5 million people in the world are living with HIV, of whom 2.3 million are children under 15 years of age.[35] IDU is cited as one of the main modes of transmission for those living with HIV/AIDS in seven of the 10 regions of the world, including North America, North Africa and the Middle East, Western Europe, and East Asia and Pacific. In Eastern Europe and Central Asia, where the epidemic began relatively later than in other regions (early 1990s), injecting drug use is listed as the single main mode of transmission.[35] Figure 3 shows the proportion of AIDS cases attributed to IDU in selected countries since 1995. While caution should be used when comparing and interpreting data from surveillance systems that may differ, it is interesting to note that although Canada is in the lower half of the graph, countries like Australia, Netherlands, and the UK have even lower proportions of reported AIDS cases attributed to IDU. Such ecological comparisons have their limitations, but this difference may be related to the availability and acceptability of programs and services that advocate harm reduction for IDU populations in these countries. More research is needed to study the effectiveness of these programs and whether similar approaches could be applicable in the Canadian setting.

Figure 3. Proportion of reported AIDS cases attributed to IDU in selected countries* by year of diagnosis



*The sources of these data can be found after the References section, under Sources (accessed January 2005).

Comment

A number of biases must be taken into account when interpreting the results given here. HIV diagnostic data are limited to persons who present themselves for testing, and so trends in these numbers may be influenced by testing patterns and/or improved ability to remove duplicate tests. In addition, identifying information that accompanies HIV testing data is sometimes incomplete or inaccurate, and this may limit the usefulness of HIV data. Results of cohort studies are limited by selection biases, loss to follow-up, and problems with generalizability. Studies that have a cross-sectional design have their own limitations.

Although the incidence of HIV among IDU may be decreasing somewhat, the issue of HIV among IDU in Canada continues to be a serious problem that demands ongoing attention. The problem is best documented in larger cities but is increasingly being seen outside major urban areas. The establishment of the I-Track enhanced surveillance system represents a milestone in the objective of describing changing patterns in drug injecting and sexual behaviours, HIV testing behaviours, and HIV and HCV prevalence among IDU in Canada. Results from the I-Track pilot phase and from Phase I suggest that the pattern of drug use and HIV prevalence differ markedly across Canada and within provinces. These findings highlight the importance of expanding the geographic coverage of the surveillance system and the need to include semi-urban centres in the future. Policy and programs to address drug use and HIV will need to be tailored to local issues and IDU migration patterns.

The high levels of risky injecting and sexual behaviours reported by IDU in sentinel sites across Canada suggest that the potential for the transmission of HIV in these populations continues to be significant. Given the geographic mobility of IDU and their social and sexual interaction with non-users, the dual problem of injecting drug use and HIV infection is one that ultimately affects all of Canadian society.

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Risk Behaviours Among People Who Inject Drugs in Canada

At a Glance

- Available data indicate high levels of risky injecting and sexual behaviours among people who inject drugs (IDU), suggesting that the potential for the transmission of HIV in these populations continues to be significant.
- The sharing of needles and other injecting equipment among IDU has shown a decreasing trend across various cities in Canada.
- Marked differences in injecting drug use risk behaviour and in HIV prevalence across several cities in Canada reflect the need to increase the geographic coverage of surveillance of risky behaviours among IDU.

Introduction

Recent estimates of national HIV prevalence and incidence indicate that 14% or 350-650 of the estimated 2,300-4,500 new HIV infections that occurred in Canada in 2005 were among people who inject drugs (IDU).[1] In 2002, 19% or 400-700 of the estimated 2,100-4,000 new HIV infections were among IDU.[1] A comparable trend has been observed in the number of positive HIV test reports attributed to injecting drug use reported to the Public Health Agency of Canada (PHAC). The proportion of adult positive HIV tests attributed to injecting drug use, after peaking at just over 33% in 1996 and 1997, gradually decreased to 19.3% in 2006.[2]

Although these declining trends are encouraging, HIV among IDU remains a major concern. In the absence of a vaccine against HIV, behaviour change is the main tool for preventing HIV infection among drug injectors. Behaviour change concerns both the IDU who are HIV infected and those who are uninfected, and relates mainly to their injecting-related and sexual behaviours.

In response to a need for ongoing monitoring of HIV-associated risk behaviours among IDU, PHAC, through collaboration with provincial, regional, and local health authorities, community-based organizations, and researchers, has initiated enhanced surveillance of risk behaviours associated with HIV and hepatitis C (HCV) (I-Track) at sentinel sites across Canada. A pilot study of the I-Track surveillance system was undertaken between October 2002 and August 2003, when a total of 1,062 IDU were surveyed in Victoria, Regina, Sudbury, Toronto, and in the SurvUDI network (which includes Ottawa and nine sites in the province of Quebec).[3] Since then, Phase I was completed between October 2003 and May 2005, 3,031 subjects being interviewed in Victoria, Edmonton, Regina, Winnipeg, Sudbury, Toronto, and in the SurvUDI network.[4]

This *Epi Update* describes the drug injecting and sexual risk behaviours that have been reported by the I-Track surveys, as well as by other studies of IDU in Canada.

Neither a Borrower nor a Lender Be: the Sharing of Needles and Syringes

The sharing (borrowing and lending) of needles and syringes is well established as a means of transmitting HIV infection and is a common behaviour among IDU. While results suggest positive trends in the reduction of sharing behaviour among IDU, the proportion of participants who report sharing needles is still relatively high.

- Results from Phase I of the I-Track survey indicate that, overall, 14.5% of study participants reported injecting with used needles in the 6 months before the survey. Proportions ranged from 8.7% in Edmonton to 26.7% in the SurvUDI network.[4] This is a noticeable drop from the pilot study, when 26.8% of participants overall reported injecting with used needles (see Table 1). IDU borrow mostly from people with whom they inject, usually close friends/family or regular sex partners.[4]
- From Phase I, 18.2% of participants overall reported passing or lending a needle/syringe that they had already used to other IDU for injecting purposes, and this proportion ranged from 10.0% in Regina to 31.1% in Victoria.[4] This was slightly lower than the rate from the pilot study, of 22.7% (see Table 1).[3]
- Recent research from the VIDUS study on accessing addiction treatment found high rates of needle/syringe lending and borrowing in Vancouver. Overall, 37.8% of the participants enrolled in the VIDUS study as of May 2002 reported borrowing syringes (37.4% among those in treatment and 39.6% among those not in treatment). Over one-third of the participants (36.2%) reported lending syringes.[5] In comparison, a survey of IDU attending the safe injection facility in Vancouver found that 11% of the study participants had shared needles/syringes in the previous 6 months. It was also noted, after adjusting for covariates, that the safe injection facility was independently associated with reduced needle/syringe sharing among participants of the survey.[6]
- Researchers in Toronto compared data from the I-Track survey with past research on IDU in the city and noted a declining trend in needle sharing. In studies from 1989-90,[7] 1992-93,[8] and 2002-03,[3] needle borrowing rates were 46%, 32%, and 24%; data from Phase I of the I-Track survey noted needle borrowing by 15.0% of IDU in Toronto.[4]
- In the SurvUDI network from 1995 to 2006 significant differences were found between urban and semi-urban (small communities) participants with regard to needle sharing and borrowing: 27.8% of urban participants vs. 36.2% of rural participants had lent used needles to someone in the previous 6 months, and 32.9% of urban participants vs. 41.0% of rural participants had borrowed used needles from someone else in the previous 6 months.[9]
- Of the IDU recruited from shooting galleries in Quebec City, 28.9% reported injecting with used needles.[10] Lifetime syringe sharing was estimated in another repeated cross-sectional survey of IDU attending shooting galleries in Quebec City, where 67% reported having injected with a used syringe in the past.[11]
- In the Cedar Project, Aboriginal youth from Vancouver and Prince George, British Columbia, were surveyed on their drug use and risk behaviours. Study participants from Prince George were more likely to use needles/syringes that had already been used than participants from Vancouver (24% vs. 12%).[12]

Table 1. Sharing of needles in the I-Track survey (percentage)

Year	Average among sites	Regina	Sudbury	Toronto	Victoria	SurvUDI network	Edmonton	Winnipeg
Used needles								
2004-2005	14.5	9.2	12.0	15.0	18.9	26.7	8.7	10.8
2002-2003	26.8	16.5	26.6	24.0	30.7	36.2		
Lent needles								
2004-2005	18.2	10.0	17.3	20.0	31.1	21.9	12.7	14.4
2002-2003	22.7	15.7	18.3	18.1	30.0	31.4		

- In a study from Ottawa of crack smokers involved with the safe crack kit initiative, subjects who had used crack and injected drugs were more likely to have injected with a used needle than those who did not use crack but did inject (36% vs. 25%).[13]
- Researchers in Quebec City conducted a study that compared risk behaviours of users of needle-exchange programs (NEP) with risk behaviours of attendees at detoxification centres. Needle sharing and equipment sharing were significantly associated with NEP use, 23.2% of NEP users vs. 17.3% of detoxification centre participants reporting both in the previous 6 months.[14]

The borrowing and lending of other injecting equipment (e.g. spoons, filters, and water), often referred to as "indirect sharing", has also been associated with HIV infection. Research indicates that indirect sharing also occurs frequently among IDU:

- Results from Phase I of the I-Track survey showed that 30.9% of participants reported borrowing the equipment used to prepare drugs for injection (water, filter, cooker/spoon) in the previous 6 months, and this ranged from 23.5% in Toronto to 40.8% in Regina.[4] This is lower than the rate of borrowing equipment reported in the pilot study in 2002-03, when 47.0% of participants (range: 31.8% in Toronto to 58.8% in Sudbury) reported borrowing previously used other injecting equipment (water, filter, cooker/spoon) for injecting purposes in the preceding 6 months.[3]
- Also from Phase I of the I-Track survey, 32.0% of participants reported passing or lending the equipment used to prepare drugs for injection that they had already used (water, filter, cooker/spoon). This ranged from 23.4% in the SurvUDI network to 46.8% in Regina.[4] This was a slight change from the pilot study, when 37.5% reported lending or passing on other injecting equipment in the 6 months prior to the survey.[3]
- In Toronto, analysis of Phase I data of the I-Track survey revealed a decline in injecting equipment sharing when compared with rates from previous research studies. In studies conducted in 1991-94, 1997-98, and 2002, borrowing rates of injecting equipment were 69.1%, 55.6%, and 31.8% respectively, whereas the rate from Phase I was 24%.[4,15]
- In the VIDUS cohort study of IDU in Vancouver during 1996 to 2000, 38% of men and 37% of women reported borrowing injecting equipment, and this was found to be one of the risk factors for seroconversion among men.[16]
- The sharing of injecting equipment is related to the circumstances and place in which injecting occurs. In a pilot study of social networks of IDU recruited from shooting galleries in Quebec City, 64.4% borrowed other injecting equipment that had been used.[10] In a study conducted between October 2002 and January 2003 among street-recruited IDU in Ottawa, it was observed that the IDU who reported injecting in public places were more likely to inject with used needles.[17]
- International studies[18-20] of IDU have identified other aspects of drug injecting, such as "front-loading" or "back-loading", which may also increase the risk of HIV transmission. These practices involve two or more IDU who use only one syringe to prepare a drug solution. The solution is then squirted into one or more additional syringes either via the front of the recipient syringe after removing its needle (front-loading) or via the back after removing the plunger (back-loading); however, the full extent of such risk behaviours among Canadian IDU is not known.

Risky Business: Trading Unprotected Sex for Money and Drugs

Many IDU in Canada are involved in the commercial sex trade, and studies report inconsistent condom use with clients:

- Among IDU participating in Phase I of the I-Track survey, 32.1% of females reported having had a client male sex partner in the 6 months before the survey. Of these, 5.7%, 11.0%, and 2.0% reported never using condoms during vaginal, oral, and anal sex respectively.[4]
- Results from the SurvUDI network between 1996 and 2006 comparing urban and semi-urban participants found that 42.5% of females in urban versus 30.2% of females in semi-urban sites reported engaging in prostitution in the previous 6 months.[9] For male participants, 8.4% of males in urban versus 9.0% of males in semi-urban sites reported engaging in prostitution in the previous 6 months.[9] Further, analysis of HCV test results between 1997

and 2003 revealed that the HCV incidence was significantly associated with sex trade involvement (adjusted hazard ratio 2.61).[21]

- In the VIDUS study in Vancouver, 995 male IDU were recruited between 1996 and 2003, of whom 11% reported being involved in the sex trade at enrolment and 10% initiated sex trade involvement during the follow-up period; those in the sex trade had higher levels of risky injection behaviours.[22]
- Among young IDU in the VIDUS study (IDU under 29 years of age), Aboriginal women and young IDU who started to inject at age 16 years or younger were more likely to be involved in sex trade work.[23]
- In another study focusing on Aboriginal youth, the Cedar Project, IDU risk behaviours and HIV and HCV prevalence rates were examined. Survival sex work was reported by 34% of participants from Prince George and 41% of participants from Vancouver.[12] Bivariate analyses comparing HIV serostatus among participants showed that those more likely to be HIV infected were participants who had ever received money for sex (odds ratio = 2.3, 95% confidence interval = 1.1-4.8).[12]
- A study in Montreal of street youth who injected drugs between 1995 and 2000 revealed that 29% of study participants had exchanged sex for money or gifts in the previous 6 months, and 25% had engaged in prostitution as a source of income in the previous 6 months.[24]

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Not Safe Enough: Sex with Regular and Casual Partners

Among IDU with regular and casual opposite sex partners, condom use is low:

- Analysis of condom use among participants of Phase I of the I-Track survey indicates that reported condom use during penetrative and oral sex in the preceding 6 months was less frequent with casual sex partners than with client sex partners, and less frequent still with regular sex partners. Among males, 23.4% reported never using condoms for vaginal sex with casual female sex partners. For anal and oral sex, 25.7% and 47.1% respectively reported never using condoms. Of males with casual male sex partners, 23.6% and 41.6% reported never using condoms during anal and oral sex respectively. Among females, 29.4%, 19.9%, and 45.5% reported never using condoms with male casual sex partners for vaginal, anal, and oral sex respectively. There were no marked differences in reported condom use among participating sites.[4]
- Among IDU in the Regina seroprevalence study conducted in 2000, condom use with regular and casual partners was low. For example, 94% of male IDU and 92% of female IDU reported inconsistent or no condom use during vaginal sex with regular, opposite sex partners. Of those respondents who had casual partners, 58% of men and 71% of women reported inconsistent or no use of condoms with this type of partner.[25]
- In the VIDUS cohort study in Vancouver during 1996-2000, 18% of men and 20% of women reported the use of condoms with regular sex partners in the previous 6 months; non-use of condoms with a regular sex partner was the most significant risk factor for seroconversion among women.[16]
- From VIDUS, an examination of young Aboriginal IDU and risk behaviours revealed that only 21% used condoms with regular partners and 19% used condoms with casual partners; of non-Aboriginal IDU only 16% used condoms with regular partners and 30% used condoms with casual partners.[26] Of males involved in the sex trade, 17% had unprotected intercourse with regular partners and 44% had unprotected intercourse with casual partners, whereas among males not involved in the sex trade 19% had unprotected intercourse with regular partners and 26% had unprotected intercourse with casual partners.[27]
- In the Cedar Project, between October 2003 and April 2005 a higher percentage of Aboriginal youth in Prince George had unprotected sex with regular partners than in Vancouver (59% vs. 34%, $p = 0.008$). The proportion of unprotected sex with causal partners was found to be the same in both cities (16%).[12]

Male IDU and Same Sex Partners

The proportion of male IDU reporting sexual intercourse with same sex partners varies in different cities:

- In Phase I of the I-Track survey, among male IDU 6.2% reported having had male sex partners in the preceding 6 months.[4]

- Of male IDU in the VIDUS study who reported having had sexual intercourse in the previous 6 months, 7.0% reported having had only same sex partners, and 6.0% reported having had partners of both sexes in this time period.[28]
- Between 1996 and 2006 in the SurvUDI network, 13.5% of repeat-visit male participants living in urban sites reported same sex partners versus 9.9% of repeat-visit male participants living in semi-urban sites.[9]

Protective Behaviour Changes or Higher Risk Practices Following Positive HIV Test?

More research is needed to determine whether IDU continue to engage in high-risk behaviours or modify their behaviours after receiving a positive HIV antibody test:

- Among IDU in a Quebec cohort study conducted between 1996 and 1999, 73.1% of HIV-positive drug injectors had stopped lending needles compared with 56.0% of their HIV-negative counterparts in the 6 months after their HIV serostatus result; however, 8.5% of HIV-positive IDU compared with 16.0% of their non-infected peers began lending needles to HIV-positive partners in this same period. In the same study, 62.2% of HIV-positive drug injectors had stopped borrowing needles compared with 58.6% of their HIV-negative counterparts in the 6 months following their HIV serostatus result. Of HIV-positive IDU, 16.7% compared with 19.5% of their non-infected peers began borrowing needles from HIV-positive partners in this same period.[29]
- In the VIDUS study in Vancouver 35.0% of subjects who were HIV positive reported that they had borrowed needles before learning about their serostatus. In the months after their HIV-positive test, only 21.0% of these subjects reported that they continued to borrow needles. Similarly, 37.0% of HIV-positive IDU reported needle lending before their positive HIV test, whereas only 21.0% of these subjects continued this practice after receiving their positive test results.[30]
- In a study of women in Montreal, the rate of condom use following a positive HIV test was low among IDU (19%) as compared with non-IDU of Haitian origin (30%) and non-IDU of Caucasian origin (62%).[31]

Injecting Drug Use is a Problem Among Street Youth and Inmates

Appropriate and accessible HIV prevention programs for drug injecting, street-involved youth and inmates are clearly needed:

- Results from Phase I of the I-Track survey showed that the mean age of initiation into injecting drug use was 21.8 years in the study population. For males the mean age was 22.1 years and for females 21.8 years. Among male participants 25.5% and among female participants 29.9% reported beginning to inject at the age of 16 years or younger.[4]
- Similarly, in the VIDUS cohort, 38% of the youth initiated injection drug use at age 16 and under (females, 46% and males 31%).[32]
- In another study from VIDUS on young Aboriginal IDU and risk behaviours, it was revealed that 65% of Aboriginal youth and 59% of non-Aboriginal youth reported unstable housing.[26]
- In the Cedar Project, 56% of Aboriginal youth from Vancouver reported living in unstable housing whereas 32% of Aboriginal youth from Prince George reported living in unstable housing.[12]
- Results from the Montreal Street Youth Cohort Study, 1995 to 2000, showed that of those participants aged 14 to 25 years 47.2% had ever injected drugs. Injecting drug use was found to be the strongest indicator of HIV seroconversion.[33]
- The New Montreal Street Youth Cohort Study, a prospective cohort study of street youth aged 14 to 23 years conducted between July 2001 and August 2003, found that of the street youth who were IDU, 33.6% reported injecting with a used needle in the previous 6 months.[34] Among the participants aged 14-17 years recruited between January 1995 and September 2000 in the Montreal Street Youth Cohort Study, the incidence rate for initiation of injection drug use was found to be 23.6 per 100 person-years.[35] Combined results from the two Montreal Street Youth studies revealed that 29.4% of recent injectors reported sharing needles, 34.0% reported sharing other injecting equipment, and the sharing of needles and other injecting material showed a decline between 1995 and 2003.[36]
- Of female inmates in a Quebec prison in 1994, 38.0% reported injecting drugs before they were

incarcerated, and about half of these women had shared needles. Of those who reported drug injecting before going to prison, 11.0% admitted to injecting drugs during their incarceration, and most (80.0%) shared needles.[37]

- Of male inmates in this same study, 26.0% reported that they had injected drugs before being incarcerated, and about half of these had shared needles. Of those who admitted to injecting drugs outside prison, 2.0% reported injecting drug use during their incarceration, and most (92.0%) shared needles.[37]
- In a 2003 cross-sectional survey of HIV and HCV risk behaviours in seven Quebec prisons, more women than men reported risky sexual behaviour (unprotected sex with IDU: 83.0% vs. 77.1%), injection drug use (42.8% vs. 27.8%), tattooing (60.4% vs. 48.4%), and piercing (54.4% vs. 30.7%) outside prison; in prison, more men than women reported injection drug use (4.4% vs. 0.8%) and tattooing (37.9% vs. 4.8%).[38]
- In the same 2003 Quebec prison survey, the prevalence of HIV was estimated at 2.3% and 8.8% among males and females respectively; the prevalence among male and female inmates who reported injecting drugs was found to be 7.2% and 20.6% respectively, and all the female HIV-positive cases were IDU.[38]
- In a study conducted in 13 remand facilities in Ontario in 2003-04, saliva samples from 1,877 newly admitted inmates were tested for HIV. The HIV prevalence was found to be 2.0% among adults, 2.1% and 1.8% among males and females respectively, and 5.7% among adults who reported injecting drugs. The HIV rates were higher in jails located in the central and eastern regions of the province, and among older age groups. [39]
- In a study of young offenders in Ontario from February 2003 to July 2004, 5% of the 299 subjects had ever injected drugs. Females were more likely to have injected than males (18% vs. 4%), 33% had injected with a used needle, and 31% had passed on a needle that they had already used.[40]
- In the VIDUS study, of 1,475 IDU in Vancouver recruited between May 1996 and May 2002, 76% reported a history of incarceration, and 31% reported having ever injected in prison. Incarceration was independently associated with risky needle sharing for both HIV-positive and HIV-negative IDU.[41]
- In a study of 210 female inmates in Montreal in 1994, 9% of all inmates and 28% of those with a history of injecting drugs and of prostitution reported being HIV positive.[42]
- In a 1998 survey of male inmates at two of Correctional Service Canada's institutions in Kingston, Ontario, 24.3% of inmates in Joyceville penitentiary reported injecting drugs (12.0% in 1995) and 7.7% shared injection equipment only inside the prison; in the Pittsburgh penitentiary 28.0% reported injecting drug use while incarcerated.[43]
- In a study conducted among inmates in nine provincial jails for women in Canada in 2001-02, 81% of the women reported being sexually active, and 24% reported unprotected sex; 19% reported injecting while incarcerated.[44]
- A study in a provincial women's jail in British Columbia in 2001 revealed that 70% of the inmates reported a history of injecting drugs, and 21% reported injecting in prison, 86% of whom reported sharing needles inside prison.[45]
- In a study conducted in 1996-97 in six provincial jails in Ontario, 32% of participants reported injecting drugs, 25% reported ever injecting while incarcerated, and 17% first injected in a correctional facility, of whom 11% reported injecting drugs while incarcerated in the previous year.[46]

Comment

Although several ongoing regional studies in Canada collect risk behaviour data on IDU, and a large number of one-time, cross-sectional surveys on risk-taking among IDU have been conducted, it is challenging, if not impossible, to compare levels of risk behaviours among data sets. In addition to disparities across study methodologies, various researchers have collected risk behaviour data using different questions or differently worded questions, different variable or concept definitions, different time frames for reported behaviours, and different response categories. Consequently, it is difficult to use available IDU risk behaviour information to identify trends or to help evaluate the effectiveness of prevention programs and policies at more than the regional or local level.

The national HIV estimates for 2005 show a slight decline in the number of new infections attributed to injecting drug use compared with 2002, and during the

years 2002-2005 there was a decrease in sharing of used needles by IDU in different cities in Canada, as observed in I-Track studies. In addition, findings from the SurvUDI network in Quebec and Ottawa also point to a decrease in needle sharing and equipment sharing. The continued development of the I-Track survey will permit improved tracking of injecting and sexual risk behaviours over time and will provide important trend data that could be used to guide prevention program design and help evaluate program effectiveness. Such behavioural data could also be used to interpret changes in HIV prevalence and incidence among IDU and would serve as an early warning system for HIV spread in this population. The relatively high levels of risky injecting and sexual behaviours reported by IDU in sentinel sites across Canada suggest that the potential for the transmission of HIV in these populations continues to be significant. Behavioural surveillance of key subgroups of IDU, namely street-involved youth and inmates, is also needed to formulate an appropriate response to the evolving HIV epidemic among IDU in Canada.

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HIV/AIDS *Epi Update*
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HIV/AIDS in Canada Among Persons from Countries where HIV is Endemic

At a Glance

- Persons from countries where HIV is endemic are over-represented in the HIV/AIDS epidemic in Canada.
- HIV infection in persons belonging to the HIV-endemic exposure subcategory is diagnosed at a younger age than in other heterosexual exposure subcategories. Almost 80% of positive HIV test reports assigned to the HIV-endemic exposure subcategory are for individuals under the age of 40.
- HIV/AIDS has a significant impact on women from countries where HIV is endemic. Women represented 54.2% of positive HIV test reports attributed to the HIV-endemic exposure category between 1998 and 2006 and 41.8% of AIDS cases during this same time period.

Introduction

The Joint United Nations Programme on HIV/AIDS (UNAIDS) estimated that, at the end of 2006, the total number of people living with HIV/AIDS was 39.5 million (34.1-47.1 million) worldwide.[1] HIV and AIDS affect some countries more than others. Most countries with high rates of HIV/AIDS are exhibiting generalized epidemics, meaning that HIV is spreading throughout the general population rather than being confined to specific populations at higher risk (such as men who have sex with men and people who inject drugs).[1] In countries with these generalized epidemics, HIV is mainly spread through heterosexual contact.

The Centre for Infectious Disease Prevention and Control (CIDPC) maintains a list of countries with generalized epidemics and refers to these countries as "HIV-endemic countries" for the purpose of surveillance. HIV-endemic countries are generally defined as those that have an adult prevalence (ages 15-49) of HIV that is 1.0% or greater and one of the following:

- 50% or more of HIV cases attributed to heterosexual transmission;
- a male to female ratio of 2:1 or less among prevalent infections; or
- HIV prevalence greater than or equal to 2% among women receiving prenatal care.

Some examples of regions where HIV prevalence among adults is greater than 1% are sub-Saharan Africa (6.1%, or 24.5 million people)[2] and the Caribbean (1.6%, or 330,000 people).[2] A list of HIV-endemic countries appears in Appendix A of this *Epi-Update*; note that this list was developed by CIDPC in collaboration with provincial and territorial HIV/AIDS surveillance coordinators, and a separate report is being prepared to provide more detail on the development of the list.

This *Epi Update* provides the most current information on the status of the HIV/AIDS epidemic in Canada among persons from countries where HIV is endemic and updates a version that was produced through a collaboration between the Surveillance and

Risk Assessment Division (SRAD) of CIDPC, Public Health Agency of Canada (PHAC), and the HIV-Endemic Working Group.* The data in the report are drawn from voluntarily submitted provincial and territorial surveillance data on positive HIV test reports and diagnosed AIDS cases from 1998 to the end of 2006.

Background

People from Countries where HIV is Endemic

In Canada, the proportion of the population born in a country where HIV is endemic is 2.1%, according to the 2001 Census.[3] Relative to other provinces, Ontario and Quebec have a larger proportion of individuals born in countries where HIV is endemic, representing 3.6% and 1.6% of the provincial populations respectively.[3] Other provinces with a population proportion of 1.0% or greater who were born in a country where HIV is endemic include Alberta with 1.2%, British Columbia with 1.1%, and Manitoba with 1.0%.[3] Within the provinces of Ontario and Quebec, there are concentrations of such individuals in urban centres such as Toronto (7.0%), Ottawa (2.8%), and Montreal (3.0%).[3] The community of persons from countries where HIV is endemic is actually larger than that captured by Census data, particularly if Canadian-born descendents of persons born in these countries are considered.

The communities of people from countries where HIV is endemic are diverse, reflecting variations in historical backgrounds, language, and cultural traditions. Unfortunately, these communities are disproportionately affected by many social, economic, and behavioural factors that not only increase their vulnerability to HIV infection but also act as barriers to accessing prevention, screening, and treatment programs. Two community surveys[4,5] conducted in African and Caribbean communities and among service providers found that such factors as racism, homelessness, transience, poverty, underemployment, and settlement and status concerns presented barriers to program access. Other barriers identified by the surveys included fear and stigma; denial as a coping mechanism; social isolation; lack of social support; job loss; fear of deportation; discrimination; power relations; and cultural attitudes and sensitivities about HIV/AIDS transmission, homosexuality, the status of women, and sex/sexuality.[4-8] In addition to these barriers, the surveys also found that there is a lack of culturally competent and accessible services because of the location of services, language barriers, and the fact that health care may not be free, depending on immigration status. Stigma, the isolation of HIV-positive individuals, and cultural and linguistic barriers to treatment were also identified as particularly critical issues by members of five East African communities in Toronto.[9-11]

HIV and AIDS Surveillance

The ability to adequately monitor the HIV/AIDS epidemic among persons from countries where HIV is endemic requires accurate and complete access to key data elements, specifically, country of birth and ethnicity. These data elements are collated at the national level and provide information on ethnic categories (for example, White, Black, North American Indian) and country of birth. Information on country of birth can be categorized according to the HIV-endemic country list that appears in Appendix A. Unfortunately, the completeness of these data elements across Canada is variable.

For HIV surveillance data, there are a limited number of cases with complete data on country of birth and ethnicity: less than 10% of records are submitted with country of birth data, and ethnicity data accompanied approximately one-third (29.2%) of positive HIV test reports from 1998 to the end of 2006. Two of Canada's largest provinces, Ontario and Quebec, do not routinely collect and/or report country of birth data or ethnic information on their positive HIV tests. This is a limitation for conducting surveillance, as these two provinces together account for over two-thirds of all positive HIV test reports. They also include two large urban centers (specifically, Toronto and Montreal) that are ethnically diverse. The lack of country of birth and ethnicity data impairs the ability to accurately describe the HIV/AIDS epidemic in ethnic subgroups. Reported AIDS cases are more complete for both fields. Data on country of birth are available for just over half of all cases and ethnicity data for 79.1% of reported AIDS cases from 1979 to the end of 2006.

* The HIV-Endemic Working Group comprises representatives from community groups (specifically, the African and Caribbean Council on HIV and AIDS in Ontario and GAP-Vies in Montreal), public health departments, academia, and CIDPC. Members of the working group were from the following geographic areas: British Columbia, Ontario (Toronto and Ottawa), Quebec (Montreal) and Nova Scotia. Working group members helped to select the content of this publication and were an integral part of the review process.

Because of the limited coverage of these two data elements, CIDPC also uses exposure category information to monitor the HIV/AIDS epidemic within this population. The term "exposure category" refers to the most likely way a person became infected with the HIV virus and is assigned according to a hierarchy of exposure categories.† The first four exposure categories are men who have sex with men (MSM), people who inject drugs (IDU), recipients of blood/blood products (before 1985), and heterosexual contact. These first three exposure categories are generally accepted to be higher risk activities than heterosexual activity, and so if these are present they are assumed to be the likely route of HIV acquisition.

The category most relevant to this discussion is the HIV-endemic subcategory of the broader "heterosexual contact" exposure category. The HIV-endemic exposure subcategory was first reported to CIDPC as its own category in 1998. In addition to this subcategory, other subcategories within the heterosexual contact classification are "sexual contact with a person at risk" (HET-RISK) (such as IDU or a bisexual male) and "no identified risk – heterosexual" (NIR-HET) (cases in which no HIV risks were reported except for a history of heterosexual sex). When using these exposure categories to monitor the HIV/AIDS epidemic in this population, it is important to consider that only those individuals from HIV-endemic countries who have been exposed to HIV/AIDS through heterosexual contact are captured, and those who may have been exposed through other risks, such as MSM and IDU, are excluded. While much of the transmission within this population is through heterosexual contact, Remis and Merid[12] provide evidence that a non-negligible proportion of HIV-infected men in Ontario from regions where HIV is endemic reported having had sex with other men (refer to the section HIV/AIDS Incidence and Prevalence Estimates Among Persons from Countries where HIV is Endemic, later in this document).

Although exposure category data are more complete than data on country of birth or ethnicity, they are nonetheless incomplete. Exposure category information accompanied only 51.5% of positive HIV test reports at the national level from 1998 to the end of 2006, although it is more complete for AIDS cases, 93.7% of case reports providing these data from 1979 to the end of 2006. Since June 30, 2003, there have been limitations associated with AIDS data. Such data have not been available from the province of Quebec since this time, and AIDS data from Ontario do not include exposure category or ethnicity data for the second half of 2005 onwards because of a change in an information technology application affecting all reportable diseases. Because of the large amount of missing data and the fact that the HIV-endemic exposure category does not include all persons from countries where HIV is endemic, the surveillance data presented in this report cannot provide a representative national picture of the HIV/AIDS epidemic among persons from HIV-endemic countries. Caution should be used when making conclusions based on the percentages and frequencies in this document, as many estimates are based on small numbers.

HIV and AIDS Surveillance Data

The Proportion of HIV Test Reports Attributed to the HIV-Endemic Exposure Category is on the Rise

From 1998 to 2006, there were 20,785 positive HIV test reports and 3,761 AIDS cases among persons aged 15 years and over reported to CIDPC. Table 1 summarizes surveillance data for the heterosexual contact exposure category for positive HIV test reports and AIDS cases with exposure category information during the years 1998-2006. Of these reports, the HIV-endemic exposure subcategory amounted to 710 positive HIV test reports and 392 AIDS cases, accounting for 6.4% and 12.6% of reports with exposure category information respectively.

For HIV surveillance data, the absolute number of positive test reports in the HIV-endemic exposure subcategory increased from 36 in 1998 to a peak of 112 in 2004 (Figure 1). In 2005, this exposure category accounted for 100 positive test reports and in 2006 for 106. The proportion of overall positive test reports attributed to the HIV-endemic category increased from 3.0% in 1998 to a peak of 8.5% in 2004 and more recently to 8.4% in 2006.

† Even though all risk factors associated with a positive HIV test report are reported to CIDPC, only one exposure category is assigned for national HIV/AIDS surveillance reporting. A person reporting more than one HIV-related risk factor will be placed in the exposure category corresponding to the activity or situation that is considered to have the highest risk of HIV transmission. The exposure category hierarchy appears in Appendix B.

Table 1. Proportion and number of cases from the heterosexual exposure category, from 1998 to 2006

Exposure category	Positive HIV test reports (*n* = 11,046*)	AIDS cases (*n* = 3,106*)
	Percentage (number)	Percentage (number)
Heterosexual contact	**30.2% (3,341)**	**29.4% (912)**
HIV-endemic	6.4% (710)	12.6% (392)
HET-RISK	13.5% (1,491)	7.3% (228)
NIR-HET	10.3% (1,140)	9.4% (292)

HIV-endemic = origin from a country where HIV is endemic; HET-RISK = sexual contact with a person at risk; NIR-HET = no identified risk – heterosexual

**n* = number of cases with available information on exposure categories

Although the absolute number of AIDS cases attributed to the HIV-endemic exposure category has decreased over time (from 59 in 1998 to 43 in 2004), the proportion has increased, from 9.6% in 1998 to a peak of 16.9% in 2002 and, similarly, to 16.4% in 2004 (Figure 2). AIDS data are not shown for 2005 and 2006 because of limited exposure category data.

The increases in positive HIV test reports observed in the HIV-endemic exposure category could be due to a true increase in new infections among individuals born in HIV-endemic countries, better reporting in this exposure category by the provinces and territories, or increased HIV testing in this population. Increased testing is at least partly responsible for the increase as a result of the recent policy of Citizenship and Immigration Canada (CIC) whereby immigrants and refugees are tested for HIV for the purposes of counselling (refer to the section entitled Immigration and HIV/AIDS Surveillance). In fact, similar trends have been observed in other countries with a large number of immigrants born in countries where HIV is endemic (such as the United Kingdom).[13] Data from 12 countries in the European HIV surveillance network suggest that between 1997 and 2002 there was an increase in the number of diagnosed cases originating in countries with generalized HIV epidemics (an increase of 179%, from 1,382 to 3,861 diagnosed cases).[14] The trends were largely driven by the U.K., which accounted for 30% of the population and about 40% of the HIV diagnoses reported in the 12 countries during that period. It is not a surprise that the U.K. accounts for a large proportion of HIV diagnoses since that country has a large population born in HIV-endemic countries.[13,15,16]

A Substantial Proportion of Positive HIV Test Reports and AIDS Cases in the HIV-Endemic Exposure Category Occur in Younger Age Groups

When the HIV-endemic exposure subcategory is broken down by age, some important findings emerge. Of positive HIV test reports from 1998 to the end of 2006 that were attributed to this subcategory, 78.2% occurred in those aged less than 40 years (34.2% among those < 30 years and 44.0% among those aged 30-39). Almost half (43.9%) of the AIDS cases from 1998 to the end of 2006 that were attributed to the HIV-endemic exposure subcategory were between the ages of 30 and 39; another 15.3% were under the age of 30. Together, these two age groups accounted for more than half (59.2%) of the AIDS cases within the HIV-endemic exposure category.

When compared with other subcategories within the larger heterosexual contact exposure category, the greater contrast in age distribution was for AIDS (Figure 3). Those ≤ 39 years old accounted for 59.2% of AIDS cases in the HIV-endemic exposure subcategory as compared with 42.1% of cases in the HET-RISK subcategory and 42.5% in the NIR-HET subcategory.

A similar trend can be seen for positive HIV test reports: a substantial number in the HIV-endemic exposure subcategory occurred in younger age groups when compared with other subcategories. Figure 4 shows that almost 80% of positive HIV test reports in the HIV-endemic exposure category occurred among those ≤ 39 years old. This age group accounted for 58.7% of test reports in the HET-RISK subcategory and 65.6% of test reports in the NIR-HET exposure subcategory.

Figure 1. Number of positive HIV test reports attributed to the HIV-endemic exposure category and proportion of all HIV-positive test reports by year (1998-2006)

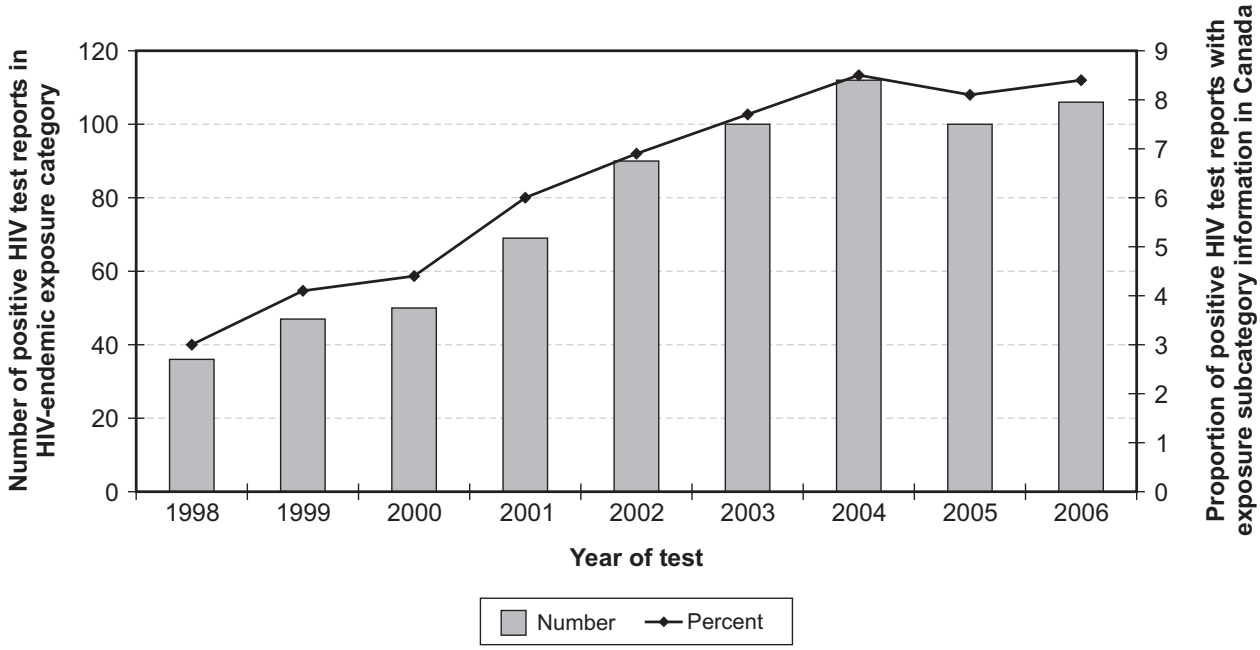
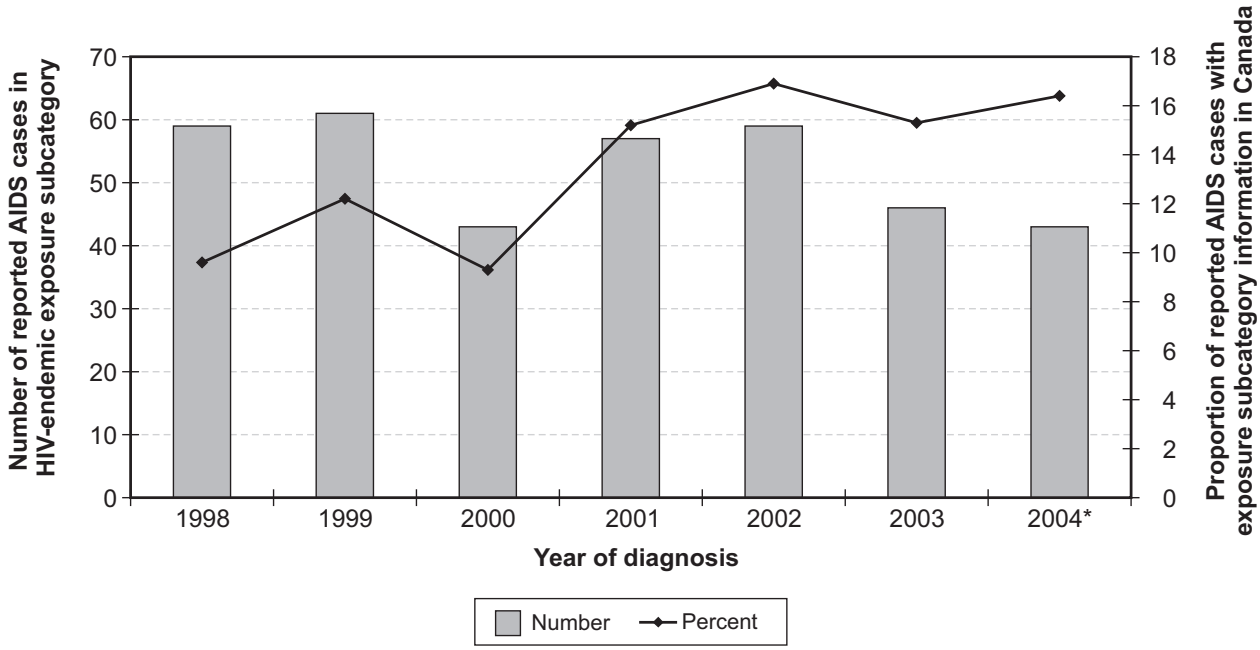


Figure 2. Number of reported AIDS cases attributed to the HIV-endemic exposure category and proportion of all AIDS cases by year (1998- 2004)



* Data exclude Quebec.

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Figure 3. Age distribution of AIDS cases among the heterosexual contact exposure subcategories (1998-2006)

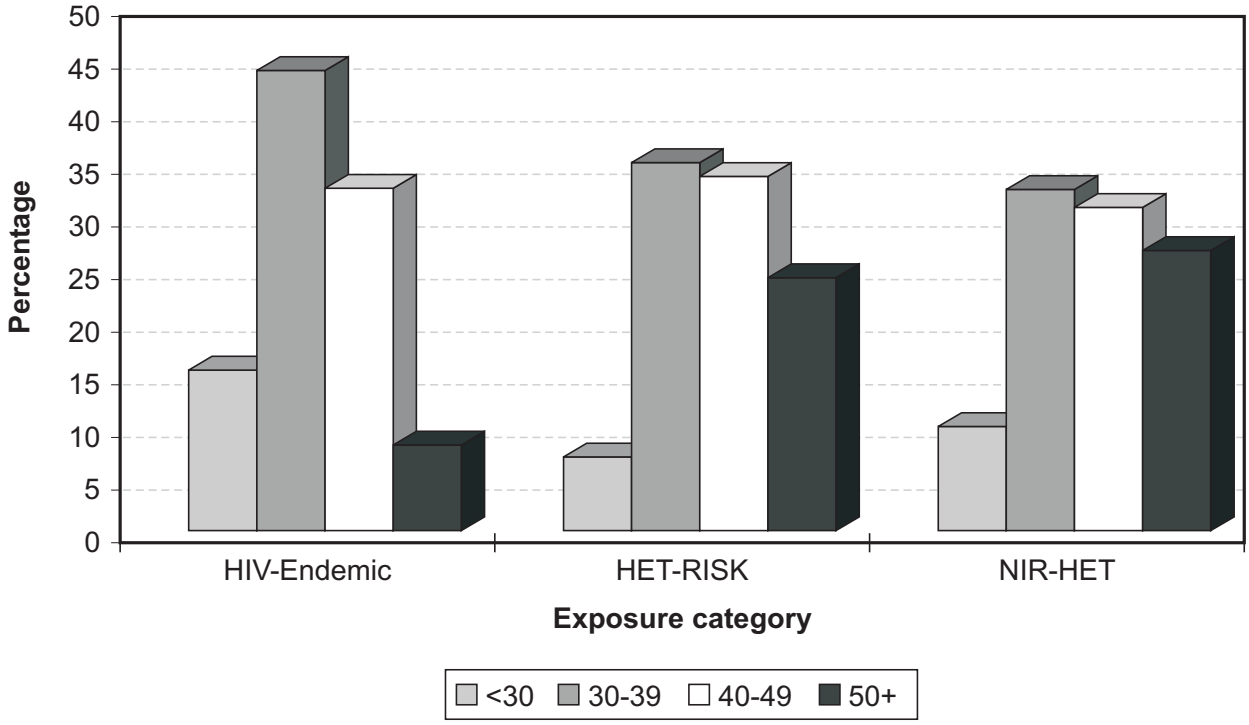
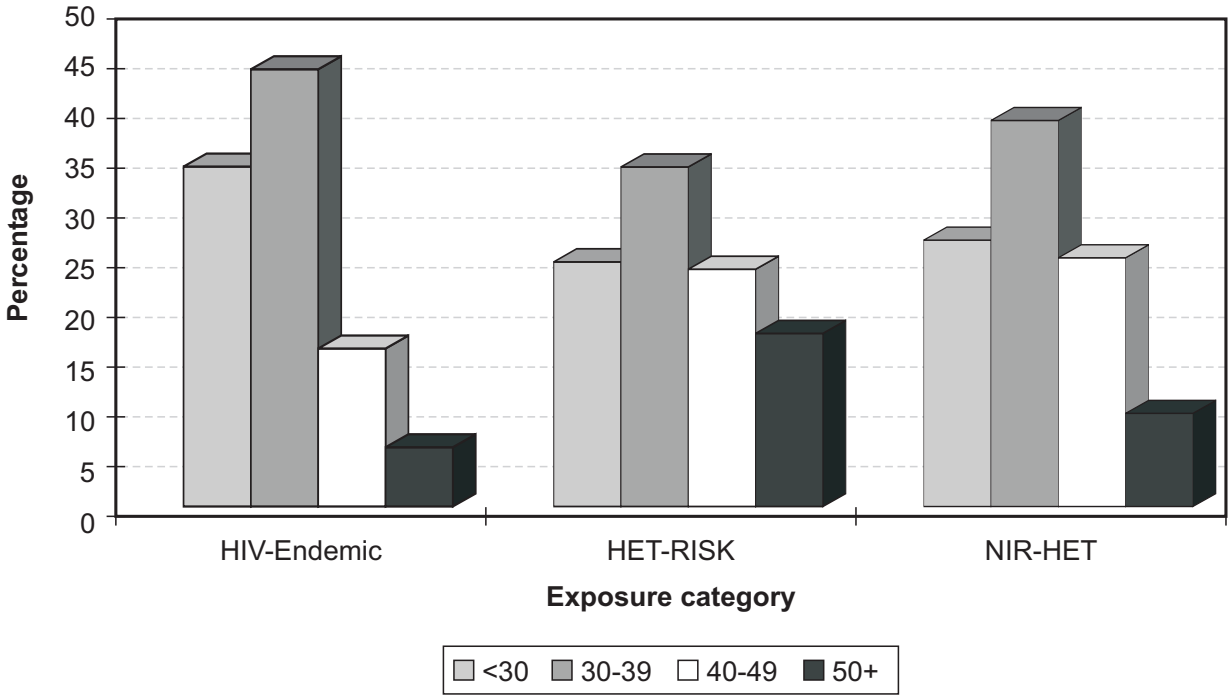


Figure 4. Age distribution of postive HIV test reports among the heterosexual contact exposure subcategories (1998-2006)



The large proportion of positive HIV test reports in younger age groups in this exposure subcategory suggests that, compared with others infected through heterosexual contact, persons in the HIV-endemic exposure category are infected at a younger age. These findings can act as early warnings for public health practice, since they indicate that HIV prevention and control programs could be more effective if targeted to a younger audience.

Ethnicity Within the HIV-Endemic Exposure Subcategory

Of the 396 positive HIV test reports from 1998 to the end of 2006 belonging to the HIV-endemic heterosexual exposure subcategory with information on ethnicity, 92.7% identified themselves as Black, 3.8% as Asian, 1.5% as Other, and 2.0% as White. Of the 334 similarly defined AIDS cases, 88.0% identified themselves as Black, 6.9% as Asian, 3.0% as Other, and 2.1% as White.

Two of Canada's largest provinces, Ontario and Quebec, do not provide ethnic information on positive HIV test reports to the national level. This is a limitation for monitoring the epidemic among persons from countries where HIV is endemic, as the two provinces together account for over two-thirds of all positive HIV test reports; as well, they include two large urban centres, namely Toronto and Montreal, that contain large proportions of people from countries where HIV is endemic.

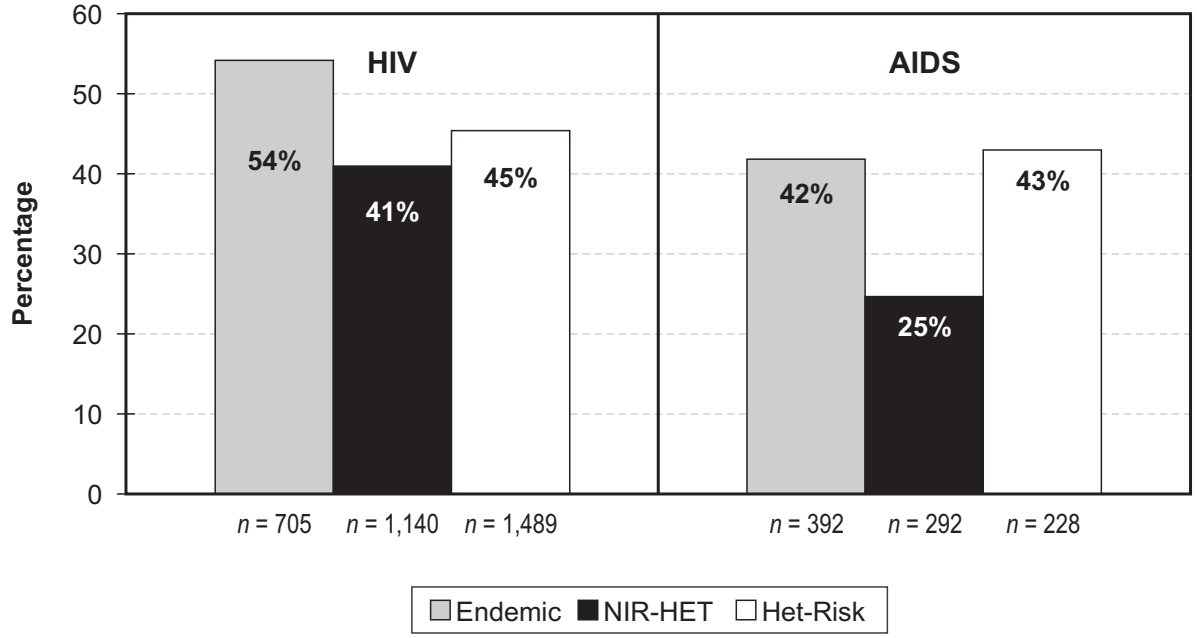
Women Represent over Half of Those in the HIV-Endemic Exposure Category

Between 1998 and 2006, women accounted for 382 positive HIV test reports and 164 AIDS cases within the HIV-endemic exposure subcategory. Figure 5 demonstrates the proportion of positive HIV test reports and AIDS cases accounted for by women in the heterosexual contact subcategories.

Women accounted for 54.2% of all positive HIV test reports attributed to the HIV-endemic exposure subcategory. In the other subcategories women also accounted for a substantial proportion of cases: 45.4% of the HET-RISK subcategory and 41.0% of the NIR-HET subcategory. For AIDS surveillance data, women accounted for 41.8% of AIDS case reports within the HIV-endemic exposure subcategory, as compared with 43.0% and 24.7% respectively of the HET-RISK and NIR-HET subcategories. However, these data are based on small numbers.

As discussed in the Introduction, there are a number of health determinants (such as poverty) that influence vulnerability to HIV infection and access to services within the community. While women from countries where HIV is endemic are affected by many of these determinants, it has been proposed that certain subpopulations (such as women and refugees) are especially marginalized and made more susceptible to these barriers.[17]

Figure 5. Proportion of positive HIV test reports and AIDS cases attributed to females for the heterosexual contact exposure subcategories (1998-2006)



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Women of Childbearing Age and Perinatal Transmission

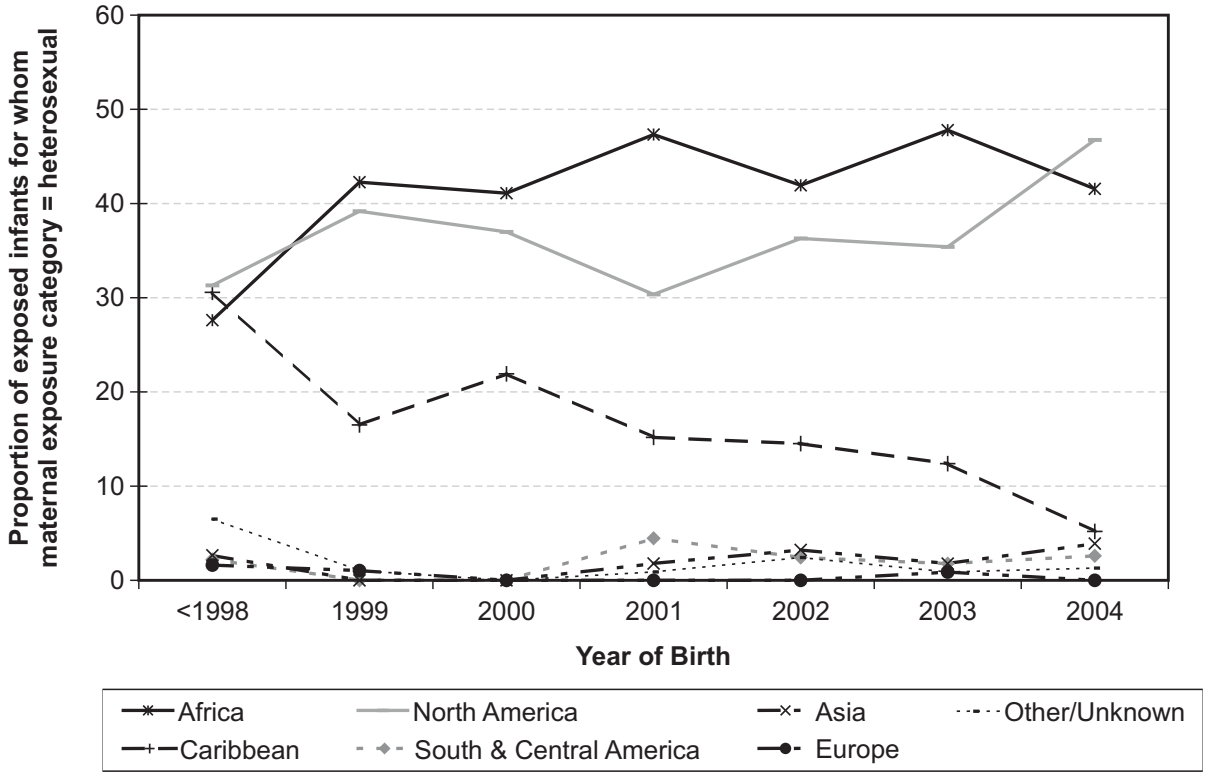
Since women account for a substantial number of positive HIV test reports in the HIV-endemic exposure subcategory and since the HIV epidemic appears to be affecting younger persons in this subcategory, it is important to consider women of childbearing age (ages 15 to 44) and the potential for perinatal HIV transmission. Each year a number of infants are perinatally exposed to HIV because of the positive HIV status of their mothers. The Canadian Perinatal HIV Surveillance Program collects data on the HIV status of such infants through a national, non-nominal confidential survey on infants known to pediatricians in tertiary care centres and HIV specialists in clinics across Canada. The Canadian Pediatric AIDS Research Group (CPARG) conducts surveillance on such exposures, on access to preventive treatment, and on actual infections that occur following exposure.

Figure 6 summarizes data on the maternal country of birth for infants in Canada who were perinatally exposed to HIV and for whom the maternal exposure category was heterosexual contact. Before 1998, three regions accounted for approximately 90% of exposures: North American born mothers and Caribbean-born mothers accounted for 31% of exposures each, followed by African-born mothers at 28%. By 2004, there were increases in the proportion of exposures attributed to North American and African-born mothers, accounting for 47% and 42% respectively. The proportion of exposure attributed to Caribbean-born mothers decreased to 5% of all exposures.

When interpreting these data, it is important to note that the data presented in this section are based on infants born to women who were known to be HIV positive. The numbers presented do not reflect all infants perinatally exposed to HIV infection, as not all pregnant women are aware of their HIV status. Also, the data on region of birth presented by CPARG does not break down the sub-Saharan regions of Africa.

Although all provinces and territories in Canada promote voluntary HIV testing of pregnant women and women considering pregnancy, there is variation in how this policy is implemented across jurisdictions. For more information on perinatal transmission, refer to the *Epi Update* entitled Perinatal Transmission of HIV, in this document.

Figure 6. Region of birth of mothers in the heterosexual exposure category whose infants were perinatally exposed to HIV (1984-2004)



HIV-1 Strains

The SRAD recently released a report on the distribution of HIV-1 strains based on 2,759 samples that were collected between the years 1986 and 2005.[18] Overall, the vast majority of positive samples were of the B group as compared with the non-B group HIV-1 strain (88.3% and 11.7% respectively). However, the HIV-endemic exposure subcategory accounted for the highest proportion of non-B group HIV-1, at 82.8% of tests in this exposure category.

The high concentration of non-B group HIV-1 strains in the HIV-endemic exposure subcategory has been supported by an Ontario study by Njihia and colleagues[19] that used some of the data from the SRAD. These data were based on samples collected between October 2003 and October 2004. The HIV-endemic subcategory had the highest proportion (77.3% or 17 out of 22 samples) of the non-B group strain. The researchers also looked at the distribution of strains by region of birth and found that 91.5% of HIV-positive persons born in North America had B group HIV-1, whereas 86.7% of persons born in sub-Saharan Africa had the non-B group. Clearly, strain type is related to country of birth, which in turn is related to the fact that non-B strains predominate in Africa and other regions of the world outside of North America, Europe, and Australia/New Zealand.

The observed difference in strains between the HIV-endemic and all other exposure categories has several public health implications for prevention, detection, and treatment of HIV/AIDS. As the diversity of HIV subtypes continues to shift, it will invariably create a public health challenge to ensuring that existing diagnostic tests detect all subtypes, including the various non-B strains. In addition, information on strain type will help direct future vaccine development and will help assess the utility of any future vaccine for the specific situation found in Canada.[20]

Immigration and HIV/AIDS Surveillance

On January 15, 2002, Citizenship and Immigration Canada (CIC) added routine HIV testing for all applicants who require an Immigration Medical Examination (IME) and are aged 15 years and over, as well as for those children who have received blood or blood products, have a known HIV-positive mother, or are potential adoptees. In June 2002, *the Immigration and Refugee Protection Act* (IRPA) was implemented, requiring that applicants be assessed for inadmissibility on the basis of health care needs. However, certain groups were exempted from IRPA, such as refugees and family-class immigrants. Further information on this legislation is available on the CIC Web site (www.cic.gc.ca).

Between January 15, 2002, and December 31, 2006, approximately 2,567 applicants tested positive for HIV during their IME.[21] In 2006, 597 applicants who underwent an IME tested HIV positive:

- 382 were identified through testing in Canada, and 215 were identified through testing outside of Canada; and
- 417 (69.8%) were born in Africa and the Middle East, 131 (21.9%) in the Americas, 29 (4.9%) in Asia, and 20 (3.4%) in Europe.

For the HIV screening conducted in Canada, most provinces and territories handle positive HIV test reports in the same manner as all other positive HIV tests and include them in provincial/territorial HIV reporting to CIDPC. The 382 positive HIV test reports identified through testing in Canada in 2006 represent 14.9% of the 2,558 positive HIV tests reported to CIDPC.

HIV/AIDS Incidence and Prevalence Estimates Among Persons from Countries where HIV is Endemic

National HIV surveillance data may understate the magnitude of the HIV epidemic because such data are subject to reporting delays, underreporting, and changing patterns in HIV testing behaviours (i.e. who comes forward for testing); surveillance data also do not include individuals who remain untested and undiagnosed. Since HIV is a chronic infection with a long incubation period, many newly infected persons may only be diagnosed in the years after infection. Consequently, the number of new HIV positive tests reported to CIDPC in a given year does not estimate the new HIV infections that occurred in that year because many will have been infected in earlier years.

Since surveillance data can describe only the diagnosed portion of the epidemic, modelling and additional sources of information are required to describe the epidemic among both diagnosed and undiagnosed

Canadians. The methods used to estimate the total number of people living with HIV (prevalence) and the number newly infected with HIV (incidence) at the national level bring together all available data, including national HIV surveillance data.

At the end of 2005, an estimated 58,000 (48,000 to 68,000) people in Canada were living with HIV infection (including AIDS).[22] It was also estimated that the HIV-endemic exposure subcategory comprised approximately 7,050 (5,200-8,800) of these prevalent HIV infections, representing about 12% of all prevalent infections in Canada.

An estimated total of 2,300 to 4,500 new HIV infections occurred in Canada in 2005.[22] New infections attributed to the HIV-endemic exposure subcategory increased slightly from a range of 300 to 600 (15% of the total) in 2002 to 400 to 700 (16%) in 2005. According to the 2001 Census, approximately 2.1% of the Canadian population were born in an HIV-endemic country as per PHAC's 2007 updated list of HIV-endemic countries,[4] and this compares with 1.5% for the pre-2007 list.[4] Using this 1.5% (since the 2005 estimates were based on the pre-2007 list), the estimated infection rate among individuals from HIV-endemic countries was estimated to be at least 12.6 times higher than among other Canadians in 2005. With the methods and available data used to estimate incidence in Canada, it was not possible to differentiate infections acquired abroad from those acquired in Canada. CIDPC is currently collaborating with other government departments, provincial/territorial partners, researchers, and community groups to develop methods and obtain data to better understand the current status and trends of HIV infection in this group. As an example, Remis and Merid[12] completed a modelling exercise to try to differentiate the sources of infection in Ontario, and their results suggest that 20%-60% of new infections in the HIV-endemic group in Ontario occurred after arrival in Canada. Distinguishing between HIV infections acquired abroad from those acquired within Canada is important not only to accurately measure incidence but also to more effectively guide prevention and care programs.

As previously mentioned, these estimates pertain only to HIV-infected persons from countries where HIV is endemic and with heterosexual contact as their exposure category. Persons from these countries who would fall into other exposure categories are not included in the incidence and prevalence estimates, and the number of such persons is likely not insignificant. For example, using mathematical modeling, Remis and Merid[12] have estimated that in 2002 there were 2,627 persons from HIV-endemic regions (1,366 from sub-Saharan Africa and 1,261 from the Caribbean) living with HIV infection and residing in Ontario, and an estimated 400 or more were from the MSM exposure category.

In 1999, Adrien et al.[23] estimated the prevalence of HIV infection among Montrealers of Haitian origin in a clinic-based epidemiologic study of 5,039 persons aged 15 to 49 years who were either born in Haiti or had at least one parent who was born in Haiti. Overall, the HIV prevalence in this population was 1.3% (1.6% among men and 1.1% among women) and was lower among individuals born in Canada and those who had had a longer residence in Canada. These data further illustrate the over-representation of persons from HIV-endemic countries in Canada's HIV epidemic.

In 2005, Remis et al.[24] developed a statistical model to characterize the HIV epidemic from 1981 to 2002 among persons in Quebec who originated from countries of the Caribbean and sub-Saharan Africa. As of December 2002, the authors estimated that 2,946 persons from HIV-endemic regions residing in Quebec were living with HIV infection (2,553 from the Caribbean and 393 from sub-Saharan Africa). The largest number of HIV-infected persons were from Haiti (2,298), Zaire (113), Rwanda (67), Jamaica (62), and Trinidad (53). These five countries represented 88% of HIV-infected persons living in Quebec who were from HIV-endemic countries. The estimated HIV prevalence among persons from the Caribbean in 2002 was 3.2% but varied from 1.0% to 4.2% by country. Similarly, for persons from sub-Saharan Africa the overall HIV prevalence was 1.4%, but this varied from 0.37% to 8.0% by country. It is important to note that the methods used in this study have limitations, including lack of data for some components of the model (such as data from HIV-infected mothers), incomplete Quebec AIDS data for recent years, and potential confusion in the data in relation to name changes of countries (such as Zaire/Congo and Eritrea/Ethiopia).

Comment

Limitations

This report has summarized HIV and AIDS surveillance data for persons belonging to the HIV-endemic exposure subcategory of the broader heterosexual category. It should be reiterated that because of the limitations mentioned earlier surveillance data may understate the magnitude of the HIV epidemic, since such data are subject to reporting and can only describe the diagnosed portion of the epidemic. Of the estimated prevalent infections in 2005, about 15,800 (11,500 to 19,500) or 27% were unaware of their HIV infection. This compares with an estimated 14,400 (10,700 to 17,900) or 29% who were living and unaware of their HIV infection in 2002.[22] In addition, information on some variables in the surveillance data was incomplete, which affects the interpretation of the diagnosed portion of the epidemic. Reliance on the HIV-endemic exposure subcategory does not capture information on persons from countries where HIV is endemic who are assigned to an exposure category higher up in the hierarchy (such as MSM or IDU). Further limitations to the HIV/AIDS surveillance data are detailed in *HIV and AIDS in Canada: Surveillance Report to December 31, 2006*.[21]

Interpretation

Despite the limitations associated with surveillance data, a picture emerges regarding the pattern of the HIV/AIDS epidemic among persons from countries where HIV is endemic. The observed trends suggest that there is an increasing proportion of reported HIV and AIDS cases attributed to this group, which appears to be over-represented in the Canadian HIV epidemic. Furthermore, those particularly affected include persons under the age of 40 and women, including women of childbearing age. Most of the people associated with the HIV-endemic exposure subcategory identify themselves as being of Black ethnicity.

Public Health Implications

There is a need for improved HIV/AIDS surveillance data at the national level to permit better monitoring and characterization of trends in HIV among persons from HIV-endemic countries, which will in turn provide better data to guide prevention and care programs for this group. To accomplish this, CIDPC is strengthening its collaboration with provincial/territorial governments and community stakeholders specifically to find ways to improve the quality of information on exposure category and ethnicity for the population born in countries where HIV is endemic. It is also important that further research in this area be developed to better understand the reasons behind these observed trends and to assess the best way to address them. More complete surveillance and research information would enable policy makers, public health officials, and community members to jointly develop, implement, and sustain culturally relevant prevention, education, and support services for this population across Canada.

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APPENDIX A
HIV-ENDEMIC COUNTRY LIST

Caribbean, Bermuda and Central/South America:

Anguilla
Antigua and Baruda
Bahamas
Barbados
Bermuda
British Virgin Islands
Cayman Islands
Dominica
Dominican Republic
French Guiana
Grenada
Guadeloupe
Guyana
Haiti
Honduras
Jamaica
Martinique
Montserrat
Netherlands Antilles
St. Lucia
St. Kitts and Nevis
St. Vincent and the Grenadines
Suriname
Trinidad and Tobago
Turks and Caicos Islands
U.S. Virgin Islands

Asia:

Cambodia
Myanmar/Burma
Thailand

Africa:

Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Congo
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Ivory Coast
Kenya
Lesotho
Liberia
Malawi
Mali
Mozambique
Namibia
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
Somalia
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zaire
Zambia
Zimbabwe

APPENDIX B
EXPOSURE CATEGORY HIERARCHY

HIV and AIDS cases are assigned to a single exposure category according to a hierarchy of risk factors. If more than one risk factor is reported, a case is classified as the exposure category listed first (or highest) in the hierarchy. For example, injecting drug users (IDU) may also be at risk of HIV infection through heterosexual activity. Injecting drug use is accepted as the higher risk activity even though there may also be risk of HIV infection through sexual activity. The only exception to this is men who are reported to have had sex with men (MSM) and to have also injected drugs. Such cases are classified in the combined exposure category MSM/IDU.

Exposure Categories

The exposure categories are defined as follows.

MSM: Men who have had sex with men; this includes men who report either homosexual or bisexual contact.

MSM/IDU: Men who have had sex with men and have injected drugs.

IDU: People who inject drugs.

Blood/blood products:

a) **Recipient of blood/clotting factor:** Before 1998, it was not possible to separate this exposure category. However, where possible, it has been separated into subcategories b and c.

b) **Recipient of blood:** Received transfusion of whole blood or blood components, such as packed red cells, plasma, platelets, or cryoprecipitate.

c) **Recipient of clotting factor:** Received pooled concentrates of clotting factor VIII or IX for treatment of hemophilia/coagulation disorder.

Heterosexual contact:

a) **Origin from an HIV-endemic country/sexual contact with a person at risk:** Before 1998, it was not always possible to separate this exposure category. However, where possible, it has been separated into subcategories b and c.

b) **Origin from an HIV-endemic country:** People who were born in a country where HIV is endemic (i.e. a country in which the predominant means of HIV transmission is heterosexual contact).

c) **Sexual contact with a person at risk:** People who report heterosexual contact with someone who is either HIV infected or who is at increased risk of HIV infection (i.e. injecting drug user, bisexual male, or a person from an HIV-endemic country).

d) **NIR-HET:** If heterosexual contact is the only risk factor reported and nothing is known about the HIV-related factors associated with the partner, the case would be classified as *No Identified Risk-Heterosexual* (NIR–HET).

Occupational exposure: Exposure to HIV-contaminated blood or body fluids, or concentrated virus in an occupational setting. This applies only to reported AIDS cases and not occupational positive HIV test reports, which are listed under "Other".

Perinatal transmission: The transmission of HIV from an HIV-infected mother to her child either *in utero,* during childbirth, or through breastfeeding.

Other: Used to classify cases in which the mode of HIV transmission is known but cannot be classified into any of the major exposure categories listed here – for example, a recipient of semen from an HIV-positive donor.

NIR (No Identified Risk): The history of exposure to HIV through any of the modes listed is unknown, or there is no reported history. This exposure category may include cases that are currently being followed up by local health department officials; people whose exposure history is incomplete because they died, declined to be interviewed, or were lost to follow-up; and people who cannot identify any mode of transmission.

Exposure Category Not Reported: In certain provinces, it is not possible to report information regarding exposure category; such cases are thus classified as *Not reported.* This applies only to positive HIV test reports and not to reported AIDS cases.

Acknowledgements

National level HIV and AIDS surveillance is possible as a result of all provinces and territories participating in and setting directions for HIV and AIDS surveillance. PHAC acknowledges the provincial/territorial HIV/AIDS coordinators, public health units, laboratories, health care providers, and reporting physicians for sharing non-nominal, confidential data for national surveillance.

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HIV-1 Strain Surveillance in Canada

At a Glance

- The Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) monitors and assesses HIV strains and the transmission of drug resistance among individuals with newly diagnosed but untreated HIV infection in Canada.
- Although HIV-1 strain B continues to predominate in Canada (88.4% of samples analysed), a wide variety of non-B strains have also been identified (11.6% of samples analysed).
- On the basis of results from the SDR program, the likelihood of a non-B strain infection is greater among individuals of African/Caribbean origin than Caucasians and greater among those whose primary risk exposure is heterosexual sex than among those with male-to-male sex as the primary risk exposure.
- HIV strain variation is part of the changing evolution of the HIV epidemic in Canada. It is therefore important to implement the systematic collection and analysis of data related to strain surveillance across the country.

Introduction

Two types of HIV have been characterized in humans, HIV-1 and HIV-2. HIV-2 is less common than HIV-1 and is found mainly in West Africa. Both HIV-1 and HIV-2 lead to AIDS, and differences in their transmission and biologic characteristics are well documented.[1] HIV-1, which is primarily responsible for the AIDS pandemic, can be divided into three major groups: "M" (major), "O" (outlier), and "N" (new).[2] The vast majority of HIV strains (> 90%) are clustered in the M group, which is classified into nine subtypes (A-D, F-H, J and K), four different sub-clades, and 13 circulating recombinant forms (e.g. AB).[3-5]

According to the WHO-UNAIDS Network for HIV Isolation and Characterization, 49.9% of diagnosed infections worldwide were due to HIV-1 subtype C in 2004.[6] This subtype predominates in India, southern Africa, and Ethiopia. HIV-1 subtype A (including the circulating recombinants AE and AG) was the second most commonly identified subtype, accounting for 21.8% of diagnosed infections worldwide. Subtype A predominates in Eastern Europe, Central Asia, and East and Central Africa. The recombinant AG predominates in Western and Central Africa, whereas the recombinant AE is more commonly found in Thailand, China, the Philippines, and Central Africa. Other recombinant forms accounted for 8.2% of diagnosed infections. Overall, HIV-1 subtype B was responsible for 10.4% of diagnosed infections worldwide and is the dominate subtype in Canada, the United States, and Western Europe. Through increased travel and migration non-B subtypes are increasingly being reported in other parts of the world. Additional subtypes and recombinant forms are constantly being discovered, largely as a result of travel and migration of populations.[7]

This *Epi Update* describes why surveillance of HIV strains is important and provides a summary of the prevalence of divergent HIV strains in Canada identified through the Canadian Strain and Drug Resistance Surveillance Program (SDR program). For additional information, the reader is referred to the surveillance report entitled *HIV-1 Strain and Primary Drug Resistance in Canada*.[8]

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Why Conduct HIV Strain Surveillance?

The SDR program was initiated as an integrated group of projects aimed at enhancing the national surveillance of HIV; it is a collaboration between the provinces and the Public Health Agency of Canada (PHAC) (Surveillance and Risk Assessment Division and the National HIV and Retroviral Laboratories). Laboratory samples (serum from treatment-naïve individuals with newly diagnosed HIV infection) and corresponding epidemiologic data are sent from the provincial health laboratories to PHAC for HIV strain and drug resistance testing. The results are then shared with provincial and other stakeholders. One of the central goals of this program is to conduct the systematic surveillance of HIV subtypes in Canada in order to attain the following four main objectives.

1. **Improve HIV Diagnostics and Screening Strategies**

   The broad genetic diversity of HIV has implications for the ability of diagnostic tests to reliably detect circulating HIV strains. The sentinel arm of the SDR program, through the reference services of the National HIV and Retrovirology Laboratories, addresses this goal by testing samples with untypical test results. Using knowledge of the circulating HIV strains, modifications can be made to current tests to ensure that all HIV-positive persons are detected upon testing. This is also relevant to the safety of the blood supply, since the tests used for screening donated blood would be able to detect circulating HIV variants.

2. **Inform Vaccine Development**

   Information on the distribution of the viral subtypes and sub-clade variations can be used to target vaccine development and testing, since the efficacy and effectiveness of any vaccine that is developed would likely be subtype-specific.[9,10]

3. **Assess HIV Transmission Patterns**

   Although genetic analyses have been used to assess the spread of HIV globally, there is little consensus on whether differences in HIV subtype affect transmissibility of the virus in sexual[11-13] or maternal exposures.[14-17] Some studies have noted differences in the biological properties of HIV-1 subtypes,[13,16,18] though what these differences mean is still to be determined. Knowing the distribution of HIV variants in Canada, along with corresponding epidemiologic factors, will help to assess the implications of any differences in transmissibility. The public health implications of such findings, including prevention and treatment strategies, are of special interest.

4. **Assess HIV Pathogenesis and Progression of HIV-related Diseases**

   Although the rate of HIV-related disease progression is affected by many factors, including host, agent and environmental factors, evidence suggests that the immunologic responses may be less suppressed by HIV-2 than by HIV-1.[18-20] Although some studies suggest that genetic subtypes play a role in disease progression, other studies suggest the reverse. Many of these studies were reviewed by Tatt et al.[9] and Hu et al.,[21] and the results remain inconclusive. Last, while recent evidence suggests that currently available antiretroviral drugs are equally effective against all HIV subtypes, certain subtypes or viruses from particular geographic regions may have a higher propensity to develop resistance against specific antiretroviral drugs.[22,23]

Distribution of HIV-1 Subtypes in Canada

- HIV-1 subtype A was first reported in 1995 from an individual of African origin.[24]
- HIV-2 was detected in Canada as early as 1988.[25]
- Cumulative results from the SDR program show that HIV-1 subtype B continues to predominate, at 88.4%, with only 11.6% of the sampled population (n = 3,374) infected with non-B subtypes (see Table 1 for subtype distribution).

Results from the SDR program suggest that individuals infected with non-B HIV-1 subtype are more likely to be female, younger in age at initial diagnosis, of African/Caribbean background (compared with Caucasian and other backgrounds), and to report heterosexual sex as their primary HIV risk factor (compared with male-to-male sex).

Comment

The introduction of new variant HIV strains into Canada is most likely related to travel and migration patterns from regions of the world where non-B HIV-1 strains predominate. As the diversity of HIV increases,

Table 1. Distribution of HIV-1 subtypes in samples submitted to the SDR program to the SDR program (1985-Dec. 31, 2005)[8,26]

HIV-1 subtype	Frequency	Percentage
B	2,981	88.4
C	213	6.3
A	63	1.9
AG	33	0.9
AE*	33	1.0
D	19	0.6
AD	13	0.4
BD	4	0.1
G	3	0.09
AB	2	0.06
BC	2	0.06
AC	1	0.03
B/AG	1	0.03
F	1	0.03
H	1	0.03
K	1	0.03
K/AE	1	0.03
K/AG	1	0.03
CRF06_cpx**	1	0.03
Total	**3,374**	**100**

*The circulating recombinant form AE has also been referred to as subtype E.

**CRF = circulating recombinant form

it will invariably challenge existing diagnostic tests and interpretation algorithms. Depending on the impact that strains have on vaccine effectiveness and efficacy, it may direct the course of future vaccine research and testing. Furthermore, depending on future findings related to strain-specific transmissibility, pathogenicity, and treatment, HIV strain variation may play a role in changing the nature of the HIV epidemic in Canada. It is therefore important to continue the systematic collection and analysis of information related to strain surveillance across Canada.

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Primary HIV Antiretroviral Drug Resistance in Canada

At a Glance

- The Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) monitors and assesses HIV strains and the transmission of HIV drug resistance among individuals with newly diagnosed but untreated HIV infection in Canada.
- Preliminary observations from the SDR program of HIV drug resistance among treatment-naïve individuals with newly diagnosed HIV infection in Canada (i.e. primary drug resistance) are as follows:
  - → The overall prevalence of primary drug resistance to at least one antiretroviral drug is 9.1%.
  - → The overall prevalence of multi-drug resistance to two or more classes of antiretroviral drugs is 1.1%.
  - → Primary drug resistance has been observed in both females and males, across different age groups, ethnicities, and exposure categories, in HIV-1 subtype A, B, C, D and recombinant subtype infections, and among recent and established HIV infections.
- The prevalence of primary drug resistance is similar to that observed in other countries where highly active antiretroviral treatment is widely used.

Introduction

Drug resistance in individuals receiving treatment (secondary drug resistance) is well documented. Resistance observed in treatment-naïve individuals with newly diagnosed HIV infection, in whom resistance is presumably due to the transmission of a drug-resistant variant of HIV-1 (primary drug resistance), is less well understood. There is increasing evidence to suggest that transmission of drug-resistant strains of HIV-1 is becoming more widespread in countries where highly active antiretroviral treatment (HAART) is used. Currently, there are more than 20 antiretroviral drugs that have been approved or are soon to be approved for the treatment of HIV-1 infection in Canada. Drug resistance complicates the treatment of HIV, has important implications for HIV-related morbidity and mortality, and may result in increased health care costs.

Drug Resistance in Treated Individuals

In Canada and the United States, the prevalence of drug resistance among treated individuals infected with HIV-1 subtype B may be as high as 78%.[1] The development of resistance to these drugs is likely a result of treatment failure due to incomplete viral suppression. Given the extensive literature and sequence data from treated individuals infected with HIV-1 subtype B, patterns of mutations associated with resistance to specific drugs have become increasingly recognizable, making it possible to recommend alternative treatment regimens. However, such data are generally not available for non-B subtypes.

Drug Resistance in Untreated Individuals

Detection of mutations associated with drug resistance in individuals with newly diagnosed but untreated infection is thought to be the result of the transmission of drug resistance from a treated individual. Several studies from Europe and the United States have reported mutations associated with drug resistance in up to 20% of untreated, early, or acute HIV-1 infections.[2-6] In general, little is known about mutations associated with drug resistance in non-B subtypes. Recent studies suggest that genotypic differences

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between B and non-B subtypes may lead to the identification of previously unidentified mutations associated with drug resistance in non-B subtypes, as well as differences in long-term outcomes of antiretroviral therapies.[7-9] Associated trends over time are not well understood. In the United Kingdom, there is recent evidence that suggests a decline in the rate of transmitted drug resistance,[10] and in western Canada it appears that the overall prevalence of primary drug resistance is stable over time.[11]

This *Epi Update* provides a summary of drug resistance patterns seen in Canada and an overview of key studies on the prevalence of primary drug resistance in countries where HAART is commonly used. It also includes recent data from the Canadian Strain and Drug Resistance Surveillance Program (SDR), which is a collaboration between the provinces and the Public Health Agency of Canada (PHAC) (Surveillance and Risk Assessment Division and National HIV and Retroviral Laboratories). For additional information, the reader is referred to the surveillance report entitled *HIV-1 Strain and Primary Drug Resistance in Canada.*[12]

Why Conduct Primary Drug Resistance Surveillance?

Although HAART has led to a reduction in HIV-1-related morbidity and mortality in Canada and many other countries, there is a concern that its widespread use and the increasing number of treatment failures may result in an increased transmission of drug-resistant virus. The first case of primary drug resistance was reported in 1993 with the transmission of a zidovudine-resistant HIV-1 strain.[13] Since then, many reports of transmission of drug-resistant HIV strains have been published, and there is evidence suggesting that the proportion of new HIV infections involving drug-resistant strains may be increasing in countries where HAART is routinely used.

Less well understood is the prevalence of primary drug resistance and its variation over time, geographic area, and population risk group. The HIV Strain and Drug Resistance Surveillance Program (SDR program) aims to address these questions, and the resulting information will help in the development of treatment guidelines and effective HIV prevention and control strategies.

Evolution of Drug Resistance

Viral resistance develops largely as a result of changes (mutations) in the genetic material that codes for the HIV reverse transcriptase (RT) and protease enzymes. Both of these enzymes are required for viral reproduction, and current antiretroviral drugs interact with them to impede their activity. Although new drugs are continually being developed, the most commonly used antiretroviral drugs that are approved for the treatment of HIV infection fall into three classes: nucleoside reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), and protease inhibitors (PIs).

Most mutations are not associated with development of drug resistance, but, under conditions in which treatment does not completely inhibit viral replication, virus with drug-resistant mutations may develop and replicate, resulting in treatment failure. For some drugs in particular (e.g. NNRTIs) a single mutation is associated with a high level of drug resistance to multiple drugs of that class.

Methods to Identify Drug Resistance

Genotypic tests identify mutations in the viral genetic material through commercially available probes for particular mutations or through sequencing of viral genes of interest. By comparing the generated sequences with databases containing resistance-conferring mutations, the presence or absence of drug resistance can be identified.

Phenotypic tests determine the enzymatic activity of viral genes or assess viral growth in increasing concentrations of drugs. Resistance is usually defined when the amount of drug required to inhibit viral growth by 50% is 4 or more times greater than that required to achieve the same result in a wild-type strain. This test is similar in concept to antibiotic-resistance testing in bacterial culture.

Note: Genotypic and phenotypic testing and interpretation for patient care are evolving fields that are extremely complex, requiring expert input.

Summary of Key Studies on the Prevalence of Primary Drug Resistance

Table 1 illustrates the results obtained from Canadian studies on primary drug resistance. It is important to note that drawing firm conclusions from inter-study comparisons is difficult because of differences in study design, including study populations, types of resistance testing used, and the specific mutations studied and reported. The results from the SDR program are shown in the bottom section of Table 1. The cumulative prevalence during 1997-2005 of primary drug resistance to at least one antiretroviral drug was 9.1% (262/2,888), and the cumulative prevalence of multi-drug resistance to two or more classes of antiretroviral drugs was 1.1% (33/2,888). The percentage of samples resistant to at least one drug remained stable, between 9.0 and 9.8%, during 2001-2004; the percentage for 2005 was 14.3 %, but the data for that year are incomplete and we will continue to monitor the situation to determine whether this apparent increase is sustained when all the data for 2005 have been reported.

Table 2 shows the results of studies on primary drug resistance that were conducted in the United States and in Western Europe. Again, this table is not meant for inter-study comparisons for the reasons given earlier. The results suggest that the prevalence of major mutations associated with at least one antiretroviral drug is similar to that in Canada. It is of note that mother-to-child transmission of resistance to zidovudine and nevirapine or of multi-drug resistant HIV-1 has been reported in the United States and France.[19,20]

Please see the following pages for Tables 1 and 2.

Table 1. Summary of key studies on HIV-1 primary drug resistance in Canada

Province*	Year of diagnosis	Risk exposure**	Sample size	RTIs† (%)	Protease inhibitors (%)	Multi-drug resistance (%)	Total (%)
BC[14]	1996-1998	Mixed	423	1.9	1.9	0.2	3.5
QC[15]	1997-1999	IDU (26%) Sexual (69%)	81	20	6.0	9.9	–
QC[16]	1997	Mixed	50	12 (NRTI) 0 (NNRTI)	5.0	~5	–
	1998		42	0 (NRTI) 6 (NNRTI)	0	0	–
	1999		17	~18 (NRTI) ~13 (NNRTI)	~18	~12	–
	2000		18	~12 (NRTI) ~6 (NNRTI)	~6	~5	–
	2001		18	0 (NRTI) 0 (NNRTI)	~6	0	–
	2002		18	0 (NRTI) ~6 (NNRTI)	~6	0	–
	2003		17	0	0	0	–
ON[17]	1997-1999	MSM	23	13	–	–	–
BC, AB, SK, MB, ON, NS[12,18]	1997	Mixed	38	0	0	0	0
	1998		88	3.4 (NRTI) 0 (NNRTI)	1.1	0	4.5
	1999		304	5.9 (NRTI) 0.3 (NNRTI)	1.6	1.0	8.9
	2000		437	3.9 (NRTI) 0.5 (NNRTI)	1.1	1.1	6.6
	2001		340	4.7 (NRTI) 2.1 (NNRTI)	1.8	0.9	9.4
	2002		366	3.0 (NRTI) 3.0 (NNRTI)	2.5	1.4	9.8
	2003		435	2.8 (NRTI) 2.5 (NNRTI)	2.8	0.9	9.0
	2004		608	3.3 (NRTI) 2.8 (NNRTI)	2.0	1.2	9.2
	2005		272	4.4 (NRTI) 5.9 (NNRTI)	1.8	2.2	14.3

* BC = British Columbia, QC = Quebec, ON = Ontario, AB = Alberta, SK = Saskatchewan, MB = Manitoba, NS = Nova Scotia

** Reported proportions may not add up to 100% since risk exposure category may not be mutually exclusive. IDU = people who inject drugs, MSM = men who have sex with men

† RTI = reverse transcriptase inhibitor, NRTI = nucleoside reverse transcriptase inhibitor, NNRTI = non-nucleoside reverse transcriptase inhibitor. Information on NRTI and NNRTI provided where available.

Table 2. Summary of key studies on HIV-1 primary drug resistance in the United States and Western Europe

Country	Year of diagnosis	Risk exposure*	Sample size	RTIs** (%)	Protease inhibitors (%)	Multi-drug resistance (%)	Total† (%)
United States[4]	1989-1998	MSM (80%)	141	3.5 (NRTI)	10	-	27.6
				17 (NNRTI)			
United States[3]	1995-1999	MSM (94%)	80	12.5 (NRTI)	2.4	3.8	16.3
				7.5 (NNRTI)			
United States[21]	1997-2001	Mixed	1,082	6.4 (NRTI)	1.9	1.3	8.3
				1.7 (NNRTI)			
United States[22]	1998	Mixed	238	3.4 (NRTI)	0	0	3.8
				0.4 (NNRTI)			
	1999		240	8.3 (NRTI)	1.7	1.7	10
				2.1 (NNRTI)			
	2000		245	6.9 (NRTI)	2	1.2	9
				1.2 (NNRTI)			
United States[7]	2003-2004	Mixed	539	7.1 (NRTI)	3.2	3.2	15.2
				9.1 (NNRTI)			
United States (with samples from Canada)[2]	1995-1998	MSM	377	8.5 (NRTI, *n* = 176)	0.9 (*n* = 213)	3.8 (*n* = 213)	8.0 (*n* = 213)
				1.7 (NNRTI, *n* = 176)			
	1999-2000			15.9 (NRTI, *n* = 82)	9.1 (*n* = 88)	10.2 (*n* = 88)	22.7 (*n* = 88)
				7.3 (NNRTI, *n* = 82)			
United States[23]	1996-96	Mixed	40	25 (NRTI)	2.5	2.5	25
				0 (NNRTI)			
United States[24]	-	Youth	55	4.0 (NRTI)	5.5	2	18
				15 (NNRTI)			
Germany[25]	1996-1999	Mixed	64	6.3 (NRTI)	1.6	1.6	12.5
				3.1 (NNRTI)			
France[26]	1995-1998	Mixed	48	16.7	2.1	-	-
France[27]	1999-2000	Mixed	251	7.6 (NRTI)	5.2	4.8	10
				4.0 (NNRTI)			
France[28]	2001-2002	Mixed	666	2.4 (NRTI)	1.2	7.2	11.3
				0.3 (NNRTI)			
France[29]	1999-2000	Male (82%)	249	8 (NRTI)	6	5	10
				4 (NNRTI)			
France[30]	1996-2004	Male (80%)	518	5.2 (NRTI)	4.4	3.1	8.5
				2.5 (NNRTI)			
	1998-99		94	7.4 (NRTI)	5.3	1.1	18.1
				6.4 (NNRTI)			
	2000-2001		91	20.9 (NRTI)	7.7	13.2	27.4
				13.2 (NNRTI)			
Spain[31]	1996-1998	Mixed		16.2	6	4.4	-
Spain[32]	1997-1999	Mixed (72% MSM)	31	16.1	9.7	0	25.8
	2000-2001		21	0	4.8	0	4.8

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Table 2. Summary of key studies on HIV-1 primary drug resistance in the United States and in Western Europe *(continued)*

Country	Year of diagnosis	Risk exposure*	Sample size	RTIs** (%)	Protease inhibitors (%)	Multi-drug resistance (%)	Total† (%)
Spain[33]	2004	Mixed	182	2.2 (NRTI)	0.5	-	~4
				1.1 (NNRTI)			
Spain[34]	1997	Mixed	9	33.3 (NRTI)	0	-	33.3
				0 (NNRTI)			
	1998		17	29.4 (NRTI)	5.9	-	29.4
				5.9 (NNRTI)			
	1999		5	20 (NRTI)	0	-	20
				0 (NNRTI)			
	2000		7	0 (NRTI)	14.3	-	14.3
				0 (NNRTI)			
	2001		30	3.3 (NRTI)	0	-	3.3
				0 (NNRTI)			
	2002		28	10.7 (NRTI)	3.6	-	14.3
				3.6 (NNRTI)			
	2003		50	8 (NRTI)	0	-	10
				4 (NNRTI)			
	2004		52	3.8 (NRTI)	2	-	7.7
				7.7 (NNRTI)			
	Total		198	9.6 (NRTI)	2	-	12.1
				4.0 (NNRTI)			
Switzerland[35]	1996	Mixed	193	5.6	3	-	8.6
	1997			6.9	7.7	-	14.6
	1998			6.8	2	-	8.8
	1999			3.1	1.9	-	5
Switzerland[36]	1999-2001	Mixed	200	6.5 (NRTI)	1	1.5	10
				0.5 (NNRTI)			
Switzerland[37]	1999-2001	Mixed	220	8.6 (NRTI)	2.3	1.4	10.5
				0.9 (NNRTI)			
Netherlands[38]	1994-2002	MSM/IDU	100	10 (NRTI)	1	0	13
				2 (NNRTI)			
United Kingdom[39]	1997	Mixed	324	~6.4 (NRTI)	~0.9	~0.8	~7.7
				~1.2 (NNRTI)			
	1998		355	~6.7 (NRTI)	~2.2	~1.6	~8.7
				~1.4 (NNRTI)			
	1999		393	~7.6 (NRTI)	~1.0	~2.7	~8.9
				~3.0 (NNRTI)			
	2000		528	~8.3 (NRTI)	~3.4	~3.1	~12.7
				~4.1 (NNRTI)			
	2001		595	~8.6 (NRTI)	~3.4	~5.0	~11.7
				~4.7 (NNRTI)			

Table 2. Summary of key studies on HIV-1 primary drug resistance in the United States and in Western Europe *(continued)*

Country	Year of diagnosis	Risk exposure*	Sample size	RTIs** (%)	Protease inhibitors (%)	Multi-drug resistance (%)	Total† (%)
United Kingdom[39]	2002	Mixed	596	~9.4 (NRTI)	~4.0	~4.1	~13.5
				~4.2 (NNRTI)			
	2003		935	~6.4 (NRTI)	~2.9	~2.9	~11.5
				~5.1 (NNRTI)			
	2004		1,786	~4.7 (NRTI)	~2.1	~1.7	~9.2
				~4.1 (NNRTI)			
	2005		2,760	~5.1 (NRTI)	~1.9	~2.3	~9.0
				~4.3 (NNRTI)			
United Kingdom[40]	2004-2005	Mixed	180	3.3 (NRTI)	1.7	0.6	7.2
				2.8 (NNRTI)			
Italy[41]	1996-2001	Mixed	112	11.6 (NRTI)	2.7	1.8	16.1
				3.6 (NNRTI)			
Germany[42]	1999-2003	Mixed	49	12.2 (NRTI)	2	-	20.4
				10.2 (NNRTI)			
Europe/Canada[43]	1987-1995	Mixed	69	5.8 (NRTI)	1.4	-	7.2
				0 (NNRTI)			
	1996-1998		145	11.7 (NRTI)	1.4	-	13.1
				0.1 (NNRTI)			
	1999-2003		224	11.2 (NRTI)	6.2	-	19.6
				6.2 (NNRTI)			
Europe[44]	1996-2002	Mixed	2,208	7.6 (NRTI)	2.5	-	10.4
				2.9 (NNRTI)			
Europe[45]	2000-2004	Mixed	698	6.1 (NRTI)	1.8	-	10
				4.0 (NNRTI)			

* MSM = men who have sex with men, IDU = people who inject drugs

** RTI = reverse transcriptase inhibitors, NRTI = nucleoside reverse transcriptase inhibitor, NNRTI = non-nucleoside reverse transcriptase inhibitor. Information on NRTI and NNRTI provided where available.

† Total may include major and minor mutations associated with primary drug resistance.

Comments

Primary HIV drug resistance has been observed in most countries where HAART is used. Although the interpretation of results is difficult and evolving, persons infected with drug-resistant variants of HIV may be at increased risk of drug failure despite being therapy naïve. Surveillance of primary drug resistance is needed not only to develop guidelines for initial therapy but also to better understand and prevent the transmission of resistant HIV.

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HIV/AIDS in Canadian Prisons

At a Glance

- HIV prevalence among offenders in Canadian correctional facilities has remained at about 2% over the last 5 years.
- Recent prevalence estimates are as follows: 1.6% (males) and 2.8% (females) in federal prisons; 2.1% (males) and 1.8% (females) in Ontario provincial prisons; and 2.3% (males) and 8.8% (females) in Quebec provincial prisons.
- HIV infection in Canadian prisons is strongly associated with a history of injecting drugs: roughly one-third of offenders report a history of injecting drug use, and some continue while incarcerated.
- Offender populations report very high-risk sexual practices in the community, which may continue or resume after incarceration.

Introduction

Incarcerated populations have been shown to be at increased risk of bloodborne and sexually transmitted infections, including human immunodeficiency virus (HIV), hepatitis C virus (HCV), and hepatitis B virus (HBV).

Prisons are part of the Canadian community. Inmates come from our communities and for the most part return to our communities. In Canada, people who are sentenced to 2 years or more are the wards of Correctional Service Canada (CSC), which has the mandate from the federal government under the *Corrections and Conditional Release Act* (1992) to provide essential health care for each inmate. Each provincial/territorial jurisdiction also has its own correctional system for offenders sentenced to less than 2 years. In this case, offender health care is the jurisdiction of the province/territory.

As of 2006, the incarceration rate was 107 persons per 100,000 population* in Canada.[1] In 2002, there were 256,873 adult custodial admissions (7,659 of which were admissions to a federal facility) and 111,906 community supervision admissions. On any given day in 2002 there were 19,674 people in provincial/territorial jails and 12,383 in federal penitentiaries. In 2002 a total of 111,906 people were released from a correctional facility, 7,428 from CSC facilities.[2]

HIV and HIV-Related Risk Behaviours in Federal Penitentiaries

Up to two-thirds of federal inmates report having had a previous HIV test,[3] although it is not clear whether they had been tested in the community, in the provincial/territorial system at the time of admission or during the current incarceration, or during a previous federal or provincial incarceration. Currently, all newly admitted inmates to a federal penitentiary are offered a thorough medical examination, which includes a risk factor screening questionnaire for bloodborne and sexually transmitted infections. Those who are

* The comparable incarceration rates per 100,000 in other countries were USA 737, Russia 611, Cuba 487, England and Wales 148, Australia 126, China 118, Germany 95, France 85, Sweden 82, and Japan 62.[1]

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at risk and do not know their infection status are encouraged to participate in testing for these infections, including HIV. As is the case in provincial/territorial prisons, testing for HIV and other bloodborne and sexually transmitted infections in federal prisons is voluntary. Inmates with a known or self-reported HIV infection on admission are offered confirmatory testing (not screening). However, some inmates may not disclose risk and may refuse a blood test.

If a significant risk history is reported and/or HIV infection is suspected in an inmate with a recent negative HIV test, the inmate is counselled and offered another HIV test within 6 months of the negative test (based on the upper limit of the HIV seroconversion window period). In the case of an inmate at low risk or with a recent negative HIV test result, repeat testing is not recommended. While all inmates are screened for risk factors, there is a 50% uptake for voluntary HIV testing among new admissions to federal prisons.

Table 1 shows the number of screening tests done among new admissions, the number of newly diagnosed cases, and the overall estimated HIV prevalence among new admissions to federal prisons (CSC). The estimated prevalence of HIV infection among new admissions to CSC was 2.8% in 2005, and the diagnostic yield (number of newly diagnosed HIV cases per 1,000 tests) was 2.9.[4] While the diagnostic yield has gone down over the last 5 years, the overall prevalence of HIV among new admissions has been around 3.0%, suggesting that most of these inmates may have been tested prior to admission.

The number of HIV tests conducted among inmates in federal prisons at the end of each year increased from 2,573 tests in 2000 to 3,688 in 2005, and the estimated HIV point prevalence at the end of each year during this time period has remained relatively stable (Table 2).

Table 1. HIV testing and estimated prevalence among new admissions to CSC 2000-2005[4]

	2000	2001	2002	2003	2004	2005
New admissions, *n*	4,302	4,288	4,159	4,238	4,413	4,819
HIV tests,† *n* (percent)	1,596 (37.1)	1,768 (41.2)	2,317 (55.7)	2,059 (48.6)	2,112 (47.9)	2,418 (50.2)
Newly diagnosed HIV positive, *n*	24	11	15	13	3	7
Diagnostic yield‡	15.3	6.2	6.5	6.3	1.4	2.9
Prevalent HIV on admission	104	123	139	118	28	126
HIV prevalence§	**3.0%**	**3.1%**	**3.7%**	**3.1%**	**3.0%**	**2.8%**

† Screening tests among those who did not previously know their status or who had a previous negative test

‡ Diagnostic yield calculated as the number of newly diagnosed HIV infections per 1,000 screening tests

§ HIV prevalence among new admissions calculated as the number of prevalent infections on admission added to the number of newly diagnosed infections divided by the number of new admissions

Table 2. HIV testing and estimated prevalence among inmates, CSC 2000-2005

	2000	2001	2002	2003	2004	2005
Inmate population, *n*	12,363	12,479	12,295	12,179	13,107	12,222
HIV tests, *n*	2,573	2,770	3,505	3,771	3,567	3,688
Newly diagnosed HIV positive, *n*†	21	5	12	20	2	7
HIV+ inmates at year end, *n*‡	214	223	251	234	188	204
Year-end HIV prevalence	**1.7%**	**1.8%**	**2.0%**	**1.9%**	**1.4%**	**1.7%**

† Annual cumulative number of newly diagnosed

‡ Year-end HIV point prevalence calculated as the number of HIV+ inmates at year end divided by the total inmate population at the end of that year.

The assessment of risk behaviours among inmates has primarily focused on injecting drug use, snorting drugs, tattooing, and high-risk sexual behaviours (e.g. multiple sex partners, unprotected sexual intercourse with casual sex partners, having a sex partner who injects drugs). Data from a 2004 pilot project in CSC aimed at implementing enhanced screening forms indicated that among 888 new male admissions, nearly a quarter (22%) reported ever injecting drugs, 45% had a history of snorting drugs, 61% reported having received a tattoo, and 26% had body piercings.[4] The majority of the inmates were sexually active: among newly admitted male inmates, 89% reported ever having had sex with a female (median number of partners was 4), 61% reported having had unprotected casual sex, and 12% reported sex with someone who was an injecting drug user. Sixteen percent reported having been the client of a sex trade worker, and 2% reported a history of sex trade work. Of the male inmates 4% reported having had sex with a male.[4]

Data from a 1995 survey of male inmates in CSC penitentiaries (n = 4,285) indicated that 38% reported having used drugs in their current correctional institution. The drug most often used was cannabis, followed by heroin and cocaine or crack. Eleven percent reported injecting drugs while incarcerated, and 50% were unsure of the cleanliness of the injecting equipment. With respect to sexual risks, 6% of inmates reported sex with another inmate, and approximately three-quarters of these persons did not use condoms. Thirteen percent reported having received a tattoo in prison, and 5% had had body piercing done while incarcerated.[3]

In a 1998 study of male inmates at CSC's Joyceville and Pittsburgh penitentiaries (n = 355), 37% reported a history of injecting drugs, two-thirds of whom injected while incarcerated;[5] this was up from 12.0% reported in these institutions in 1995.[6] The HIV prevalence reported in these studies was 1.0% in 1995 and 1.7% in 1998.[5] In a study conducted among female inmates at the Prison for Women in Kingston, the HIV prevalence was found to be 0.9%.[7] Among federal prisoners in 2005, the overall prevalence of HIV was estimated to be 1.7%* (2.8% among women and 1.6% among men)[8] (see Table 2).

Provincial Jails

British Columbia: In a study conducted in 1992 among adults in provincial prisons in British Columbia (n = 2,482), the HIV prevalence was found to be 1.0% among men and 3.3% among women.[9] Almost a third (31%) reported ever having injected drugs. Among young male and female offenders in 1994, the HIV prevalence based on data from six juvenile offender intake centres in British Columbia (n = 806) was found to be 0.25%.[10] Injecting drug use was reported by 4.3% of the surveyed inmates and was higher among females (10.2%) than males (3.4%). In a 2001 study conducted among female inmates in a British Columbia prison (n = 104), 8% of the women reported being HIV positive, 70% reported a prior history of injecting drugs, 21% of all inmates reported injecting in prison, and 86% of those who injected in prison reported sharing injection equipment inside prison.[11]

Quebec: In a study of female inmates in Montreal in 1994 (n = 210), HIV prevalence was reported to be 9% overall and 28% among women with a history of injecting drugs and sex trade work.[12] Over a third (39%) of these inmates had addiction issues (based on the Addiction Severity Index scale), and 62% of all respondents were considered to be at risk of HIV infection as a result of having had sex with multiple partners or unprotected anal sex and through participation in commercial sex work. In a 1994 study among male and female detainees at Quebec City Detention Centre (n = 618), 3% of the inmates were found to be HIV positive, 3.0% among males and 8.0% among females.[13] Ever having injected drugs was reported by 26% of males (10% of whom injected while incarcerated) and 38% of females (11% of whom injected while incarcerated).

In a multi-centre study conducted in seven detention centres in Quebec in 2004 (n = 1,617), the prevalence of HIV was found to be 2.3% and 8.8% among males and females respectively.[14] Ever having injected drugs was reported by 27.7% of the males and 42.8% of the females. Injecting drugs while incarcerated was reported by 4.4% of males and 0.8% of females. The prevalence of HIV among male and female inmates who reported ever injecting drugs was found to be 7.2% and 20.6% respectively.

Ontario: In a large study (n = 12,561) conducted in 1993 among adult and juvenile males and females, rep-

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* The corresponding estimate for HCV prevalence was 29.3% (39.5% among women and 29.0% among men).

resentative of all Ontario correctional facilities, the prevalence of HIV among adult males and females was found to be 1.0% and 1.2% respectively, while none of the juvenile offenders was found to be HIV positive.[15] In this sample 13% of the adult males and 20% of the adult females reported ever having injected drugs, and 3% of juvenile males and 2% of the juvenile females reported injecting drugs.

In a 1996-1997 study conducted in six provincial correctional centres in Ontario, 58% of the inmates (343/595) reported ever being tested for HIV, and 3.6% of those tested reported receiving an HIV-positive result.[16] Of those who reported ever being tested, 21% were tested while incarcerated in the previous year. Overall, 32% of all participants reported injecting drugs, 25% of whom reported injecting while incarcerated. Almost 1 in 5 (17%) reported that they had first injected in a correctional facility.

A more recent study conducted in 13 remand facilities* in Ontario in 2003-2004 (n = 1,877)[17] reported an overall HIV prevalence of 2.0%. Unlike other studies, HIV prevalence was higher among adult males (2.1%) than adult females (1.8%). None of the juvenile offenders was found to be HIV positive. Almost a third of adult offenders (30.3%) had a history of injecting drugs, and HIV prevalence among users was higher (5.7%) than among non-users (0.7%). Injecting drug use was reported by 4.7% of young offenders. A history of unprotected sex was reported by virtually the entire sample of adults (94.7%) and more than three-quarters of the juvenile offenders (78.2%).

Conclusions

The estimated HIV prevalence based on newly diagnosed and self-reported cases in federal penitentiaries was found to be between 1.4% and 2.0% between 2000 and 2005. However, there was a marked difference in the estimated HIV prevalence among male (1.6%) versus female (2.8%) inmates in 2005. These results must be interpreted with caution as they are based on cases that have either been tested or self-reported voluntarily to federal penitentiary authorities. Non-disclosure of risk behaviours in the behavioural screening process may lead to an underestimate of HIV prevalence. However, these findings are consistent with estimated HIV prevalence estimates for inmates in federal penitentiaries in the United States.[18]

Independent cross-sectional studies from provincial prisons suggest that the prevalence of HIV varies across jurisdictions. The data also suggest a higher prevalence of HIV among women than men in certain jurisdictions (e.g. 2.3% and 8.8% among males and females respectively in a multi-centre study conducted in seven detention centres in Quebec in 2004). In federal prisons, the estimated HIV prevalence between 2000 and 2005 has remained relatively stable (1.7% in 2000 and 2005, range = 1.4% to 2%). However, data from 2005 suggest a higher prevalence among female than male inmates (2.8% vs. 1.6%, respectively).

The data for a history of injecting drug use are remarkably consistent across provincial and federal prison populations. Estimates of injecting drug use among offenders are roughly 30%, and they tend to be high among women (70% in BC in 2001; 42.8% in Quebec in 2004). The prevalence of HIV infection in incarcerated populations in Canada is strongly associated with a history of injecting drugs; people who inject drugs are at increased risk of incarceration and a greater proportion of female inmates than male inmates have a history of injecting drug use.

Studies have also shown that some inmates continue to engage in risk behaviours during incarceration. As a result, the risk of acquiring and transmitting HIV and other sexually transmitted and bloodborne infections during incarceration is present. The proportion of inmates who reported injecting drugs in federal penitentiaries was 11% in 1995. Estimates of injecting drug use during incarceration among those with a history of injecting drug use are of a similar magnitude in provincial correctional systems.

It is important to note that the population of offenders in Canada is also characterized by a high-risk sexual history, including multiple sex partners, unprotected sex with casual partners, and sex trade involvement during and prior to incarceration. This is in part due to the association between drug use and sex work. The role of sexual transmission of HIV as an important transmission pathway in this population, both in the community and during incarceration, should not be underestimated.[19,20]

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* A remand facility holds persons charged with an offence who are awaiting trial; a prison holds persons while they serve their sentence. Some large facilities may have mixed populations, holding persons in remand and in sentence.

These data clearly demonstrate a high prevalence of risk behaviours for HIV infection among inmates in federal and provincial/territorial prisons. In turn, there is a high prevalence of HIV infection among inmates in Canadian correctional facilities. While longitudinal studies of HIV incidence are required to estimate the magnitude of disease transmission inside prisons, the public health response to the disproportionate burden of HIV in offender populations needs to be comprehensive and integrated across jurisdictional boundaries.[19,20] In Canada, this requires all local, provincial/territorial, and federal public health workers, both in corrections and in the community, to work together.[2] There is a need to monitor the risk behaviours and infection status in offender populations in order to help guide the development and refinement of HIV prevention and control tools, such as screening and testing, counselling, behaviour modification, and education programs, as well as other prison-based illness prevention programs (e.g. distribution of methadone, condoms, bleach, dental dams, and water-based lubricants) and treatment delivery. In response, the CSC and the Public Health Agency of Canada are instituting a surveillance system to monitor the HIV-related injecting and sexual risk behaviours among inmates in federal penitentiaries. It is anticipated that this system will provide important information that can be used to guide the HIV prevention and control programs for inmates, which will also contribute to the prevention and control of STIs and hepatitis C in incarcerated populations.

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HIV/AIDS and Associated Co-infections

At a Glance

- Because of common routes of transmission, decreased immune function, and increased survival due to highly active antiretroviral therapy, individuals infected with HIV are at risk of becoming co-infected with other diseases, such as hepatitis C and sexually transmitted infections.
- A significant proportion of HIV-infected individuals also have hepatitis C virus infection; among HIV-infected individuals with a history of injecting drug use, the prevalence is 50% to 90%.
- The presence of a sexually transmitted infection, such as syphilis, gonorrhea, or chlamydia, increases the risk of acquiring HIV through sexual contact.
- For HIV-infected individuals, the presence of another sexually transmitted infection increases the infectiousness and risk of HIV transmission.
- HIV is the most potent risk factor for progression to active disease among individuals infected with *Mycobacterium tuberculosis* and, globally, TB is one of the leading causes of death among HIV-positive individuals.
- A comprehensive approach to prevention, screening, and treatment has been demonstrated to successfully reduce the co-infection disease burden in HIV-infected individuals.

Introduction

Because of common routes of transmission, decreased immune function, and increased survival due to highly active antiretroviral therapy (HAART)[1], individuals infected with HIV are at increased risk of co-infection with hepatitis C and other sexually transmitted infections. This is of particular concern given that morbidity can be worse, disease progression more rapid, and treatment more difficult for HIV co-infected individuals. The prevention, diagnosis, management, and care needs of many other infections will also differ when co-infection is present. In this *Epi Update*, three HIV co-infections of significant public health importance will be discussed—hepatitis C, sexually transmitted infections (STIs), and tuberculosis.

HIV and Hepatitis C

First described in 1989, the hepatitis C virus (HCV) is a major cause of acute hepatitis and chronic liver disease, including cirrhosis and liver cancer.[2] Globally, it has been estimated that 3-4 million people become newly infected with HCV each year, and an estimated 123 to 170 million people, including 250,000 Canadians, are chronically infected.[2-4] HCV is transmitted predominantly through blood-to-blood contact, and injecting drug use has accounted for approximately 70% to 80% of recent HCV cases in Canada. Injecting drug use is considered to be the primary mode of HCV acquisition in the developed world.[2,5,6] In addition, approximately 17% of the estimated 58,000 prevalent HIV infections in Canada as of the end of 2005 are attributable to injecting drug use, and there is an apparent increased risk of HIV/HCV co-infection in this group.[7,8]

A significant proportion of HIV-positive persons are estimated to be co-infected with HCV: among HIV-positive people with a history of injecting drug use the estimate is between 50% and 90%.[6,9] In a study of young injection drug users in Vancouver, the prevalence of HIV/HCV co-infection was 25.7%.[10] An enhanced surveillance system to identify risk behaviours associated with HIV and HCV among people who inject drugs (IDU) determined that 11.7% of adult participants recruited from seven sites across Canada were co-infected with the viruses.[11] The true prevalence of HIV/HCV co-infection in this study was likely underestimated, however, be-

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cause of insufficient samples available for testing at some sites and the fact that the study participants were selected primarily from among those already accessing needle exchange programs. Rates of co-infection are also high in the Canadian prison setting, where as many as half of all inmates report a history of injecting drug use. In two separate studies conducted in Ontario and Quebec, the prevalence of HCV among HIV-infected inmates was 68.0% and 64.8% respectively.[12,13]

Although injecting drug use remains the predominant mode of transmission of HCV and HIV/HCV co-infection worldwide, several European countries have observed a noticeable increase in the sexual transmission of HCV, particularly among non-IDU men who have sex with men (MSM). Among several reported clusters of HCV-positive MSM with no history of IDU, the most common risk factors facilitating the sexual spread of HCV included unprotected traumatic anal sex (i.e. sexual practices potentially leading to mucosal damage), numerous and often anonymous sexual contacts, and concomitant STIs, such as lymphogranuloma venereum.[14-17] These findings suggest that public health interventions aimed at reducing the spread of HCV among MSM must also incorporate promotion of safer sex.

HIV accelerates the progression of chronic HCV infection and, as a result, end-stage liver disease has become a significant cause of morbidity and mortality in the HIV-positive population.[5,6,18-21] In addition to its effects on clinical outcomes, HIV influences the rate of HCV transmission, particularly from mother to child, in whom transmission of HCV may be increased up to 3-fold in the presence of HIV.[5,19] Although the effects of HCV on the natural history of HIV are less understood and somewhat controversial, infection with HCV has been associated with increased rates of hospitalization and death among HIV-positive individuals.[22] Given the complex interactions between HIV and HCV in co-infected individuals, universal screening for HCV is recommended for all HIV-infected patients.[5] Co-infected people can be treated successfully, but the care-giving team should have expertise in liver disease, HIV and, if needed, in addiction treatment.

HIV and STIs

HIV is transmitted by three major routes—sexual, blood-to-blood, and mother-to-child; however, sexual transmission is by far the commonest mode of transmission, accounting for over 75% of all HIV infections worldwide.[23] In Canada, a total of 58,404 positive HIV tests among adults had been reported to the Public Health Agency of Canada as of the end of 2006. Of those with an identified risk factor, 75% were exposed through sexual contact.[8] HIV and STIs are behaviourally and biologically inter-related, and the risk of both acquiring and transmitting HIV through sexual contact is further amplified by the presence of an STI, a fact that has become increasingly significant given the concurrent rise in the incidence of STIs worldwide. Since 1997, both the number and rate (per 100,000) of reported cases of the three nationally notifiable STIs in Canada (i.e. chlamydia, gonorrhea, and infectious syphilis) have increased annually: rates of chlamydia and gonorrhea have increased by 73% and 94% respectively, and rates of infectious syphilis have increased 7-fold.[24] An understanding of the complex and synergistic relationship between HIV and STIs, particularly in the context of increasing rates of STIs, is crucial for the development and implementation of public health interventions aimed at halting both epidemics.

HIV-negative individuals who are co-infected with another STI are at least 2 to 5 times more likely than uninfected individuals to acquire HIV if they are exposed to the virus through sexual contact.[25] STIs are thought to increase susceptibility to HIV infection through two mechanisms. First, genital ulcers (e.g. from syphilis, herpes, or chancroid) result in breaks in the genital tract lining or skin that create a portal of entry for HIV.[26] For example, studies have demonstrated that among men and women with recent syphilis or genital ulcer disease the risk of HIV seroconversion was increased 4- to 5-fold, and among MSM the risk of acquiring HIV was close to 4 times higher for those with recent herpes simplex virus type 2 (HSV-2) infection.[27,28] Second, non-ulcerative STIs (e.g. chlamydia, gonorrhea, and trichomoniasis) increase the concentration of cells in genital secretions that can serve as targets for HIV.[26] Among men with no history of genital ulcer disease or syphilis, those recently infected with gonorrhea (i.e. within the previous year) were almost 3 times more likely to acquire HIV than those without gonorrhea.[27]

HIV-infected individuals who are co-infected with an STI are more likely than other HIV-infected individuals to transmit HIV to their partner through sexual contact.[25] Studies have shown that when HIV-infected

individuals are also infected with other STIs, they are more likely to have HIV in their genital secretions, particularly if they are symptomatic.[26] Numerous studies have found that HIV-positive men with symptomatic gonorrhea and/or chlamydia have HIV viral loads in semen that are as much as 5 to 8 times higher than in men without symptoms, and that HIV-positive women with either gonorrhea or chlamydia are 2 to 3 times more likely to be shedding HIV than those without a concomitant infection.[29-31] In studies involving ulcerative STIs, primary and secondary syphilis infections were not only associated with significant increases in HIV viral loads but also with significant decreases in the CD4 cell count, both of which serve to enhance HIV replication and transmission.[32-34]

The interaction between HIV and STIs is bidirectional, and for co-infected individuals HIV infection may alter the natural history, associated morbidity, and clinical management of the concomitant STI. In a cross-sectional study of inner-city women in the United States, the prevalence of HSV-2 shedding was nearly 4 times greater for those who were HIV positive, and close to 80% of the viral shedding was asymptomatic.[35] This finding suggests that women co-infected with HIV and HSV-2 have a substantially increased risk of transmitting HSV-2. Other studies have demonstrated that for those infected with early syphilis, the progression to serious neurological or cardiovascular outcomes may occur much more rapidly for those co-infected with HIV.[36,37] Among HIV-positive MSM, reports indicate that the incidence of human papillomavirus (HPV)-associated anal dysplasia and cancer was much higher than among heterosexual men and women and HIV-negative MSM.[38,39]

Numerous intervention studies have shown that treating STIs in HIV-infected individuals decreases both the amount of HIV they shed and how often they shed the virus.[26] In the studies described above, the presence of HIV in the genital secretions of individuals co-infected with an STI and HIV decreased significantly when the STI was treated appropriately.[29-31,33,34] In addition, treatment of STIs in co-infected individuals may substantially reduce the transmission of HIV in communities. In a study conducted in the United States, the treatment of STIs in HIV/STI co-infected individuals, in the absence of any other behavioural intervention, resulted in an estimated 27% decrease in the community transmission of HIV.[40] In Tanzania, a community-based syndromic approach to the treatment of symptomatic STIs led to a 42% decrease in HIV incidence compared with that in control villages.[41] In contrast, the Rakai study conducted in Uganda determined that community-wide mass STI treatment offered to everyone every 10 months in the absence of regular access to improved STI services did not reduce HIV transmission.[42] These differences may have been due to the much higher prevalence of curable STI in the Tanzanian study than the Ugandan study and differences in the stage of the HIV epidemic in these two sites (early in Tanzania vs. more mature in Uganda). Nonetheless, taken together, these findings provide evidence that a comprehensive approach to the prevention and treatment of STIs, including ready access to STI services, is a key strategy in community-level HIV prevention.

HIV and Tuberculosis

Tuberculosis (TB) was declared a "global emergency" by the World Health Organization (WHO) in 1993, and it has since been estimated that up to one-third of the world's population are infected with *Mycobacterium tuberculosis*, close to 8 million cases of TB disease occurring annually.[43] In Canada, the annual incidence of TB has declined steadily since the mid-1980s. In 2005, preliminary data indicated that 1,616 cases (5.0 per 100,000) were reported to the Public Health Agency of Canada (PHAC), the majority of whom (63%) were born outside of Canada.[44]

In 2000, the WHO determined that 11% of all new TB cases in adults occurred in persons infected with HIV and that 9% of all new TB cases were directly attributable to HIV.[45] There is considerable geographic variation in the prevalence of HIV/TB co-infection: in the Western Pacific and the Americas, the proportion of TB cases concomitantly infected with HIV is less than 10%, but in some African countries with high TB prevalence the proportion may exceed 50%.[43,45] In Canada, several epidemiologic studies have estimated HIV prevalence among adult incident TB cases to be between 3.8% and 14.7%, and the WHO estimates that 10% to 19% of all adult TB cases in Canada are attributable to HIV infection.[43,45-49] Aboriginal peoples and recent immigrants have been identified as being at greatest risk of HIV/TB co-infection compared with the general Canadian population.[50,51]

HIV infection is the most significant risk factor for the progression of active disease among those with latent

TB infection, in large part because of the virus's ability to destroy the two types of immune cells (macrophages and CD4 lymphocytes) most important to the containment of *M. tuberculosis*.[52,53] For individuals infected with *M. tuberculosis* only, the *lifetime* cumulative risk for the development of active disease is estimated to be 10%; for those co-infected with HIV, the *annual* risk of active disease may exceed 10%.[53] In the presence of HIV-associated immunosuppression, both the clinical and radiological features of TB may be altered, and appropriate treatment of both infections is more challenging.[52] Globally, TB is one of the leading causes of death among HIV-infected individuals: in 2000, the WHO estimated that 246,000 HIV-positive adults died as a result of TB, accounting for 11% of all adult AIDS deaths worldwide.[45,52]

Patients with TB constitute an important "sentinel" population for HIV screening, and for a number of years universal HIV testing for newly diagnosed TB cases and TB assessment for all newly diagnosed HIV cases have been recommended in Canada.[54] Since these recommendations were proposed, the proportion of TB cases with HIV status reported to the PHAC increased from 5.7% to 23.2% between 1997 and 2004; however, it is apparent that universal HIV screening of all TB cases is still not occurring.[49,50] Furthermore, results indicate that those with an HIV test on record were more likely to have one or more risk factors for HIV, suggesting that HIV testing of TB patients is rather selective and is likely biased towards individuals already perceived to be at high risk of co-infection.[49]

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GLOSSARY

A *Guide to HIV/AIDS Epidemiological and Surveillance Terms* is available. The guide contains over 65 terms and over 20 frequently asked questions, and is accessible at http://www.phac-aspc.gc.ca/publicat/haest-tesvs/index.html. Hard copies may be obtained through the Surveillance and Risk Assessment Division, from the address listed under the Information to Readers of HIV/AIDS Epi Updates section. A selected number of abbreviations/acronyms and terms that may be useful when reading *HIV/AIDS Epi Updates* are listed below.

ACRONYMS/ABBREVIATIONS

AIDS – acquired immunodeficiency syndrome

HIV – human immunodeficiency virus

IDU – people who inject drugs

MSM – men who have sex with men

NEP – needle exchange program

WHO – World Health Organization

TERMS

Cohort Study: The purpose of a cohort study is to investigate the development of new occurrences of a disease or to investigate how responses to treatment are related to specific factors. These factors can be recorded at the beginning of the study and/or during the course of the study.

A cohort study starts with a group of people who will be participants in the study. This group of people is called a cohort.

The cohort is followed for a specified time period, which can be weeks, months, years or decades. Follow-up data are collected at regularly defined periods either through the use of questionnaires, personal interviews, laboratory testing, medical examinations, or a combination of these methods.

A cohort study is sometimes referred to as a prospective or longitudinal study.

Co-infection: Having two infections at the same time. For example, a person infected with both HIV and hepatitis C, or HIV and tuberculosis, has a co-infection. With co-infections the progression of either disease can potentially be accelerated as a result of infection with the other disease.

Exposure Category: In HIV and AIDS surveillance, exposure category refers to the most likely way a person became infected with the HIV virus, that is, the most likely route through which HIV was transmitted to that person.

Incidence: Incidence is the number of *new* events of a specific disease during a specified period of time in a specified population. HIV incidence is the number of *new* HIV infections occurring in a specified period of time in a specified population.

Methodology: The methodology section of a report or research study describes how the study was conducted (the methods) and the principles used by study investigators. These methods include how participants were recruited and how the data were collected, organized and analyzed.

Notifiable Disease: A disease that is considered to be of such importance to public health that its occurrence is required to be reported to public health authorities.

Perinatal Transmission: The transmission of HIV from an HIV-infected mother to her child either *in utero,* during childbirth, or through breastfeeding.

Person Years: Person years describes the length of time of experience or exposure of a group of people who have been observed for varying periods of time. It is the sum total of the length of time each person has been exposed, observed or at risk. You will sometimes see person years reported as PY or py. Person years is often used as the denominator in expressing incidence rate.

Population at Risk: The population at risk represents those persons at risk of contracting a disease.

Prevalence: Prevalence is the total number of people with a specific disease or health condition living in a defined population at a particular time. HIV prevalence among Canadians is the total number of people living with HIV infection (including those with AIDS) in Canada at a particular time.

Rate: A rate is an expression of the frequency with which an event occurs in a defined population in a specified period of time. In HIV/AIDS research, a rate can be the proportion of a population with a particular "event", such as HIV infection, occurring during a specified time period.

Risk Factor: An aspect of someone's behaviour or lifestyle, a characteristic that a person was born with, or an event that he or she has been exposed to that is known to be associated with a health-related condition. A *behavioural* risk factor describes a specific behaviour that carries a proven risk of a particular outcome. In HIV/AIDS research, you will often see the term "HIV-related risk behaviour" to describe a behaviour that, when practised, carries a proven risk of HIV infection.

Self-Reported Data: In research studies, self-reported data is a term applied to information that is directly reported by the study participants.

Sentinel Surveillance: A type of surveillance activity in which specific facilities, such as offices of certain health care providers, hospitals or clinics across a geographic region, are designated to collect data about a disease, such as HIV infection. These data are reported to a central database for analysis and interpretation.

Seroconversion: The root "sero" means the serum of the watery portion of blood. In HIV/AIDS research, seroconversion refers to the development of detectable antibodies to HIV in the blood as a result of HIV infection. A person who goes from being HIV negative to HIV positive is said to have seroconverted or is a seroconverter.

Seroprevalence: The terms refers to the prevalence or prevalence rate of a disease as determined by testing blood rather than saliva, urine or sputum.

Surveillance: The ongoing collection, analysis and interpretation of data about a disease such as HIV or about a health condition. The objective of surveillance is to assess the health status of populations, detect changes in disease trends or changes in how the disease is distributed, define priorities, assist in the prevention and control of the disease, and monitor and evaluate related treatment and prevention programs.