

# HIV/AIDS EPI UPDATES

## CHAPTER 1: NATIONAL HIV PREVALENCE AND INCIDENCE ESTIMATES FOR 2011

October 2014



PROTECTING CANADIANS FROM ILLNESS



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## AT A GLANCE

- More Canadians are living with HIV infection: Approximately 71,300 people were living with HIV at the end of 2011 compared with 64,000 at the end of 2008.
- Approximately 3,175 new HIV infections occurred in 2011 (range: 2,250 to 4,100) compared with approximately 3,335 in 2008 (range: 2,370 to 4,300). Over the past decade, the annual number of new HIV infections has remained relatively stable in Canada.
- In 2011, the estimated HIV incidence rate among men who have sex with men was 71 times higher than the rate for other men. The HIV incidence rate for people who inject drugs was 46 times higher than the rate among people who had never injected drugs.
- Aboriginal people and people from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic.
- The HIV incidence rate for males was 14.2 per 100,000 population, which was 3.3 times greater than the rate of 4.3 per 100,000 for females.

## INTRODUCTION

This *HIV/AIDS Epi Update* outlines the estimates of the total number of people living with human immunodeficiency virus (HIV) infection in Canada at the end of 2011 (prevalence) and the number of new HIV infections in Canada in 2011 (incidence). Estimates published in this report replace all previous estimates published by the Public Health Agency of Canada (the Agency) of HIV prevalence and incidence in Canada because new data and methods have permitted an improved analysis of the epidemic and have led to more reliable estimates.

National estimates of HIV prevalence and incidence are part of ongoing risk assessment and management work conducted by the Centre for Communicable Diseases and Infection Control (CCDIC) at the Public Health Agency of Canada. They are used as a tool to monitor the HIV epidemic in Canada and to help evaluate and guide prevention efforts. Furthermore, information on national HIV prevalence and incidence among key populations in Canada provides a more accurate picture of the HIV epidemic and can help improve reach and impact of national programs. These estimates are also used to inform the work that the Agency and other federal departments perform under the *Federal Initiative to Address HIV/AIDS* in Canada.

## METHODS

Methods to estimate HIV prevalence and incidence at the national level are complex and contain a level of uncertainty. We used several methods to estimate national HIV prevalence and incidence in 2011: the workbook method,<sup>1,2</sup> an iterative spreadsheet model,<sup>3</sup> and two statistical modelling methods.<sup>4,5</sup> The workbook method multiplies an estimated prevalence or incidence rate by an estimated population size, while the statistical models back-calculate estimates of HIV incidence by relating the timing of HIV diagnoses with the timing of HIV infection and testing behaviour. The iterative spreadsheet model combines elements of the workbook and the statistical modelling methods.

These methods were used to generate separate estimates of HIV prevalence and incidence for six provinces, namely, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and Quebec. Together, these provinces account for over 93% of the population of Canada and over 98% of cumulative reported HIV and AIDS diagnoses in Canada. The results of the different methods were used to obtain exposure category-specific prevalence and incidence estimates for each of these six provinces. The exposure categories used are described in Table 1 below and in further detail in the HIV/AIDS in Canada surveillance report for 2012.<sup>6</sup>

Table 1. HIV exposure categories used for HIV case surveillance and HIV prevalence and incidence estimation process

Type of exposure	Exposure category classification
During male-to-male sex	Men who have had sex with men (MSM) exposure category
During use of injection drugs	Injection drug use (IDU) exposure category
During either male-to-male sex and/or the use of injection drugs—used in instances where both exposures were reported for one person	MSM-IDU exposure category
Exposure during heterosexual sex and: <ol style="list-style-type: none"> <li>born in a country where HIV is endemic*</li> <li>born in Canada or in a country not on the HIV-endemic list</li> </ol>	<ol style="list-style-type: none"> <li>heterosexual/endemic exposure category</li> <li>heterosexual/non-endemic exposure category</li> </ol>
Exposure attributed to receipt of transfusion of blood or clotting factor, perinatal exposure, or occupational exposure	Other exposures

\* The Public Health Agency of Canada defines countries where HIV is endemic as those countries where the prevalence of HIV among adults (age 15–49 years) is 1.0% or greater and one of the following: 50% or more of HIV cases are 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.



Based on the relative contribution of the other provinces and the territories to the total number of reported cases within the national HIV and AIDS surveillance data, we extrapolated HIV prevalence and incidence estimates for the remainder of Canada. Surveillance data were obtained from the national HIV and AIDS surveillance reporting system,<sup>6</sup> and supplemented with data from two additional sources: the Laboratory Enhancement Program in Ontario<sup>7</sup> and recently published surveillance data from Quebec on exposure categories of cases diagnosed with HIV between 2002 and 2010.<sup>8</sup>

In addition to the estimates generated for each exposure category, we generated estimates of HIV prevalence and incidence for sex (females/males) and race/ethnicity (Aboriginal people vs other ethnicities). These were calculated based on the distributions of reported sex and Aboriginal status in the national HIV and AIDS surveillance data<sup>6</sup> and two additional data sources.<sup>7,8</sup>

We also estimated HIV incidence rates within demographic and risk behaviour subgroups, specifically Aboriginal people, people from countries where HIV is endemic, men who have sex with men and people who use injection drugs. For the Aboriginal population and for people from HIV-endemic countries, population sizes were estimated by multiplying the total Canadian population (data from 2011 census data<sup>9</sup>) by the proportion contribution of these key population subgroups from 2006 census data (as 2011 detailed data was not available at the time).<sup>10,11</sup> To obtain these population subgroup proportions, the following definitions were used in querying the 2006 census data:

- Aboriginal people included Inuit, Métis, First Nations, and people who reported Aboriginal origin to unspecified groups.
- HIV-endemic countries included those on the Agency's 2007 list of HIV-endemic countries.<sup>6</sup>

Using available literature and survey data (including the 2009–2010 Canadian Community Health Survey), we estimated the proportion of the adult male population that identified as being gay or bisexual or engaged in male-to-male sex.<sup>12–15</sup> This estimated proportion was then applied to the overall male Canadian population aged 15 years or older from the 2011 census data in order to obtain the population size of this subgroup. Multiple data sources were used to estimate the proportion of people in Canada who were current users of injection drugs.<sup>14–18</sup> This proportion was then applied to the overall Canadian population aged 15 years or older from the 2011 census data in order to obtain the population size of this subgroup. For these analyses, we defined the populations of interest as follows:

- Men aged 15 years or older who reported having had sex with a man (at least once) during the previous 12 months;
- People aged 15 years or older who reported injecting non-prescription drugs (at least once) during the previous 12 months.

Formal 95% confidence intervals for HIV prevalence and incidence estimates could not be calculated due to the complexity of the multiple methodologies used. Instead, bounds of uncertainty were developed based on a conservative consideration of the range of results obtained from the different methods. This approach to uncertainty is similar to the approach taken in other fields (e.g., information theory and artificial intelligence) where information of varying quality is combined. It also relates to work in public health where decisions are based on expert judgement in addition to formal statistical inference.<sup>19</sup>

## RESULTS

### HIV prevalence in Canada

At the end of 2011, approximately 71,300 (range: 58,600 to 84,000) people in Canada were living with HIV infection (including AIDS), an increase of about 11.4% from the 2008 estimate of 64,000 (range: 53,000 to 75,000). The increase in the number of people living with HIV is mainly due to:

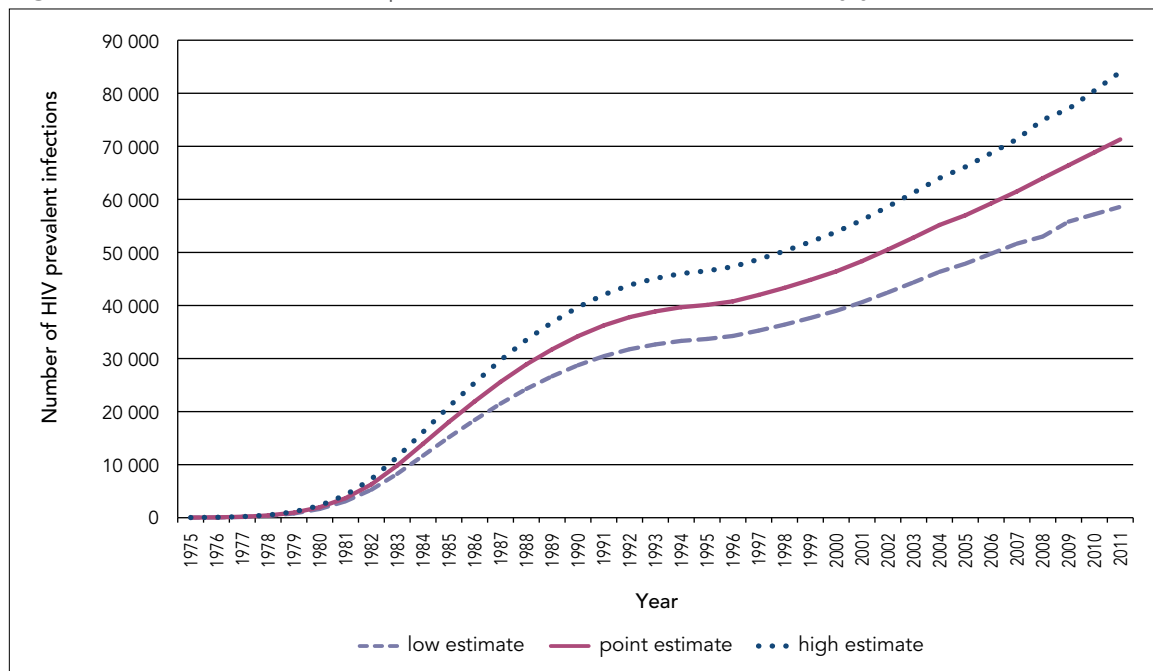
- new infections continuing to occur each year; and
- fewer HIV-related deaths among people living with HIV because antiretroviral treatment has improved survival.

The estimated all-age HIV prevalence rate in Canada in 2011 was 208.0 per 100,000 population (range: 171.0 to 245.1 per 100,000 population).

### HIV prevalence—time trend

HIV prevalence (Figure 1) rose steadily during the 1980s, corresponding to the initial rise in HIV infection in the Canadian population, mainly attributable to the MSM exposure category. This rise slowed down during the early to mid-1990s, likely as a result of both high mortality among people with HIV and reduced HIV transmissions with people learning how to minimize infection as a result of effective prevention programs. HIV prevalence began to rise moderately again in the late 1990s as new infections continued to occur and as advances in HIV treatment enabled individuals infected with HIV to live longer.

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



Abbreviation: HIV, human immunodeficiency virus.

## HIV prevalence—exposure categories

The greatest proportion of prevalent HIV infections in 2011 continued to be attributable to the MSM exposure category (46.7%), followed by the heterosexual/non-endemic exposure category (17.6%), the IDU exposure category (16.9%) and the heterosexual/endemic exposure category (14.9%). (Table 2)

The largest absolute increase was seen within the MSM exposure category with 3,330 more prevalent infections compared with the estimates for 2008 (an 11.1% increase). There were an estimated 1,630 more prevalent infections within the heterosexual/non-endemic exposure category (a 15.0% increase), 1,300 more within the heterosexual/endemic exposure category (a 14.2% increase) and 890 more within the IDU exposure category (an 8.0% increase) compared to with the 2008 estimates.

## HIV prevalence—Aboriginal status

Approximately 6,380 (range: 5,160 to 7,600) Aboriginal people in Canada were living with HIV at the end of 2011, representing 8.9% of all prevalent HIV infections in 2011 and an increase of 17.3% from the 2008 estimate of 5,440 (range: 4,380 to 6,500) (Table 2). The estimated HIV prevalence rate among Aboriginal people of all ages in Canada in 2011 was 486.9 per 100,000 population (range: 393.8 to 580.0 per 100,000 population), while the corresponding rate among other ethnicities of all ages in 2011 was 195.7 per 100,000 population (range: 159.3 to 232.9 per 100,000 population).

## HIV prevalence—Sex

At the end of 2011, approximately 16,600 (range: 13,200 to 20,000) females were living with HIV in Canada, accounting for 23.3% of the national total. This represents a 12.6% increase from the estimated 14,740 (range: 11,980 to 17,500) females living with HIV in 2008 (Table 2). The estimated HIV prevalence rate among females of all ages in Canada was 95.5 per 100,000 population (range: 75.9 to 115.1 per 100,000 population) in 2011, while the corresponding rate among males of all ages was 319.8 per 100,000 population (range: 259.4 to 380.0 per 100,000 population).

Table 2. Estimated number of prevalent HIV infections and associated ranges of uncertainty, Canada, at the end of 2011 and 2008, by exposure category, sex and ethnicity (point estimates and ranges are rounded)

Category	2011			2008		
	Point estimate, n	Range, n	Percentage, %	Point estimate, n	Range, n	Percentage, %
<b>Exposure category</b>						
MSM	33,330	28,160–38,500	46.7	30,000	25,000–35,000	46.9
MSM-IDU	2,160	1,520–2,800	3.0	2,030	1,460–2,600	3.2
IDU	12,040	9,580–14,500	16.9	11,150	9,000–13,300	17.4
Heterosexual/ non-endemic	12,530	10,260–14,800	17.6	10,900	8,900–12,900	17.0
Heterosexual/ endemic	10,640	8,780–12,500	14.9	9,320	7,640–11,000	14.6
Other	600	400–800	0.8	600	400–800	0.9
<b>Sex</b>						
Female	16,600	13,200–20,000	23.3	14,740	11,980–17,500	23.0
Male	54,700	44,400–65,000	76.7	49,260	40,520–58,000	77.0
<b>Ethnicity</b>						
Aboriginal	6,380	5,160–7,600	8.9	5,440	4,380–6,500	8.5
Other ethnicities	64,920	52,840–77,000	91.1	58,560	47,120–70,000	91.5
<b>Total</b>	<b>71,300</b>	<b>58,600–84,000</b>	<b>100.0</b>	<b>64,000</b>	<b>53,000–75,000</b>	<b>100.0</b>

Abbreviations: HIV, human immunodeficiency virus; IDU, injection drug use exposure category; MSM, men who have sex with men exposure category.

## HIV prevalence by province

The provinces with the highest estimated number of people living with HIV at the end of 2011 were: Ontario, Quebec and British Columbia (Table 3). There was some diversity among provinces in the exposure category contribution to prevalent cases, for example, in British Columbia, Ontario, Quebec and the Atlantic provinces, the MSM category accounted for approximately half of prevalent cases, while in Alberta and Manitoba, heterosexual contact accounted for approximately half of prevalent infections, while in Saskatchewan, over 70% of prevalent infections were attributed to IDU exposure.

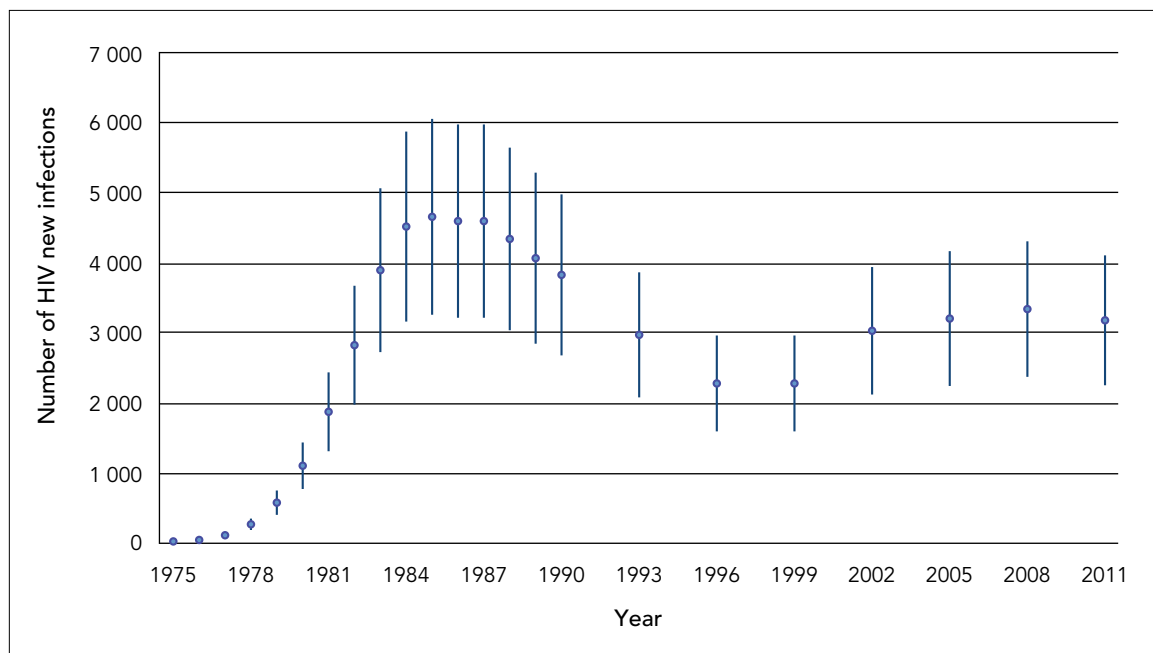
## HIV incidence in Canada

The number of new HIV infections in 2011 was approximately 3,175 (range: 2,250 to 4,100), which was about the same or slightly lower than the estimate for 2008 (3,335 new infections; range of 2,370 to 4,300) (Table 4).

## HIV incidence—time trend

Figure 2 shows point estimates and ranges of uncertainty for HIV incidence over time. New HIV infections peaked from 1984 to 1985, with the majority attributed to the MSM exposure category. The number of new HIV infections decreased steadily after 1985 until 1996 and then increased slightly; they remained relatively stable after 2002.

Figure 2. Estimated number of new HIV infections in Canada for selected years (bars indicate range of uncertainty)



Abbreviation: HIV, human immunodeficiency virus.

Table 3. Estimated number of prevalent HIV infections and associated ranges of uncertainty, Canada<sup>a</sup>, at the end of 2011, by exposure category and province/region (point estimates and ranges are rounded)

Province	Measure	Exposure category					Provincial Total	
		MSM	MSM-IDU	IDU	Hetero/Non-endemic	Hetero/Endemic		Other
British Columbia	Point estimate	4950	370	3640	2240	370	130	11,700
	Range	3,900–6,000	260–480	2,780–4,500	1,680–2,800	240–500	90–170	9,400–14,000
	Row %	42.3	3.2	31.1	19.1	3.2	1.1	
Ontario <sup>b</sup>	Point estimate	16000	800	2120	5010	5850	220	30,000
	Range	13,000–19,000	600–1,000	1,640–2,600	3,820 – 6,200	4,400 – 7,300	140–300	25,000–35,000
	Row %	53.3	2.7	7.1	16.7	19.5	0.7	
Quebec	Point estimate	9690	790	3000	2710	2970	140	19,300
	Range	7,880–11,500	530–1050	2,400–3,600	2,120–3,300	2,340–3,600	90–190	15,600–23,000
	Row %	50.2	4.1	15.5	14.0	15.4	0.7	
Saskatchewan <sup>c</sup>	Point estimate	160	50	1500	310	50	30	2,100
	Range	120–200	30–70	1,100–1,900	220–400	30–70	20–40	1,600–2,600
	Row %	7.6	2.4	71.4	14.8	2.4	1.4	
Manitoba	Point estimate	480	40	360	770	420	30	2,100
	Range	360–600	30–60	260–460	580–960	300–540	20–40	1,600–2,600
	Row %	22.9	1.9	17.1	36.7	20.0	1.4	
Alberta	Point estimate	1,510	90	1,220	1250	890	40	5,000
	Range	1,120–1,900	70–110	930–1,510	930–1,570	680–1,100	20–60	3,800–6,200
	Row %	30.2	1.8	24.4	25.0	17.8	0.8	
Atlantic provinces <sup>d</sup>	Point estimate	519	18	162	201	82	8	990
	Range	390–650	10–30	120–200	140–260	40–120	10–20	740–1240
	Row %	52.4	1.8	16.4	20.3	8.3	0.8	

<sup>a</sup> Estimates are not shown for the Northwest Territories, Yukon and Nunavut due to high level of uncertainty and small numbers.

<sup>b</sup> These estimates were generated by Public Health Agency of Canada. The interpretation and conclusions contained herein do not necessarily represent the position of the Ontario Ministry of Health and Long-Term Care or Public Health Ontario. For the most recent estimates developed by Ontario, please refer to the Report on HIV/AIDS in Ontario, 2009 available at [www.ohernu.utoronto.ca/doc/2011/PHERO2009\\_report\\_preliminary.pdf](http://www.ohernu.utoronto.ca/doc/2011/PHERO2009_report_preliminary.pdf).

<sup>c</sup> This study was based in part on de-identified data provided by the Saskatchewan Ministry of Health. The interpretation and conclusions contained herein do not necessarily represent those of the Government of Saskatchewan or the Saskatchewan Ministry of Health.

<sup>d</sup> Atlantic provinces—Prince Edward Island, New Brunswick, Nova Scotia, Newfoundland and Labrador.



## HIV incidence—exposure categories

Almost half (46.6%) of new HIV infections in 2011 were attributed to the MSM exposure category; this proportion was slightly higher than that in 2008 (44.1%). The proportion of new HIV infections attributed to the IDU exposure category was lower in 2011 than in 2008 (13.7% in 2011 vs 16.9% in 2008), while the proportions attributed to the heterosexual/non-endemic and the heterosexual/endemic exposure categories were about the same in 2011 and 2008 (Table 4).

Figure 3 shows the estimated HIV incidence over time by exposure category. The number of incident HIV infections attributed to the MSM exposure category reached a peak from 1984 to 1986, decreased until 1999, then increased until 2005; it has remained stable since. The number of incident HIV infections attributed to IDU rose steadily at the beginning of the epidemic and peaked during the period 1987 to 1990, after which there was a sustained decrease. The number of incident HIV infections among the heterosexual/non-endemic and heterosexual/endemic categories increased slightly over time and stabilized after 2005.

The distribution of new HIV infections by exposure category has changed since the beginning of the HIV epidemic in Canada (Figure 4). At the early stage of the epidemic (1981 to 1983), almost all new HIV infections (82%) were attributed to MSM. In the mid-1990s, the majority of new HIV infections were almost evenly distributed between the MSM exposure category (40%) and the IDU exposure category (33%), while both of the heterosexual/endemic and heterosexual/non-endemic categories each accounted for around 10%. In 2011, almost half of new HIV infections were attributed to the MSM exposure category (46.6%), while the IDU exposure category accounted for 13.7%, the heterosexual/endemic exposure category for 16.9% and the heterosexual/non-endemic exposure category for 20.3%.

## HIV incidence—Aboriginal status

Approximately 390 (range: 280 to 500) new HIV infections occurred among Aboriginal people in 2011, representing 12.2% of all new HIV infections that year, and slightly lower than the estimated 420 (range: 290 to 550) new infections in 2008 (Table 4). The exposure category distribution for new HIV infections in 2011 was IDU (58.1%), heterosexual contact (30.2%), MSM (8.5%) and MSM-IDU (3.1%), compared with IDU (63.4%), heterosexual contact (28.3%), MSM (6.0%) and MSM-IDU (2.4%) in 2008.

## HIV incidence—Sex

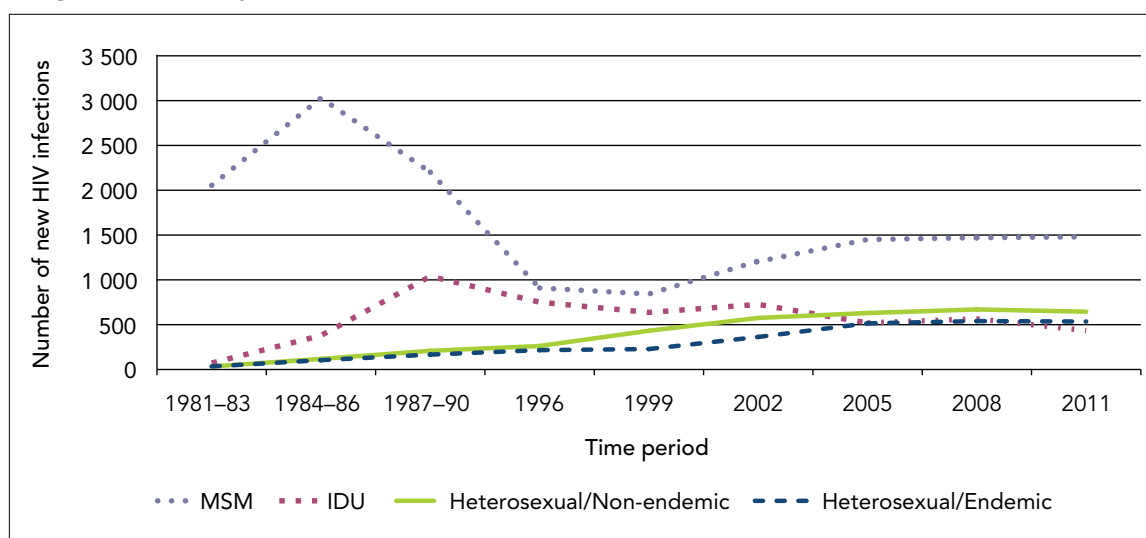
New HIV infections among females in Canada numbered approximately 755 (range: 510 to 1,000) in 2011; the corresponding estimate for 2008 was 865 (range: 630 to 1,100). Females accounted for 23.8% of all new HIV infections in 2011 compared with 25.9% in 2008 (Table 4). The proportion of new infections attributed to IDU exposure was slightly lower in 2011 than in 2008 (23.4% versus 28.3%, respectively), whereas the proportion attributed to heterosexual contact (endemic and non-endemic combined, 76.6%) was slightly higher in 2011 compared with 2008 (71.7%).

Table 4. Estimated number of new HIV infections and associated ranges of uncertainty, Canada, in 2011 and 2008, by exposure category, sex and ethnicity (ranges are rounded)

Classification	2011			2008		
	Point estimate, n	Range, n	Percentage, %	Point estimate, n	Range, n	Percentage, %
<b>Exposure category</b>						
MSM	1,480	1,060–1,900	46.6	1,470	1,040–1,900	44.1
MSM-IDU	80	50–110	2.5	90	50–130	2.7
IDU	435	300–570	13.7	565	400–730	16.9
Heterosexual/ non-endemic	645	450–840	20.3	670	470–870	20.1
Heterosexual/ endemic	535	370–700	16.9	540	380–700	16.2
Other	<20			<20		
<b>Sex</b>						
Female	755	510–1,000	23.8	865	630–1,100	25.9
Male	2,420	1,740–3,100	76.2	2,470	1,740–3,200	74.1
<b>Ethnicity</b>						
Aboriginal	390	280–500	12.2	420	290–550	12.6
Other ethnicities	2,785	1,970–3,600	87.8	2,915	2,030–3,800	87.4
<b>Total</b>	<b>3,175</b>	<b>2,250–4,100</b>	<b>100.0</b>	<b>3,335</b>	<b>2,370–4,300</b>	<b>100.0</b>

Abbreviations: HIV, human immunodeficiency virus; IDU, intravenous drug use; MSM, men who have sex with men.

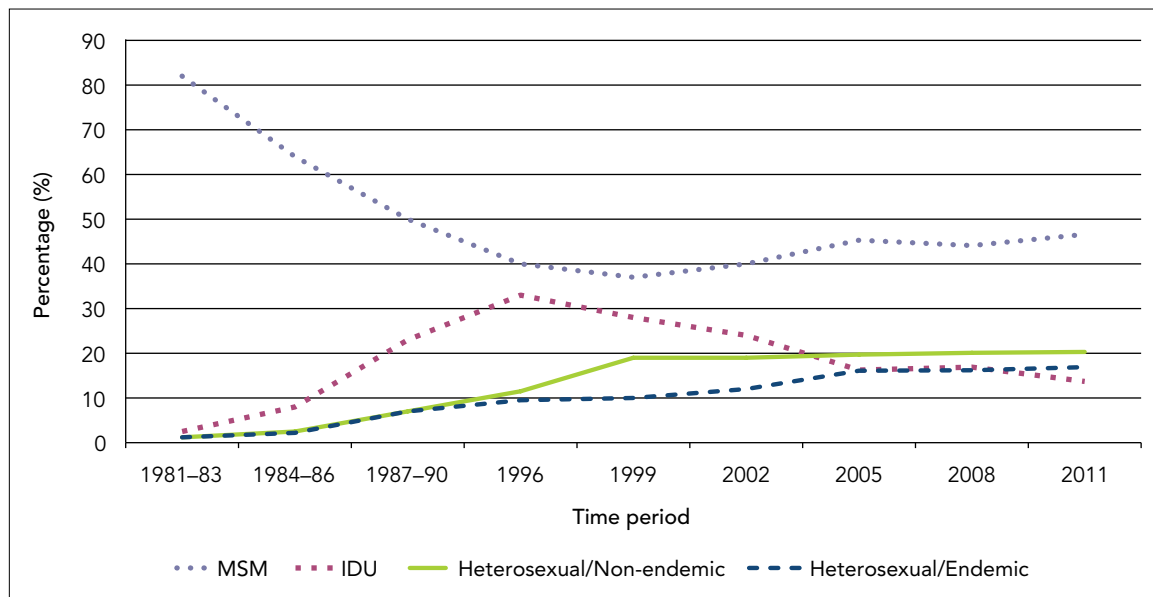
Figure 3. Estimated number of incident HIV infections in Canada over time, by exposure category (range of uncertainty omitted)



Abbreviations: HIV, human immunodeficiency virus; IDU, intravenous drug use; MSM, men who have sex with men.



Figure 4. Distribution of estimated new HIV infections in Canada over time, by exposure category



Abbreviations: HIV, human immunodeficiency virus; IDU, intravenous drug user; MSM, men who have sex with men.

## HIV incidence by province

The provinces with the highest estimated number of new HIV infections at the end of 2011 were: Ontario, Quebec and British Columbia (Table 5). As seen with HIV prevalence, there was diversity among provinces in the exposure category contribution to incident cases. For example, in British Columbia, Ontario, Quebec and the Atlantic provinces, the MSM exposure category accounted for half or more of incident cases, while in all jurisdictions except Saskatchewan, the IDU exposure category accounted for less than one-fifth of incident infections.

Table 5. Estimated number of new HIV infections and associated ranges of uncertainty, Canada<sup>a</sup>, 2011, by exposure category and province/region (point estimates and ranges are rounded)

Province	Measure	Exposure category						Provincial Total
		MSM	MSM-IDU	IDU	Hetero/ Non-endemic	Hetero/Endemic	Other	
British Columbia	Point estimate	206	12	60	89	13	0	380
	Range	140–270	10–20	40–80	60–120	10–20	<10	260–500
	Row %	54.2	3.2	15.8	23.4	3.4		
Ontario <sup>b</sup>	Point estimate	690	35	85	270	320	0	1400
	Range	480–900	25–50	50–120	180–360	220–420	<10	1000–1800
	Row %	49.3	2.5	6.1	19.3	22.9		
Quebec	Point estimate	425	20	60	132	123	0	760
	Range	290–560	10–30	40–80	85–180	85–160	<10	520–1000
	Row %	55.9	2.6	7.9	17.4	16.2		
Saskatchewan <sup>c</sup>	Point estimate	11	6	175	36	2	0	230
	Range	<20	<10	120–230	20–50	<10	<5	160–300
	Row %	4.8	2.6	76.1	15.7	0.9		
Manitoba	Point estimate	28	2	14	49	22	0	115
	Range	20–40	<10	5–25	30–70	10–35	<10	80–150
	Row %	24.3	1.7	12.2	42.6	19.1		
Alberta	Point estimate	96	3	39	59	53	0	250
	Range	60–130	<10	20–60	40–80	35–70	<10	170–330
	Row %	38.4	1.2	15.6	23.6	21.2		
Atlantic provinces <sup>d</sup>	Point estimate	22	2	1	8	2	0	35
	Range	15–30	<10	<5	5–20	<10	<5	20–50
	Row %	62.9	5.7	2.9	22.9	5.7		

<sup>a</sup> Estimates are not shown for the North West Territories, Yukon and Nunavut due to high level of uncertainty and small numbers.

<sup>b</sup> These estimates were generated by Public Health Agency of Canada. The interpretation and conclusions contained herein do not necessarily represent the position of the Ontario Ministry of Health and Long-Term Care or Public Health Ontario. For the most recent estimates developed by Ontario, please refer to the Report on HIV/AIDS in Ontario, 2009 available at [www.ohemu.utoronto.ca/doc/2011/PHERO2009\\_report\\_preliminary.pdf](http://www.ohemu.utoronto.ca/doc/2011/PHERO2009_report_preliminary.pdf).

<sup>c</sup> This study was based in part on de-identified data provided by the Saskatchewan Ministry of Health. The interpretation and conclusions contained herein do not necessarily represent those of the Government of Saskatchewan or the Saskatchewan Ministry of Health.

<sup>d</sup> Atlantic provinces—Prince Edward Island, New Brunswick, Nova Scotia, Newfoundland and Labrador.

## HIV incidence rate among key populations

The estimated size of key affected populations in Canada are noted in Table 6, while Table 7 shows estimated HIV incidence rates for these key populations in Canada in 2011. The overall HIV incidence rate was 9.2 per 100,000 population (6.5–11.9 per 100,000). The all-age HIV incidence rate for Aboriginal people was 29.9 per 100,000, 3.6 times higher than the HIV incidence rate for people of other ethnicities. The all-age HIV incidence rate for people in Canada who originate from countries where HIV is endemic was 71.5 per 100,000 among all ages, 9.2 times higher than the rate for people born in Canada and other (non-endemic) countries. The all-age HIV incidence rate for males was 14.2 per 100,000 population, which was 3.3 times greater than the rate of 4.3 per 100,000 for females.

We estimated that, in 2011, there were 1,480 new HIV infections among men who have sex with men and 435 among people who inject drugs. We have made the assumption that these new HIV infections were among people aged 15 years and over because, within the available HIV surveillance data for the period 1985 to 2012, there were only four cases under the age of 15 years (out of the 23,160 reported cases) attributed to the MSM exposure category and two cases under the age of 15 years (out of the 7,278 reported cases) attributed to the IDU exposure category. Thus, using the estimated size of the MSM and IDU population, the 2011 HIV incidence rate for men who have sex with men aged 15 years or over was 443 per 100,000 population, 71 times higher than the HIV incidence rate for other men in the same age range. The 2011 HIV incidence rate for people who inject drugs aged 15 years or over was 431 per 100,000; 46 times higher than the rate among people who had never injected drugs in the same age range.

Table 6. Estimated size of key populations in Canada, 2011

Population	Estimated population size in Canada (range)	Estimated proportion of Canadian population (range)	Sources
Men who have sex with men (age 15 years and older)	369,500 (312,700–426,300)	2.6% (2.2%–3.0%)	Ref 12–15
Other men (aged 15 year and older)*	13,843,287	97.4%	
People who inject drugs (age 15 years and older)	112,900 (90,000–135,800)	0.39% (0.31%–0.47%)	Ref 14–18
People who do not injected drugs (age 15 years and older)**	28,736,169	99.6%	
Aboriginal people (all ages)	1,310,391	3.8%	Ref 10
People of other ethnicities (all ages)†	33,173,584	96.2%	
People from HIV-endemic countries (all ages)	758,647	2.2%	Ref 11
People born in Canada or non-endemic countries (all ages)‡	33,725,328		
Female (all ages)	17,377,018	50.4%	Ref 9
Male (all ages)	17,106,957	49.6%	Ref 9
<b>Total population (all ages)</b>	<b>34,483,975</b>	<b>100.0%</b>	<b>Ref 9</b>

\* The population of other men (aged 15 year or older) was calculated as the population of men who have sex with men (age 15 or older) subtracted from the overall Canadian male population (aged 15 year or older). Based on available reference information, the estimate for the population size of men who have sex with men accounts for recent sexual behaviour (i.e. preceding 12 months).

\*\* The population of people who do not inject drugs (aged 15 year and older) was calculated as the population of people who injected drugs (age 15 or older) subtracted from the overall Canadian population (aged 15 year or older). Based on available reference information, the estimate for the population size of people who inject drugs accounts for recent behaviour (i.e. preceding 12 months).

† The population of people of other ethnicities was calculated as the population of people identified as Aboriginal subtracted from the overall Canadian population.

‡ The population of people born in Canada or in non-endemic countries was calculated as the population of people born in HIV endemic countries subtracted from the overall Canadian population.

Table 7. Estimated HIV incidence number (range of uncertainty omitted), rate per 100,000, rate ratio for different sub-populations, by exposure category, ethnicity, origin and sex, Canada, 2011

Population	Estimated number of new HIV infections (range)	Estimated rate per 100,000 population (range)*	Rate ratio
Men who have sex with men (age 15 years and older)	1,480 (1060–1900)	443 (317–569)	71
Other men (aged 15 year and older)	860 (630–1090)	6.2 (4.5–7.9)	(Ref)
People who inject drugs (age 15 years and older)	435 (300–570)	431 (297–565)	46
People who do not injected drugs (age 15 years and older)	2,660 (1900–3420)	9.3 (6.6–11.9)	(Ref)
Aboriginal people (all ages)	390 (280–500)	29.9 (21.5–38.3)	3.6
People of other ethnicities (all ages)	2,785 (1970–3600)	8.4 (6.0–10.9)	(Ref)
People from HIV-endemic countries (all ages)	535 (370–700)	71.5 (49.5–93.6)	9.2
People born in Canada or non-endemic countries (all ages)	2,640 (1880–3400)	7.8 (5.6–10.1)	(Ref)
Male (all ages)	2,420 (1740–3100)	14.2 (10.2–18.2)	3.3
Female (all ages)	755 (510–1000)	4.3 (2.9–5.8)	(Ref)
<b>Total (all age)**</b>	<b>3175 (2250–4100)</b>	<b>9.2 (6.5–11.9)</b>	

Abbreviations: HIV, human immunodeficiency virus; IDU, injection drug use exposure category; MSM, men who have sex with men exposure category.

\* For calculation of estimated incidence rates in each key population, the numerator was the estimated number of new infection in the key population, and the denominator was the estimated the population size of the key population minus the people already infected with HIV in that key population.

\*\* Infections attributed to the MSM-IDU exposure category were not included in either MSM or IDU population estimates in the table. Therefore, the total of new infections in the MSM and Other men category did not equal the total of new infections among males (n = 2420). Similarly, the total of new infections in the IDU and non-IDU categories was not equal to the total of new infection in Canada in 2011 (n = 3175).

## DISCUSSION

Approximately 71,300 Canadians were estimated to be living with HIV infection at the end of 2011. The increase in the number of people living with HIV since 2008 is mainly due to the fact that new infections continue to occur each year, while new treatments have improved survival resulting in fewer HIV-related deaths. Modelling demonstrates that even with a 50% reduction in the HIV transmission rate within 10 years, prevalence would still increase by 20% by the end of the tenth year.<sup>20</sup> This illustrates the continued need to expand the reach and impact of HIV prevention and treatment efforts in Canada.

Globally, an estimated 34.0 million people were living with HIV at the end of 2011 and the estimated global HIV prevalence rate was 0.8% among people aged 15 to 49 years old. The burden of the epidemic varied considerably between countries.<sup>21</sup> In our estimation process, we did not break down our estimates by age group, however if we apply age-specific HIV diagnosis proportions to our prevalence point estimates, we can posit that the Canadian HIV prevalence rate for people aged 15 to 49 years old in 2011 was approximately 0.38% (range: 0.31% to 0.45%), which was about half the estimated global HIV prevalence rate for that age group<sup>20</sup> and was similar to that of France (0.4%) and Switzerland (0.4%), and slightly higher than the rates for the United Kingdom (0.3%) and Germany (0.2%) among the same age group.<sup>22</sup>

The estimated all-age HIV prevalence rate in Canada in 2011 was 208.0 per 100,000 population (range: 171.0 to 245.1 per 100,000 population) which was higher than that in the United Kingdom (150 per 100,000 for all ages in 2011)<sup>23</sup> and Australia (115 per 100,000 for all ages in 2011),<sup>24</sup> but less than half of the rate in the United States (453.4 per 100,000 population among age 13 years and over in 2009).<sup>25</sup>

In terms of exposure category, 46.7% of prevalent infections in Canada in 2011 were attributed to the MSM exposure category, 16.9% to the IDU exposure category, 32.5% to heterosexual contact, 3.0% to the MSM-IDU exposure category, and 0.8% to other exposures. This distribution was comparable with the exposure category distribution of prevalent cases in the United States in 2009 (51.6% MSM, 16.0% IDU, 26.8% heterosexual contact, 5.2% MSM-IDU and 0.4% others);<sup>25</sup> however, different distribution patterns were reported in other high-income countries. For example, in Australia, the MSM exposure category accounted for a higher proportion of total HIV infections and the IDU exposure category for a lower proportion of prevalent HIV cases compared with Canada's estimates.<sup>24</sup> In the United Kingdom, the MSM exposure category accounted for a similar proportion, the heterosexual contact for a higher proportion and the IDU proportion for a lower proportion compared with Canada's estimates.<sup>23</sup>

The estimated number of new HIV infections in 2011 in Canada was about the same as the estimated number for 2008. Over the past decade, the annual number of new HIV infections has remained relatively stable in Canada, which was very similar to the trend observed in France, the United Kingdom and the United States.<sup>23,24,26</sup> However, in Australia, the number of new HIV diagnoses in 2011 was 8.2% greater than the number in 2010 and the annual number of new HIV diagnoses has gradually increased over the past 12 years.<sup>24</sup>



With respect to exposure category among new infections in Canada in 2011, the greatest proportion was due to the MSM exposure category (46.6%), followed by heterosexual contact (37.2%) and IDU exposure (13.7%). Overall, the distribution of exposure categories among new HIV infections in Canada differed from other high-income countries. The proportion of new infections in Canada attributed to the MSM exposure category was similar to estimates in the United Kingdom (48%)<sup>23</sup> but lower than in the United States (60.9%)<sup>25</sup> and Australia (86%).<sup>24</sup> The proportion of new infections in Canada attributed to the IDU exposure category was higher than in all other high-income countries: the United States (9.4%), the United Kingdom (2.5%) and Australia (1%).<sup>23,24,26</sup> The proportion of new infections in Canada attributed to heterosexual contact was higher than in the United States of America (USA; 26.8%)<sup>26</sup> and Australia (10%),<sup>24</sup> and lower than in the United Kingdom (48%).<sup>23</sup>

HIV incidence rates varied substantially among key populations in Canada, with particularly high incidence among men who have sex with men and among people who inject drugs. A recent USA study found that estimated HIV new diagnosed rate among MSM was 67 times higher than the rate for other men<sup>27</sup> which is very comparable to our finding of an HIV incidence rate among MSM that was 71 times higher than the rate for other men.

We found that HIV incidence attributed to the MSM exposure category in Canada increased between 1999 and 2005, though it appears to have stabilized between 2005 and 2011. Resurgence of the HIV epidemic among gay, bisexual and other men who have sex with men is apparent in several high-income countries, however data on HIV incidence are not always available. As a proxy, we reviewed data on new HIV diagnoses. In the United Kingdom, new HIV diagnoses among MSM exposure have been increasing since 2007. Direct and indirect measures of HIV incidence in the United Kingdom show that the rate of HIV transmission in this population remains high.<sup>23</sup> Estimations of HIV incidence using a back-calculation analysis indicate that HIV transmission among MSM remained high with 2,300 to 2,500 new infections annually in England and Wales over the period 2001–10.<sup>28</sup> In the United States, the estimated number of new HIV infections in the MSM exposure category increased by a significant 12% increase between 2008 and 2010.<sup>26</sup> In Australia, MSM exposure continues to account for the majority of new HIV diagnoses; for example, the overall number of new diagnoses in this category was 3,189 in 2002 to 2006 and 3,526 in 2007 to 2011.<sup>24</sup> The increase in new HIV diagnoses among men who have sex with men may be related to increased high-risk behaviour associated with greater HIV transmission, increased HIV testing or a combination of both.

Over the past two decades, HIV incidence among the IDU exposure category has been decreasing gradually in Canada, although there have been some fluctuations. HIV diagnoses attributed to IDU exposure varies considerably across jurisdictions and over time in Canada. New HIV diagnoses among IDU in the province of Saskatchewan increased dramatically from 2004 to 2009 and stabilized since 2010.<sup>6</sup> Injection drug use is the predominant exposure category reported among Aboriginal people diagnosed with HIV in Canada, and this group accounts for the majority of new HIV diagnoses reported in Saskatchewan.<sup>6</sup> However, newly diagnosed HIV cases attributed to IDU exposure are declining in other Canadian jurisdictions,<sup>6</sup> a trend consistent with that reported in most high-income countries. The role of injection drug use in national epidemics in Western Europe and the United States has declined dramatically over time.<sup>21,29,30</sup>

## LIMITATIONS

The estimation process in Canada used a combination of methods and included data from a wide variety of sources. However, a number of limitations should be acknowledged. Incomplete information on exposure category in surveillance data may have caused misclassification when we redistributed newly diagnosed cases with missing information. Despite the use of multiple data sources to reduce the likelihood of bias, information on the size of key populations remained limited. There was particular uncertainty in denominator population estimates for behaviour-based populations such as men who have sex with men and people who inject drugs, due to several factors, including varying survey questions/criteria, potential under-reporting due to social desirability bias, etc. Furthermore, it was not possible to update population estimates for Aboriginal people or people from HIV-endemic countries, as 2011 National Household Survey data were not yet available.

Despite the limitations noted, these estimates are generated from robust methodology applied in previous HIV incidence and prevalence estimation processes.<sup>2</sup> The results portray a plausible picture of the current epidemic in Canada and provide a solid foundation to inform and guide the development of HIV/AIDS programs.

It is worthwhile to point out that the national estimates do not necessarily reflect local trends in HIV prevalence and incidence. For example, while new HIV diagnoses attributed to the IDU exposure category are gradually declining in the majority of jurisdictions, the province of Saskatchewan has seen a substantial increase in recent years<sup>6</sup>. Overall estimates may mask regional and/or population-specific trends; in addition, they also do not specifically address all populations affected by the HIV/AIDS epidemic in Canada.

## CONCLUSION

Over the past decade, the annual number of new HIV infections has remained relatively stable in Canada. However, new HIV infections continue to occur at an unacceptably high level, particularly among certain key populations. The incidence rates among men who have sex with men and among people who inject drugs were 71 and 46 times higher than the rates among their corresponding counterparts, respectively. Aboriginal people and people from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic.

These findings highlight the continued need for specific measures to address unique aspects of the HIV epidemic within certain key populations. For example, HIV transmission appears to vary by population: IDU exposure is the main mode of transmission among Aboriginal people, heterosexual contact is predominant among women and people from HIV-endemic countries and most new HIV infections among men continue to be attributable to male-to-male sexual exposure.

To successfully control the HIV epidemic in Canada, we need effective strategies that reach key populations affected by HIV/AIDS. Continued availability and improved quality of HIV/AIDS surveillance data remains essential to better understand and monitor the full scope of the HIV epidemic in Canada.



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