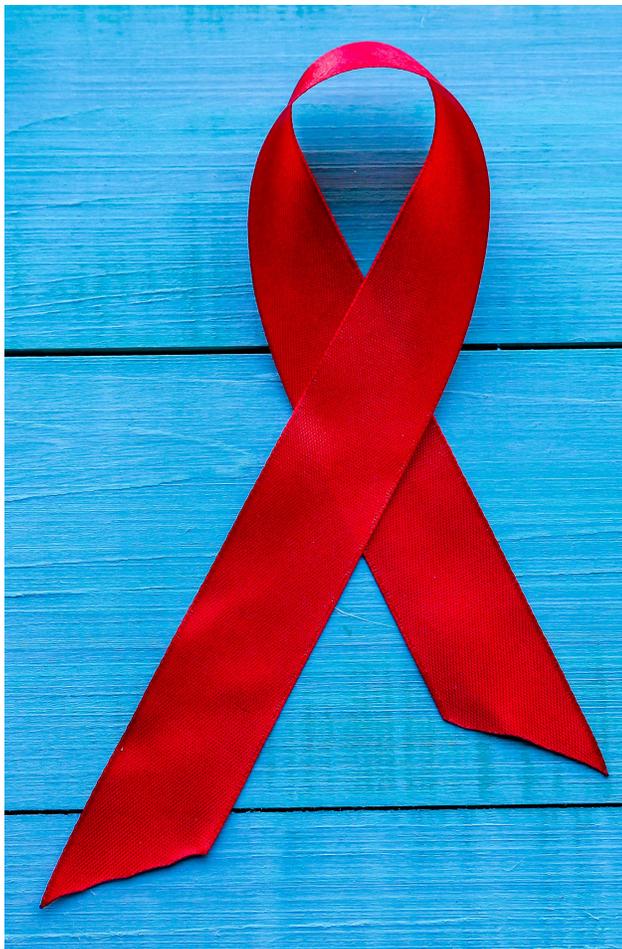


CCDR

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CCDR

CANADA COMMUNICABLE DISEASE REPORT

The *Canada Communicable Disease Report* (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authoritative and practical information on infectious diseases to clinicians, public health professionals, and policy-makers to inform policy, program development and practice.

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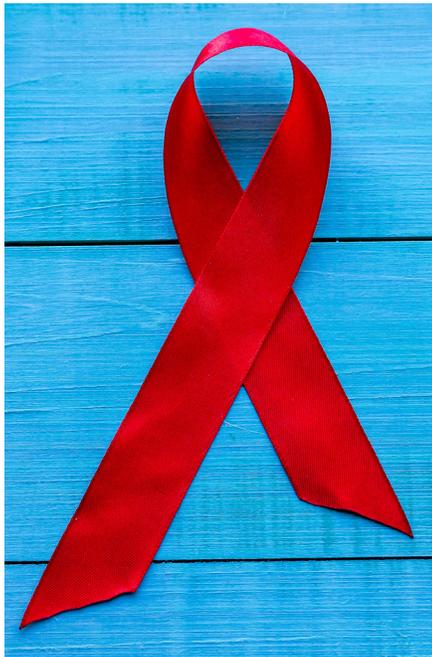
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HIV in Canada—Surveillance Report, 2016

AC Bourgeois¹, M Edmunds¹, A Awan^{1,2}, L Jonah¹, O Varsaneux¹, W Siu¹

Abstract

Background: Human immunodeficiency virus (HIV) continues to be a global public health concern, with 2.1 million people newly infected in 2015. Although many high-income countries have noted decreasing rates of HIV, between 2013 and 2015 Canada's rates had stabilized at 5.8 per 100,000 population.

Objective: To provide a descriptive overview of reported cases of HIV in Canada up until 2016 by geographic location, sex, age group, exposure category and race/ethnicity, with a focus on the most recent data.

Methods: The Public Health Agency of Canada (PHAC) monitors HIV through the national HIV/AIDS Surveillance System (HASS), Immigration, Refugees and Citizenship Canada (IRCC), and the Canadian Perinatal HIV Surveillance Program (CPHSP). HASS is a passive, case-based system that collates non-nominal data voluntarily submitted by all Canadian provinces and territories. Data were also received from the IRCC and the CPHSP. Data were collated, tables and figures were prepared, then descriptive statistics were applied by PHAC and validated by each province and territory.

Results: A total of 2,344 new diagnoses of HIV were reported in 2016 in Canada, with a cumulative total of 84,409 cases since 1985. The national diagnosis rate increased from 5.8 per 100,000 population in 2015 to 6.4 per 100,000 population in 2016. Saskatchewan reported the highest provincial diagnosis rate in 2016 (15.1 per 100,000 population). In 2016, 76.6% of reported HIV cases were among males. Adults aged 30-39 years old accounted for 28.7% of all reported cases. There was a similar age distribution of HIV cases between sexes with notable increases in the proportion of the 50 years and over age group over the past five years. The "men who have sex with men" exposure category continued to represent the largest number and proportion of all reported HIV cases in adults (44.1%). White (40.4%), Black (21.9%) and Indigenous (21.2%) race/ethnicity categories represented the largest proportions of cases.

Conclusion: In 2016, Canada saw a slight increase in the number and rate of reported HIV cases compared with previous years. Although the diagnostic rate was lower than in all years prior to 2012, it is the highest of the past five years. While a number of possibilities exist to explain this increase, further investigation and additional data are needed in order to determine the cause and significance.

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Introduction

Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) are a continuing international epidemic. Though there has been tremendous progress in international efforts to end the HIV/AIDS epidemic over the last 15 years (1), an estimated 2.1 million new (incident) cases were reported in 2015 (2). Despite this, the number of new HIV cases in high-income countries is relatively low with an average diagnostic rate of 6.3 per 100,000 for the Organisation for Economic Co-operation and Development (OECD) countries included in the 2014 HIV and AIDS surveillance report (3). While Canada's rate of new diagnoses is lower than the average of OECD countries, it still lags behind other countries such as the Netherlands, Germany, Sweden and Finland.

The Public Health Agency of Canada (PHAC) works in partnership with provincial and territorial governments, other federal departments and non-governmental organizations to address HIV/AIDS in Canada, contribute to the global efforts to eliminate HIV/AIDS, and monitor progress towards Canada's *Federal Initiative to Address HIV/AIDS*. The annual publication of HIV surveillance data is part of PHAC's mandate to collect, analyze and report on surveillance data at the national level (4).

The objective of this report is to provide a descriptive overview of the epidemiology of all reported diagnoses of HIV in Canada up to 2016 by geographic location, sex, age group, exposure category and race/ethnicity, as well as data on the number of infants perinatally exposed to HIV and the proportion of these infants receiving antiretroviral therapy (ART). In the past, HIV



data, in combination with AIDS surveillance data, were published annually by PHAC in a stand-alone report entitled *HIV and AIDS in Canada—Surveillance Report* (3). This is the first iteration of the report to be published under a new title in the *Canada Communicable Disease Report* (CCDR). Note that a separate surveillance report for 2016 AIDS cases also appears in this issue of CCDR (5). The data in these reports replace all previously published data in the HIV and AIDS surveillance series as they represent the most recent information available. Supplementary information, including data tables and exposure category definitions are available online in a web supplement on the CCDR website (6).

Methods

Data used to prepare this HIV surveillance report came from three different sources: the national HIV/AIDS Surveillance System (HASS) maintained by PHAC, the data collected through immigration medical screening for HIV by Immigration, Refugees and Citizenship Canada (IRCC) and the Canadian Perinatal HIV Surveillance Program (CPHSP).

HIV/AIDS Surveillance System

HASS is a passive, case-based surveillance system that collates non-nominal data on people diagnosed with HIV infection. Details on HASS's methods, including data collection processes, data management, data quality control, analysis and the classification and categorization of population subgroups have previously been described (3). In short, data, including but not limited to, age, sex, race/ethnicity and risks associated with the transmission of HIV (exposure categories) are voluntarily submitted to PHAC from all provincial and territorial public health authorities. Several limitations are present with regards to race/ethnicity and exposure category data submitted by the provinces. In particular, Quebec does not submit exposure category or race/ethnicity information for HIV cases to PHAC. For Ontario, limited exposure category information was available for reported HIV cases before 2009 and no race/ethnicity data were available for reported HIV cases before 2009. Race/ethnicity data for British Columbia were not submitted for the current reporting year and all historic ethnicity data have been removed at their request pending a review of reporting practices of these data.

Cases reported to PHAC must meet the national case definition (7). Provinces and territories provide data through the *National Case Reporting Form* (3) or through a secure electronic dataset transmission. All raw data (paper forms and electronic datasets) are retained in compliance with the *Directive for the collection, use and dissemination of information relating to public health* (PHAC, 2013, unpublished document). Assessment of the quality of data, such as the detection of duplicate entries, is handled by the provinces and territories prior to submission to PHAC. The data presented in this surveillance report represent HIV cases diagnosed on or before December 31, 2016 that were submitted by provincial and territorial surveillance programs to PHAC up to June 7, 2017.

In this surveillance report, the term "cases" or "reported cases" refers to individuals diagnosed by a province or territory in

a given year and reported to PHAC. Since surveillance data describe only the diagnosed portion of the epidemic, statistical modelling and additional sources of information are used to produce estimates that describe the overall HIV epidemic in Canada, including people with diagnosed and undiagnosed HIV infection (8).

Immigration medical screening for HIV

All foreign nationals applying for permanent residence and some applying for temporary residence must undergo an immigration medical examination (IME), either in Canada or overseas administered by the IRCC. The IRCC conducts mandatory routine HIV screening on all applicants 15 years of age and older, as well as those under the age of 15 who have certain risk factors (9). The IRCC provides PHAC with non-nominal data collected during the IME, including demographic information as well as the year of testing (for those tested in Canada) or the year the applicant landed in Canada (for those tested overseas). Data relating to HIV diagnosed through an IME were extracted in January 2017; however, due to reporting delays only data up to the end of 2015 were provided.

Canadian Perinatal HIV Surveillance Program

National data on the HIV status of infants exposed perinatally to HIV infection are collected through the CPHSP, an initiative of the Canadian Pediatric AIDS Research Group (CPARG). The CPHSP is a sentinel-based surveillance system that collects data on all identified infants and children in Canada born to mothers who are known to be infected with HIV, including those born outside Canada who are receiving care for HIV infection. Data were obtained through a national, non-nominal, confidential survey of infants known to participating pediatricians in tertiary care centres and specialists in HIV clinics across Canada. Additional information on CPHSP methodology has been described previously (3). The data relating to perinatal surveillance until the end of 2016 presented in this surveillance report were extracted from CPHSP's database in July 2017.

Analysis

Microsoft Excel 2010 and SAS Enterprise Guide (SAS EG) v5.1 software were used for data cleaning and analysis. Standardized data recoding procedures were applied to all submitted provincial and territorial datasets to create a national dataset for analysis. No statistical procedures were used for comparative analysis, nor were any statistical techniques applied to account for missing data. It is worth noting that different HIV reporting requirements and practices exist across the country (10) and that completeness of some epidemiological information varies between provinces and territories; as such, when percentages were calculated, missing data were excluded.

The term "adult" is used throughout the report when examining specific variables such as exposure category. For the purposes of this report, an "adult" is anyone aged 15 years or older.

With the exception of cases where data suppression was requested by the province or territory, data in tables with small cell sizes ($n \leq 5$) were not suppressed, since disclosure is not deemed to pose any risk of identifying individual cases. These

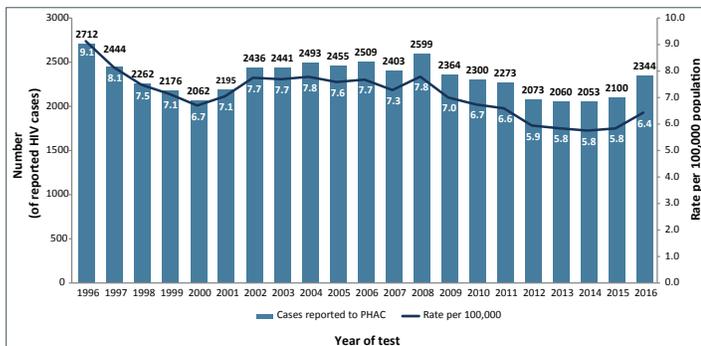


procedures are in line with PHAC's Directive for the collection, use and dissemination of information relating to public health. The data were verified by the provinces and territories to ensure accuracy. Key findings are summarised in this manuscript. Additional tables can be found in the web supplement (6).

Results

A total of 2,344 new cases of HIV were reported in Canada in 2016, representing an 11.6% increase from the number of cases reported in 2015 (2,100 cases). This is the highest number of annual HIV cases reported since 2009 (2,364 cases) and corresponds to an increase in the national diagnosis rate from 5.8 per 100,000 population in 2015 to 6.4 per 100,000 population (Figure 1).

Figure 1: Number of reported HIV cases, including diagnostic rate, by year of test—Canada, 1996-2016



Abbreviation: PHAC, Public Health Agency of Canada
Disaggregated data by year are not available before 1995 for some jurisdictions

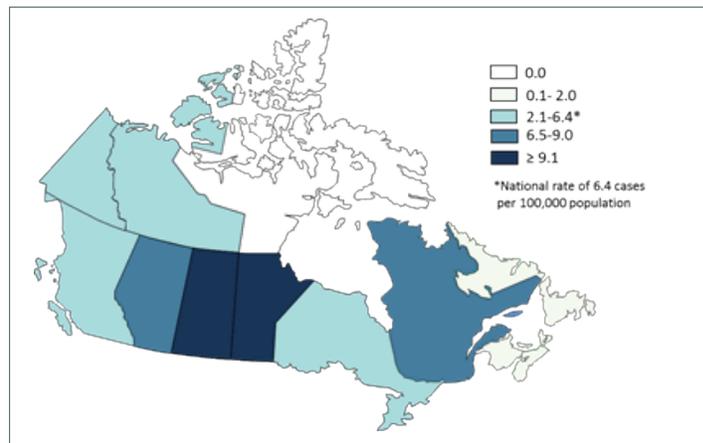
In Canada, a cumulative total of 84,409 cases of HIV have been reported to PHAC since HIV reporting began in 1985. A steady decrease of reported HIV cases was observed up until the year 2000 (2,062 cases) and then a short rise until a plateau from 2002 to 2008, when the annual number of reported HIV cases fluctuated between 2,403 and 2,599. The number of reported HIV cases then gradually declined from 2008 to 2014, followed by an increase in 2015 and 2016.

Geographic distribution

In 2016, Ontario accounted for the highest number and proportion of reported HIV cases (n=881, 37.6%), followed by Quebec (n=593, 25.3%) and Alberta (n=282, 12.0%).

The provincial and territorial HIV diagnosis rates reveal notable variations across the country. In 2016, Saskatchewan, which accounted for 7.4% (n=174) of the total reported new HIV cases, continued to have the highest diagnosis rate of HIV at 15.1 per 100,000 population, more than double that of the overall Canadian rate. Manitoba, representing 5.4% (n=126) of the 2016 HIV cases, accounted for the next highest diagnosis rate of HIV at 9.5 per 100,000 population, followed by Quebec (7.1 per 100,000 population) and Alberta (6.6 per 100,000 population). The diagnosis rates in all other provinces and territories were below the national rate of 6.4 per 100,000 population (Figure 2, Supplementary Tables 1-3) (6).

Figure 2: HIV diagnosis rate (per 100,000 population) by province and territory—Canada, 2016



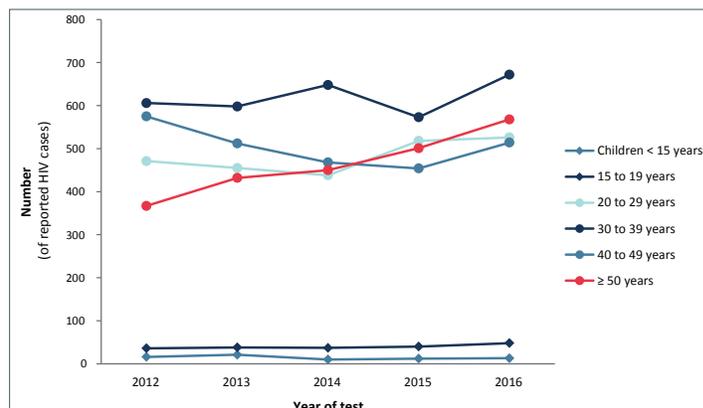
Population data source: Annual Demographic Statistics, Demography Division, Statistics Canada, October 2016

Age group and sex distribution

Data on age groups were available for 99.9% of reported HIV cases for 2016. Since 1985 in Canada, 37.2% of reported HIV cases have been diagnosed among people 30-39 years old. In 2016, those 30-39 years old still represented the group with the most new HIV cases (28.7%) but at a lower proportion than previous years. Cases 30-39 years old experienced the highest increase from 2015 to 2016 at 17.3%, followed closely by those 50 years of age or older at 13.4%.

For the past five years, the largest increase with respect to the proportion of HIV cases by age was observed in cases 50 years of age and older, increasing 6.6% from 2012 to 2016 (17.7% to 24.3%). The largest decline was found among those 40-49 years old, decreasing 5.8% from 2012 to 2016 (27.8% to 22.0%). Youth aged 15-19 years old represented 2.1% of cases in 2016. This group has experienced a small but steady increase in the number of HIV cases reported for the past five years, while HIV cases reported in children (<15 years of age) has remained fairly consistent over the same time period when compared with all other age groups (Figure 3; Supplementary Tables 3,6) (6).

Figure 3: Proportion of reported HIV cases by age group and year of test—Canada, 2007-2016





Data on sex were available for 99.6% of reported HIV cases in 2016. In Canada, males have consistently accounted for a larger percentage of reported HIV cases than females. Over the past decade, the annual proportion of reported HIV cases among female adults (≥ 15 years) has remained stable at approximately one quarter of new cases. This trend was also observed in 2016 with females comprising 23.3% of all reported cases (Supplementary Tables 2, 4-6) (6).

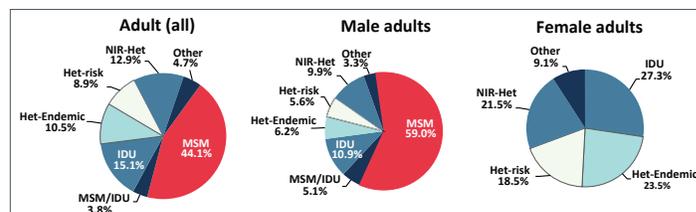
Over the past few years there have been increases in the proportion of HIV cases in the older age groups for both sexes. This trend continued in 2016, with a large proportion of cases aged 50 years and older for both sexes, specifically 25.6% in males and 20.3% in females (Figure 4). There has also been a shift over time in the age distribution for both sexes. While historically, HIV cases have been more frequent in younger age groups for females and older age groups for males, there has been an 11.3% decrease among females aged 20–29 and an increase of 7.5% in the corresponding male age group since 2001. In both sexes, cases aged 30–39 were still the highest proportion of HIV cases accounting for 27.7% and 31.8% of males and females respectively in 2016 (Figure 4).

Exposure category distribution

The “men who have sex with men” (MSM) exposure category continued to represent the largest number and proportion of all reported HIV cases in adults. In 2016, among adults whose exposure category was known (61.6% of all cases), slightly less than half (44.1%) were attributed to the MSM exposure category. The second highest reported exposure category was heterosexual contact (32.3%), with a fairly even distribution of HIV cases attributed to heterosexual contact among people

born in a country where HIV is endemic (Het-Endemic, 10.5%), heterosexual contact with a person at-risk (Het-Risk, 8.9%) and heterosexual contact with no identified risk (NIR-Het, 12.9%). The third-most frequently reported exposure category among adults was injection drug use (IDU), accounting for 15.1% of reported HIV cases (Figure 5, Supplementary Table 7) (6). No major changes in the proportions in exposure categories were noted between 2015 and 2016.

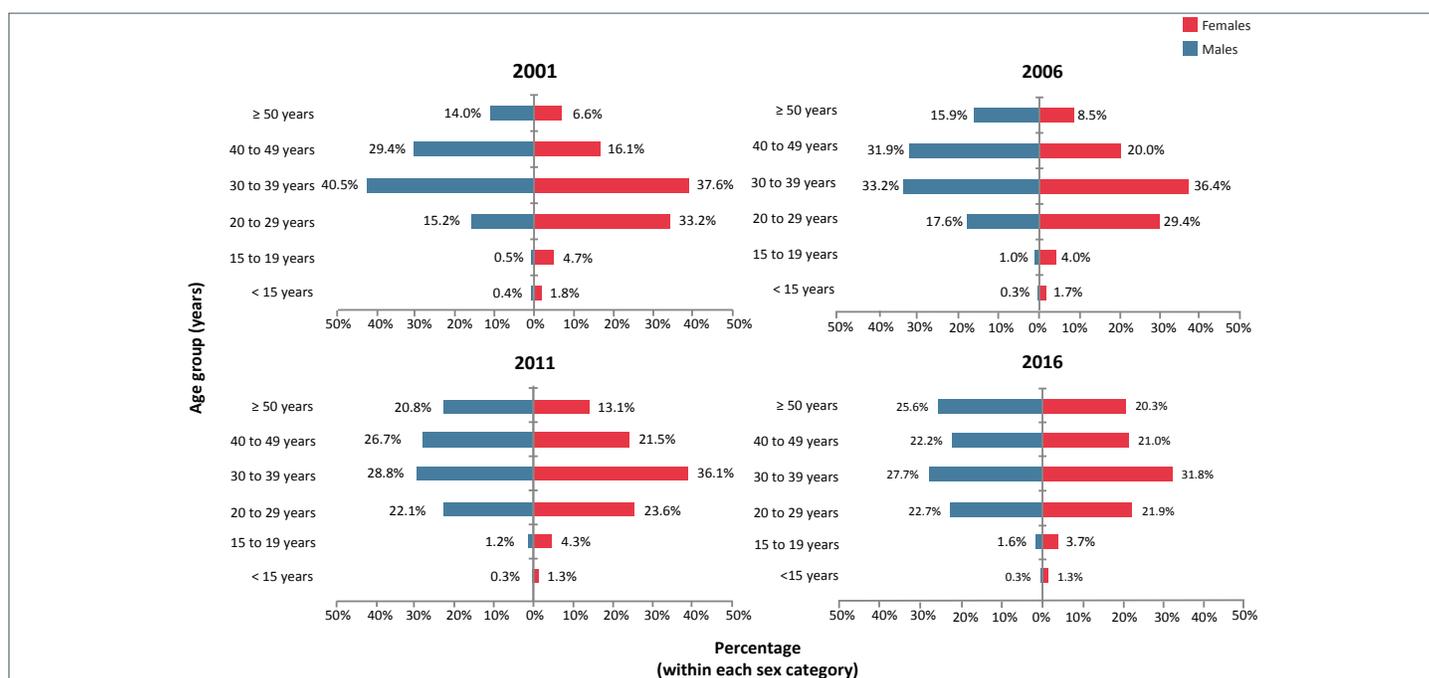
Figure 5: Proportion of reported HIV cases among all adults (≥ 15 years old), adult males and adult females by exposure category—Canada, 2016^{1,2}



Abbreviations: Het-Endemic, heterosexual contact among people born in a country where HIV is endemic; Het-Risk, heterosexual contact with a person at-risk; IDU, injection drug use; MSM, men who have sex with men; MSM/IDU, men who have sex with men and use injection drugs; NIR-Het, heterosexual contact with no identified risk
¹ Percentages are based on the total number of reported cases excluding “NIR” and “not reported” cases. Note that exposure category data were not available for Quebec. Both male and female charts exclude HIV cases where sex was not reported or reported as transsexual or transgender
² “Other” includes recipient of blood/clotting factor, unspecified exposure routes listed as “other” and Alberta, cases identified as “out of country”

The distribution of HIV cases among adult males and females varied with respect to exposure category. In 2016, the MSM exposure category continued to account for the greatest

Figure 4: Age group distribution of reported HIV cases by sex—Canada, 2016¹



¹ Denominators used to calculate percentages exclude “sex not reported/transsexual/transgender” and “age group not reported”

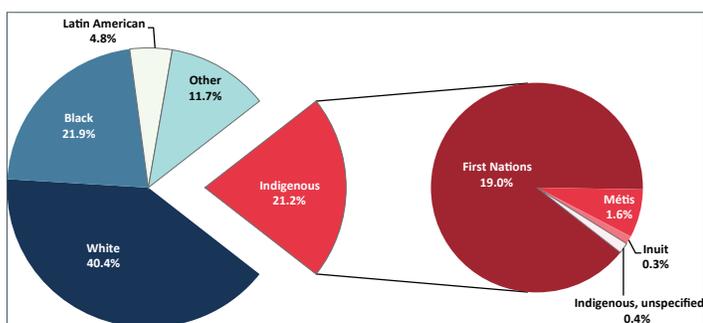


proportion (59.0%) of reported HIV cases among adult males, followed by any type of heterosexual contact (21.6%) and IDU (10.9%). Among adult females, heterosexual contact accounted for 63.5% of reported cases (23.5% Het-Endemic, 21.5% NIR-Het and 18.5% Het-Risk), followed by IDU (27.3%). With respect to heterosexual contact, there was a substantial difference between males and females in the Het-Endemic exposure category. Het-Endemic cases among males accounted for 6.2% compared with 23.5% among females. The IDU exposure category accounted for slightly over one-quarter of adult female HIV cases (27.3%), compared with 16.0% of adult male HIV cases (10.9% via IDU exposure and up to 5.1% in the MSM/IDU exposure category (Figure 5, Supplementary Tables 8–11) (6).

Race/ethnicity distribution

In 2016, information on race/ethnicity was available for nearly half (48.6%) of reported HIV cases. Since 1998, when race/ethnicity data were first collected, the White race/ethnicity has accounted for the largest proportion of new HIV cases in Canada for all ages and sexes (44.4%). In 2016, less than half of the reported HIV cases with a known race/ethnicity were White (40.4%), followed by Black (21.9%) and Indigenous (21.2%). The Indigenous race/ethnicity was further broken down to 19.0% First Nations, 1.6% Métis, 0.4% Indigenous-unspecified and 0.3% Inuit. Between 2015 and 2016 the First Nations race/ethnicity subgroup experienced the largest increase (29.9%) in case counts of all reported races/ethnicities and Indigenous subgroups (Figure 6, Supplementary Table 12) (6).

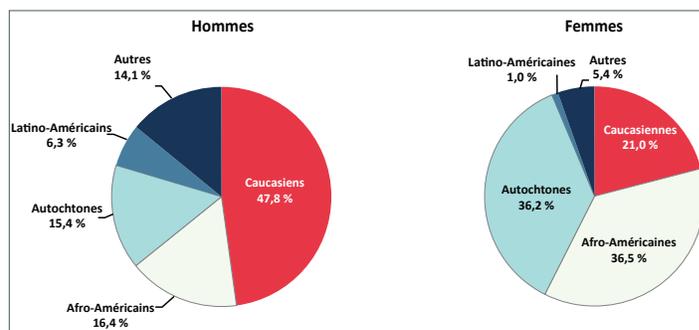
Figure 6: Proportion of reported HIV cases (all ages) by race/ethnicity (including the Indigenous subgroups)—Canada, 2016 1,2,3,4



¹ Race/ethnicity information was not available for Quebec and British Columbia
² Excludes cases where race/ethnicity was not reported
³ Latin American includes, for example, Mexican, Central American and South American
⁴ Other includes, for example, Pakistani, Sri Lankan, Bangladeshi, Armenian, Egyptian, Iranian, Lebanese, Moroccan, Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Laotian, Korean, Filipino, Somali, Haitian and Jamaican

Variations were also observed in the race/ethnicity distribution by sex. In 2016, the majority of reported cases among males were of White race/ethnicity (47.8%), followed by Black (16.4%) and Indigenous (15.4%). By comparison, just over one-third of females were identified as Black (36.5%), followed by Indigenous (36.2%) and White (21.0%) (Figure 7, Supplementary Tables 13,14) (6).

Figure 7: Proportion of reported HIV cases (all ages) by sex and race/ethnicity—Canada, 2016 1,2,3,4

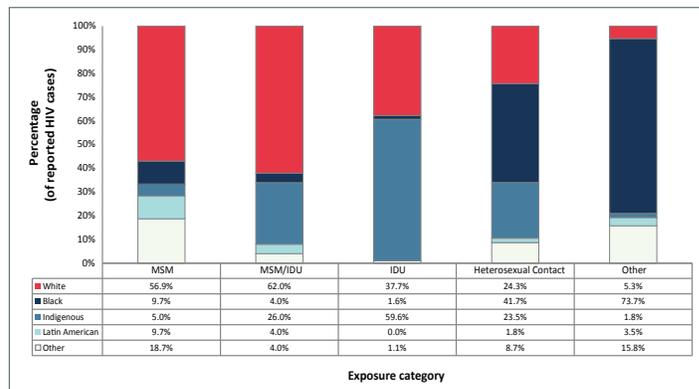


¹ Race/ethnicity information is not available for Quebec and British Columbia
² Denominators used to calculate percentages exclude HIV cases where race/ethnicity was "not reported" and HIV cases where sex was "not reported" or "reported as" transsexual or transgender
³ Latin American includes, for example, Mexican, Central American and South American
⁴ Other includes, for example, Pakistani, Sri Lankan, Bangladeshi, Armenian, Egyptian, Iranian, Lebanese, Moroccan, Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Laotian, Korean, Filipino, Somali, Haitian and Jamaican

Race/ethnicity and exposure category distribution

Information on both race/ethnicity and exposure category was available for 47.4% of reported cases in 2016. In 2016 the majority of cases were reported as White within the MSM exposure category (56.9%). Of the cases attributed to IDU, almost all of the HIV cases were either Indigenous (59.6%) or White (37.7%). The main racial/ethnic group among reported cases attributed to heterosexual contact was Black (41.7%), 84.3% of whom were reported as Het-Endemic exposure (Figure 8, Supplementary Table 15) (6).

Figure 8: Proportion of reported HIV cases (all ages) by exposure category and race/ethnicity—Canada, 2016 1,2,3,4,5



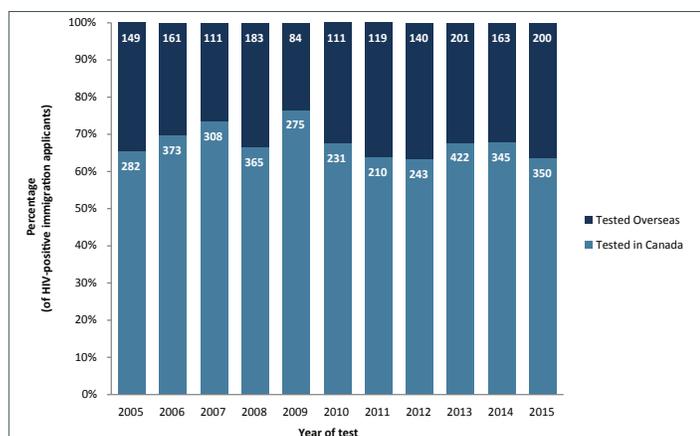
Abbreviations: IDU, injection drug use; MSM, men who have sex with men; MSM/IDU, men who have sex with men and use injection drugs
¹ Race/ethnicity information is not available for Quebec and British Columbia
² Excludes HIV cases where race/ethnicity or exposure category was "not reported"
³ Latin American includes, for example, Mexican, Central American and South American
⁴ Other race/ethnicity includes, for example, Pakistani, Sri Lankan, Bangladeshi, Armenian, Egyptian, Iranian, Lebanese, Moroccan, Chinese, Japanese, Vietnamese, Cambodian, Indonesian, Laotian, Korean, Filipino, Somali, Haitian and Jamaican
⁵ Other exposure category includes recipient of blood/clotting factor and unspecified exposure routes listed as "other"



Immigration medical screening for HIV

In 2015, there were 550 applicants for Canadian residency who tested positive for HIV. Of the 550, 350 underwent an IME in Canada and 200 underwent an IME overseas. Note that the data do not distinguish between those who eventually established residency in Canada and those who did not (Figure 9, Supplementary Table 16) (6).

Figure 9: Proportion of HIV-positive immigration applicants by testing location and year of test, 2005–2014^{1,2}



¹ Immigration, Refugees and Citizenship Canada, IRCC HIV Database as of July 2017. Immigration, Refugees and Citizenship Canada, IRCC HB Post-Arrival Health Public Health Liaison Unit Provincial Notifications - Overseas Notifications Database as of July 2017. Reproduced and distributed with the permission of Immigration, Refugees and Citizenship Canada

² For applicants tested in Canada, the year refers to the year of the test. For applicants tested overseas, the year refers to the year the applicant landed in Canada

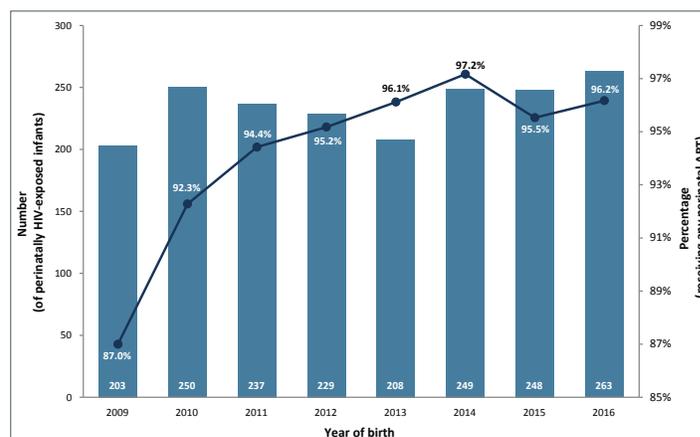
Of applicants who underwent an IME in Canada from 2002 to 2015, a total of 4,364 were diagnosed with HIV infection, at an average of 312 diagnoses per year (range: 210 to 422). In total, 57.1% of these HIV-positive applicants were male. The majority of all applicants who tested positive in Canada were either in the 30–39 years old (41.9%) or 40–49 years old (25.0%) age group. The greatest proportion of these HIV-positive applicants were tested in Ontario (54.7%), Quebec (25.2%), British Columbia (8.7%) and Alberta (7.6%) (Supplementary Table 17) (6).

Of applicants screened overseas from 2005 to 2015 who landed in Canada, 1,622 were diagnosed with HIV infection, at an average of 147 per year (range: 84 to 201). Just over half (51.4%) were female. The majority (40.0%) were 30 to 39 years old, followed by those 20 to 29 years old (25.3%). Ontario was the most common intended province of residence (33.4%), followed by Quebec (25.0%), Alberta (14.4%), British Columbia (12.9%) and Manitoba (8.7%). Among these HIV-positive applicants, 72.1% were born in HIV-endemic countries (Supplementary Table 17) (6).

Canadian Perinatal HIV Surveillance Program

From 1984 to 2016, 4,849 infants in Canada were identified as being perinatally-exposed to HIV. The number of HIV-exposed infants reported per birth year between 2009 and 2016 fluctuated from a low of 203 in 2009 to a high of 263 in 2016 (Figure 10, Supplementary Table 18–22) (6).

Figure 10: Number of perinatally HIV-exposed infants and proportion of perinatally HIV-exposed infants receiving perinatal antiretroviral therapy by year of birth—Canada, 2009–2016



Abbreviation: ART, antiretroviral therapy

Of the 263 perinatally-exposed infants born in 2016, one HIV transmission was confirmed in a mother not receiving any perinatal antiretroviral therapy (ART). The percentage of HIV-positive mothers receiving ART has increased over time and has been fairly stable since 2011, ranging between 94.4% (2011) to 97.2% (2014); in 2016, the percentage was slightly lower than 2014 at 96.2% (Figure 10, Supplementary Table 18) (6).

A review of all perinatally-exposed infants from 1984 to 2016 showed that 73.8% were born to mothers who acquired HIV infection through heterosexual contact (71.0% in 2016) and 22.8% were attributed to IDU exposure (22.3% in 2016) (Supplementary Table 19) (6).

With respect to the race/ethnicity distribution of perinatally-exposed infants from 1984 to 2016, 49.8% were reported as Black, 23.8% as White and 17.8% as Indigenous. In 2016, the Black race/ethnicity remained the most frequently reported race/ethnicity with a proportion (48.7%) similar to that seen in 1984–2016. The proportion of infants of Indigenous race/ethnicity has progressively increased reaching a high of 25.5% in 2016 and the proportion of infants of White race ethnicity has decreased to a low of 11.8% (Supplementary Table 20) (6).

Maternal region of birth for the majority of infants from 1984–2016 was North America (42.4%), Africa (38.2%) or the Caribbean (9.8%) (Supplementary Table 21). For the same time period, the highest proportion of perinatally HIV-exposed infants was reported in Ontario (34.6%), followed by Quebec (25.7%) and Alberta (14.1%) (Supplementary Table 22) (6).

Discussion

In 2016, there was an 11.6% increase in the number of HIV diagnoses compared with 2015 and this represents the highest rate since 2011. A number of possibilities exist to explain this increase in cases including increased testing due to the implementation of provincial testing initiatives (11–13).



The majority of increases were observed in Quebec, Alberta, Manitoba and Ontario although, overall, Saskatchewan had the highest absolute rate. Across age, sex and race/ethnicity, the greatest increases were observed among those 30–39 years old, the adult male sex and First Nations ethnicity respectively. It is also important to note that for Quebec, the reported increase can in part be explained by a partial shift in 2016 to nominal testing from non-nominal testing as non-nominal cases were not all previously captured for federal reporting.

At the national level, the differences previously observed between the age distribution of males and females have been reduced over the past five years, resulting in a similar age distribution between sexes for 2016. This effect is due to increased proportions diagnosed within older age groups for both sexes. The proportion of HIV diagnoses among Canadians 50 years and older has been increasing gradually since 1985. It is possible that the observed change has been driven by a population with unique risk factors such as higher proportions of widowed and divorced people engaging in new relationships, lower proportions of protected sex due to lack of pregnancy concerns, and a stronger stigma associated with discussion of sexual and drug habits with doctors in this older age group (14).

At the national level, differences continued to be observed between males and females with respect to exposure category and race/ethnicity distribution. Men who have sex with men, the most frequent exposure category in males, was associated with the White race/ethnicity, while heterosexual contact and IDU, the two most predominant exposure categories in females, were associated with people of Black and Indigenous races/ethnicities respectively. Although the White race/ethnicity was the most common racial/ethnic group, both Indigenous and Black people were disproportionately represented as they each make up less than 5% of the population in Canada (15,16), but account for more than 20% individually of the newly reported HIV cases. Of note, however, ethnicity data were available in only about half of reported cases.

Trends in exposure category have shifted since HIV reporting began in 1985. In the early stages of the epidemic, over 80% of all reported HIV cases with known exposure category were attributed to MSM and although this exposure category is still predominant in Canada, the proportion has decreased over the years. Heterosexual contact and IDU exposure remained the second and third most predominant HIV exposure categories in Canada respectively.

Strengths and limitations

The 2016 *HIV in Canada – Surveillance Report* is the primary source of national data on reported new HIV cases in Canada. The data contained within this report provide information for policy and program development and assessment, as well as public health action. While details regarding the data limitations of HASS have been previously published (3), several limitations should be highlighted. First, data in this report are deemed provisional and may be subject to change in future HIV surveillance reports, as data are updated. Differences between the data published in this report and the data issued in previous national, provincial and territorial surveillance reports may be due to reporting delays or differences in when the data were

extracted from the various surveillance databases. Where such differences are noted, it is recommended that data from the most recent provincial and territorial reports be used.

Second, HASS is a passive, case-based surveillance system that collates data submitted voluntarily to PHAC, on a yearly basis, from all provincial and territorial public health authorities, as opposed to active case solicitation. As a result, it is difficult to ascertain whether all individuals with HIV infection are being identified and reported. The accuracy of the data is partially a function of timely reporting and updates to PHAC from the provinces and territories. Some degree of lag does occur, creating a reporting delay. In addition, reporting of HIV cases for individuals younger than two years of age and those diagnosed prior to immigration also varies among provinces and territories. Occasionally there can be changes to provincial reporting practices which can impact the data.

Third, the identification and removal of duplicate reports of new diagnoses is difficult due to the non-nominal nature of HIV reporting in some jurisdictions. Where possible, provinces and territories review and assess the inclusion of duplicate reports in order to provide as accurate a picture as possible of the number of new individuals who have tested positive for HIV. Some provinces (e.g., Quebec), take a conservative approach to removing potential duplicates, including the exclusion of results from anonymous tests. For jurisdictions that use such an approach, the data presented in this report reflect the minimum number of new HIV diagnoses in that jurisdiction.

Fourth, across the provinces and territories, there is no standardized approach to the handling of HIV cases previously diagnosed out of country or out of province/territory, with some provinces and territories counting them as new cases and others excluding them. Additionally, varying approaches are also applied to HIV diagnoses under the age of two. As a result of both of these, there exists the possibility for small over- or under-reporting of new diagnoses depending on the provincial/territorial rules.

Finally, there are several limitations associated with the reporting of exposure category and race/ethnicity. As noted, little to no exposure category or race/ethnicity information for HIV cases is available from Quebec and Ontario, and no race/ethnicity information is available from British Columbia. Therefore national trends presented in this report may not be fully representative and must be interpreted with caution.

Conclusion

Canada experienced an increased number and rate of reported HIV cases in 2016. Although this diagnostic rate was lower than in all years prior to 2012, it is the highest of the past five years. Further investigation and additional data are needed to determine the significance and cause of this increase. PHAC will continue to collect and report on HIV surveillance data to observe trends and monitor progress toward the goal of reducing the burden of HIV infection in Canada and internationally.



Authors' statement

ACB—conceptualization, writing—original draft, review and editing, supervision
 ME—methodology, writing—original draft, review and editing, software, validation, data curation, visualization
 LJ—software, validation, data curation, writing—review and editing
 AA—writing—original draft preparation, visualization
 OV—writing—review and editing, visualization
 WS—writing—review and editing, project administration, supervision

Conflict of Interest

None.

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AIDS in Canada—Surveillance Report, 2016

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Abstract

Background: Although there continues to be a global epidemic of people living with human immunodeficiency virus (HIV) there has been a decrease in the number of people dying of acquired immunodeficiency syndrome (AIDS), largely due to successful treatment with antiretroviral therapy.

Objective: To provide a descriptive overview of the reported cases of AIDS in Canada by identifying trends by geographic location, sex, age group and mortality. While the descriptive analysis focuses on the year 2016, results are presented for reported cases from the beginning of national AIDS surveillance in 1979.

Methods: The Public Health Agency of Canada (PHAC) monitors AIDS in Canada through the national HIV/AIDS Surveillance System (HASS) and Statistics Canada. HASS is a passive, case-based surveillance system that maintains non-nominal data on cases of HIV and AIDS provided voluntarily by the Canadian provinces and territories. Of note, AIDS is no longer a reportable disease in Newfoundland and Labrador (as of 2009) and in Prince Edward Island (as of 2012). Data were also retrieved on annual deaths attributed to HIV/AIDS from Statistics Canada. Data were collated, tables and figures were prepared, then descriptive statistics were applied by PHAC and validated by each province and territory.

Results: A total of 114 AIDS cases were reported in 2016, with a cumulative total of 24,179 since 1979. These numbers represent a steady decline in the number of reported AIDS cases per year of diagnosis in Canada since 1993. Of reporting provinces, the greatest numbers of cases in 2016 were reported by Ontario, Saskatchewan and Alberta. Males accounted for 72.8% of reported AIDS cases and adults aged 50 years and older accounted for the greatest proportion by age group (36.0%). For all reporting years combined, the age distribution of AIDS cases is similar by sex, though a larger proportion of female cases were under the age of 30 years old. Limited data were reported for ethnicity and risk factors. The numbers of annual deaths attributed to AIDS infection have been declining since 1995. There were a record low of 241 AIDS-related deaths reported in 2013—the most recent year for which data were available. The number of AIDS-related deaths in Canada has declined 86.2% since 1995.

Conclusion: The number of AIDS cases reported by participating provinces and territories and the number of AIDS-related deaths reported by Statistics Canada has declined. While this represents a promising trend, the data should be interpreted with caution given the limitations of the dataset which could lead to an underestimate of the magnitude of the disease.

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Introduction

Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) are a continuing international epidemic. There has been tremendous progress in international efforts to end the HIV/AIDS epidemic over the last 15 years (1) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) has set a global commitment to ending the AIDS epidemic by 2030 (2). Since treatment targets were set in 2003, global annual AIDS-related deaths have decreased by 43%. While internationally an estimated one million people died from AIDS-related deaths in 2016, in high-income countries, the number of people living with AIDS and dying from AIDS-related deaths is markedly lower (3). Due in part to declining numbers of AIDS cases, some countries (for example, Australia) have ceased to include data on AIDS in their annual surveillance reports (4,5).

The Public Health Agency of Canada (PHAC) works in partnership with other federal agencies, provincial and territorial governments, and other non-governmental organizations to address HIV and AIDS in Canada. This surveillance report is based on case reports of new diagnoses of AIDS submitted to PHAC by all participating provinces and territories, and also presents data received from Statistics Canada (6). The annual publication of AIDS data is part of PHAC's mandate to collect, analyze and report on surveillance data at the national level.

The objective of this report is to provide a descriptive overview of the reported cases of AIDS from participating provinces by identifying trends by geographic location, sex, age group and mortality. Previously, AIDS data were published annually, in combination with HIV data, in a stand-alone document

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entitled *HIV/AIDS in Canada: Surveillance Report*. This is the first iteration of this report to be published under a new title, *AIDS in Canada—Surveillance Report, 2016* in the *Canada Communicable Disease Report (CCDR)*. Note that a separate surveillance report for HIV cases, entitled *HIV in Canada—Surveillance Report, 2016* also appears in this issue of *CCDR* (7).

Methods

This report presents data from two different sources relating to HIV and AIDS: the national HIV/AIDS Surveillance System (HASS) and Statistics Canada’s *Vital Statistics Death Database*. HASS is a passive, case-based surveillance system that collates and maintains data voluntarily submitted to PHAC from all provincial and territorial public health authorities. Details regarding data collection, data management, data quality and population group classification have been previously described (8). In short, the HASS database captures non-nominal data on people diagnosed with AIDS and includes, but is not limited to, reporting province or territory, year of test, age group, sex, risk factors (also known as exposure category) and race/ethnicity. In this surveillance report, the term “cases” or “reported cases” refers to individuals diagnosed by a province or territory in a given year and reported to PHAC. AIDS cases are counted by the date that the reporting jurisdiction confirmed the diagnosis of AIDS.

Reported AIDS cases must meet the Canadian surveillance case definition as described in PHAC’s *CCDR* publication *Case definitions for communicable diseases under national surveillance* (9). Provinces and territories that provide the data to HASS do so through the *National Case Reporting Form* (8) or through a secure electronic dataset transmission. All raw data (paper forms and electronic datasets) are retained in compliance with the *Directive for the collection, use and dissemination of information relating to public health* (Public Health Agency of Canada, 2013, unpublished document). Details regarding the HIV/AIDS exposure categories are available in the Web Exclusive of this issue (10).

AIDS data and the completeness of epidemiological information collected and submitted to PHAC vary by jurisdiction. With respect to AIDS reporting, there have been some changes that have occurred over time that affect the completeness of AIDS surveillance data. Ontario data on exposure category and race/ethnicity were not available after 2004 and Quebec AIDS data were not available after June 30, 2003. AIDS is no longer a reportable disease in Newfoundland and Labrador (as of 2009) and in Prince Edward Island (as of 2012). Due to expected delays associated with reporting of AIDS cases from British Columbia, there is a one-year lag in publication of AIDS data (e.g., 2015 AIDS data were published in the 2016 surveillance report). British Columbia race/ethnicity information for HIV/AIDS cases has been suppressed for all years while a review of this information is being undertaken by the province.

The data presented represent reported AIDS cases by participating jurisdictions diagnosed on or before December 31, 2016, that were submitted to PHAC by June 7, 2017. The data were extracted from the HASS database later in June 2017. Standardized data recoding procedures were applied to all submitted provincial and territorial datasets to create a national dataset for analysis. The descriptive and comparative analyses focus on the year 2016; however, data from 2015 are also highlighted since, due to infrastructure improvements to the HASS database, jurisdictions had not been previously asked

to submit AIDS data for 2015. Data on cases reported since the beginning of AIDS surveillance in 1979 are also presented.

The complete data regarding annual deaths attributed to HIV/AIDS are available from Statistics Canada (6).

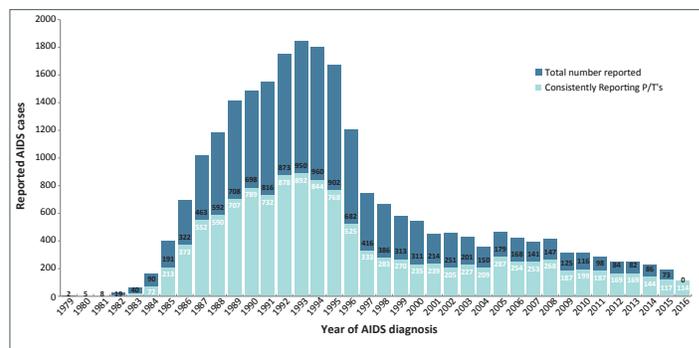
Microsoft Excel 2010 and SAS Enterprise Guide (SAS EG) v5.1 software were used for data cleaning and analysis. No statistical procedures were used for comparative analyses, nor were any statistical techniques applied to account for missing data.

With the exception of cases where data suppression was requested by the province or territory, data in tables with small cell sizes (n≤5) were not suppressed, since disclosure was not deemed to pose any risk of identifying individual cases. These procedures are in line with PHAC’s *Directive for the collection, use and dissemination of information relating to public health (unpublished document)*. The data were verified by the provinces and territories to ensure accuracy. Supplementary information, including data tables can be found in the Web Exclusive (10).

Results

The number of reported AIDS cases per year of diagnosis in Canada has decreased steadily since the mid-1990s (Figure 1). In 2016, there were 114 AIDS cases reported to PHAC; down from 190 reported in 2015. It is, however, important to note that Quebec, Newfoundland and Prince Edward Island no longer report AIDS, and the number of new AIDS cases in 2016 in BC was not yet available at the time of publication of this report. This number of reported AIDS cases per year represents an 87.2% decrease relative to 1993, when the highest number of cases for these provinces and territories that have continuously reported AIDS was reported (n=892). From 1979 to the end of 2016, a total of 24,179 AIDS cases were reported to PHAC.

Figure 1: Number of reported AIDS cases by year of diagnosis—Canada, 1979–2016



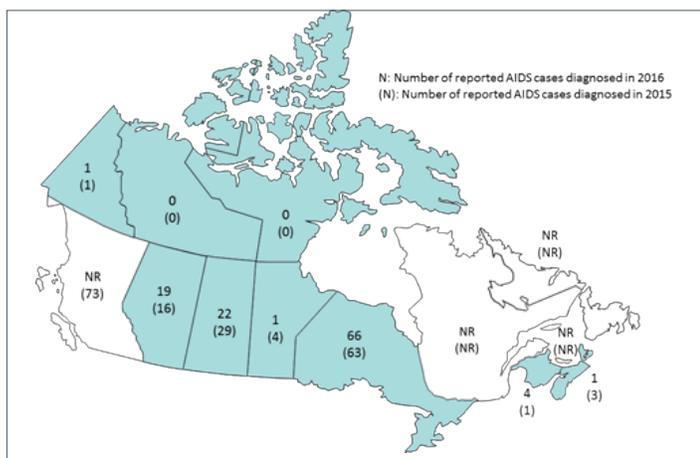
Abbreviations: P/T, province or territory
Legend: The upper section of the figure represents the cases reported by any P/T that has stopped reporting AIDS over time, or did not report in 2016 (QC (2003), NL (2009), PE (2012), and BC (2016)). The lower portion of each bar represents the cases reported by provinces that have consistently reported AIDS cases to PHAC since 1979

Geographic distribution

Among the provinces and territories reporting AIDS cases in 2016, the largest numbers of cases reported were in Ontario (n=66), Saskatchewan (n=22) and Alberta (n=19). In 2015 the largest numbers of AIDS cases were reported in British Columbia (n=73), followed by Ontario (n=63) and Saskatchewan (n=29) (Figure 2; Supplementary Table 1) (10).



Figure 2: Number of reported AIDS cases diagnosed by province/territory in 2015 and 2016

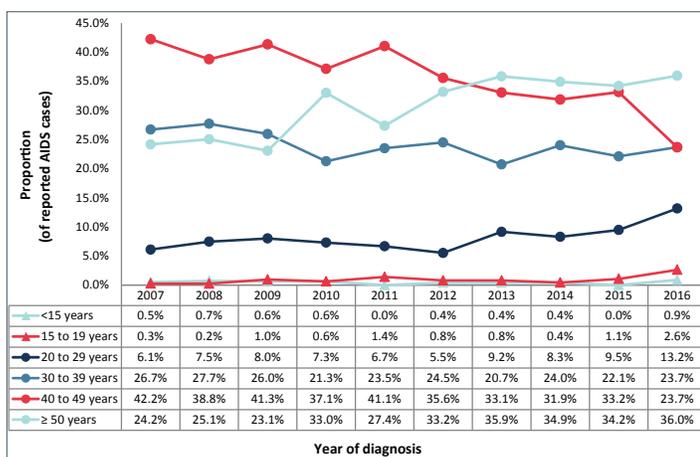


Abbreviations: NR, not reported

Age and sex distribution

Data on age group and sex were available for all reported AIDS cases in 2016; the greatest proportion of cases was among those 50 years and older (36.0%), followed by cases aged 30 to 39 years old and 40 to 49 years old (each 23.7%) (Figure 3). One AIDS case was reported in a child less than one year old.

Figure 3: Proportion of AIDS diagnoses by age group, by year—Canada, 2007–2016



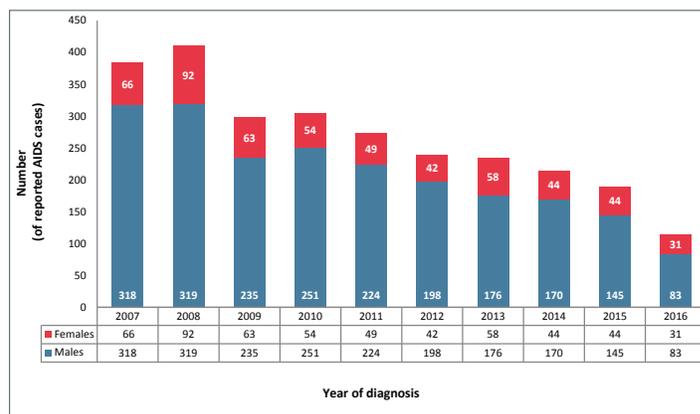
Note: Quebec AIDS data have not been available since June 30, 2003. British Columbia AIDS data were not available for 2016. AIDS is no longer a reportable disease in Newfoundland and Labrador as of 2009 and in Prince Edward Island as of 2012. This also excludes AIDS cases for which age was not reported

In 2016, the majority of reported AIDS cases were male (72.8%). Over all reporting years (1979-2016) the age distribution of AIDS cases is somewhat similar by sex, though a larger proportion of female cases were under the age of 30 (Figure 4; Supplementary Tables 1-6) (10).

Exposure category

In 2016, 37.7% of reported AIDS cases had information on exposure category. Of the available 2016 data (from Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Nova Scotia, and New Brunswick), the largest proportions of exposure

Figure 4: Number of reported AIDS diagnoses by sex—Canada, 2007–2016



Note: Quebec AIDS data have not been available since June 30, 2003. British Columbia AIDS data were not available for 2016. AIDS is no longer a reportable disease in Newfoundland and Labrador as of 2009 and in Prince Edward Island as of 2012. This also excludes AIDS cases for which sex was not reported or was reported as transsexual or transgender

categories reported, among adults, were injection drug use (IDU) (35.0%) and sexual contact with a person at risk (20.0%). This differs from 2015 (which includes British Columbia data), where proportions for the “men who have sex with men” and IDU exposure categories were similar at 23.7% and 27.8% respectively (Supplementary Tables 7-11) (10).

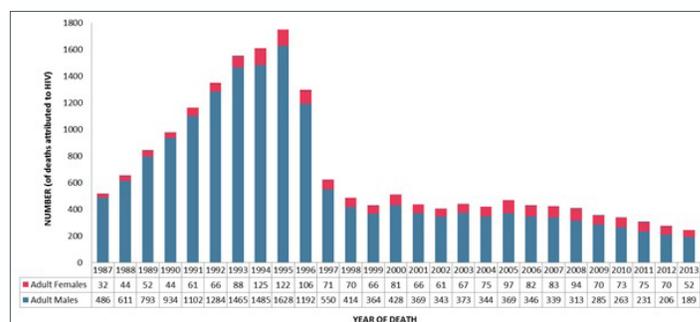
Race/ethnicity

In 2016, 38.6% of reported AIDS cases had information on race/ethnicity. Of the available 2016 data (from Yukon, Northwest Territories, Alberta, Saskatchewan, Manitoba, Nova Scotia and New Brunswick), the largest proportions of races/ethnicities reported, for all age groups, were Indigenous (50.0%), White (29.5%) and Black (13.6%) (Supplementary Table 12) (10).

AIDS mortality

Data from the *Vital Statistics Death Database* show that the numbers of annual deaths attributed to HIV infection have been declining since 1995 (Figure 5). The lowest recorded number of deaths attributed to HIV infection (n=241) was reported in 2013, the most recent year for which data were available. Of these reported AIDS-related deaths, there were more males than females (Supplementary Tables 13-15) (10).

Figure 5: Number of deaths attributed to HIV infection among adults (≥15 years old) by year of death and sex—Canada, 1987–2013



Note: From Statistics Canada. Canadian Vital Statistics, Birth and Death Databases (8)



Discussion

The number of reported AIDS cases in Canada has experienced an overall decline since the mid-1990s, with a total of 114 AIDS cases reported from participating provinces and territories in 2016. This is the lowest number of AIDS cases reported in one year since 1985 (10). Of provinces reporting in 2016, the highest count of AIDS cases were attributed to Ontario (n=66). Injection drug use (35.0%) and the over 50 year old age group (36.0%) continued to be the exposure category and age group with the largest proportion of new cases. In 2016, AIDS cases were most common in men (72.8%) and those reported as being of Indigenous race/ethnicity (50.0%). It is important to note that the total AIDS case counts across all reporting years tend to overstate the decrease from the highest year (1993) to 2016 due to a number of provinces removing AIDS as a reportable disease since 2003. Still, when examining only the provinces who submitted 2016 AIDS data, there remains an 87.2% decrease in AIDS cases from 1993 to 2016.

With the exclusion of British Columbia (n=73), the highest counts of AIDS cases in 2015 were attributed to Ontario (n=63), Saskatchewan (n=29) and Alberta (n=16). No changes to this trend were noted in 2016, with the highest AIDS case counts found in Ontario (n=66), Saskatchewan (n=22) and Alberta (n=19). Of the reported cases in 2016, adults aged 50 years and older accounted for the largest proportion of AIDS cases (36.0%) with the increase over the past five years in proportion to newly diagnosed HIV cases in this age group (11). Over all reporting years, when comparing males to females, there was a greater proportion of AIDS cases in the older age groups (30-50+ years old) for males than females, while females made up a greater proportion of cases in the younger age groups (0-29 years old). This is consistent with the proportions of age groups in cumulative HIV cases across all reporting years; however, it is possible that the distribution of female AIDS cases will shift to older age groups over time, as a similar trend has been noted in HIV cases in recent years (11).

Based on the most comprehensive dataset from Statistics Canada, the number of annual deaths attributed to HIV infection in Canada has been declining since 1995, with the most recent data showing 241 deaths in 2013—the lowest number yet. Of these, 78.4% were adult males and 21.6% were adult females, with no reported deaths in children (<15 years).

Limitations and data quality

The data in this report are deemed provisional and may be subject to change in future iterations of the AIDS in Canada surveillance report. Differences between the data published in this report and the data published in previous national, provincial and territorial surveillance reports may be due to reporting delays or differences in when the data were extracted from the various surveillance databases. Where such differences are noted, it is recommended that data from the most recent provincial and territorial reports be used.

Several limitations need to be considered. First HASS is a passive, case-based surveillance system, so it is not possible to ascertain whether all individuals with AIDS infection are being identified and reported from participating provinces. AIDS cases may be underreported for a number of reasons. Since AIDS results from an advanced HIV infection and since HIV is a chronic infection with a long latency period, many individuals who are newly infected in a given year may not receive a diagnosis of HIV for months or years (12). Additionally, not all jurisdictions

report AIDS cases to PHAC, and many physicians fail to report AIDS-defining illness for those patients already living with HIV. A second limitation is that three provinces no longer report AIDS cases. Third, reporting is not always complete; for example, exposure category or ethnicity data are submitted for fewer than 40% of cases. Fourth, data on deaths attributed to HIV infection are available only from 1987 onward and most recent available data are from 2013. Finally, the identification and removal of duplicates is difficult due to the non-nominal nature of HIV reporting in some jurisdictions. Where possible, provinces and territories review and assess the inclusion of duplicate reports in order to provide as accurate a picture as possible. Further details regarding data limitations have been published previously (3).

Conclusion

Canada has seen consistent reductions in reported AIDS cases and AIDS-related deaths, with 2016 representing the lowest annual counts to date for both. While this represents a promising trend, the data should be interpreted with caution given the limitations of the dataset, which could lead to an underestimation of the magnitude of the disease. As the primary source of national data on AIDS cases, the data within this report provide information for public health action and allow for the monitoring of Canadian and global efforts to end the AIDS epidemic by 2030.

Authors' statement

LJ—conceptualization, software, validation, visualization, writing—original draft, review and editing
ACB—writing—review and editing, supervision
ME—methodology, software, validation, data curation, visualization, writing—original draft, review and editing
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Conflict of Interest

None.

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Assessing uptake of national HIV screening and testing guidance—Part 1: Awareness, use and usefulness

GP Traversy¹, T Austin¹, J Yau¹, K Timmerman^{1*}

Abstract

Background: In 2013, the Public Health Agency of Canada released the *HIV Screening and Testing Guide* (the Guide) to support routine HIV screening and testing practices of health care providers in Canada and promote early detection of new HIV cases. Little was known regarding health care providers' awareness and use of the Guide.

Objective: To determine Canadian health care providers' awareness, use and perceived usefulness of the Guide.

Methods: An open, anonymous online survey, including questions on awareness, use and usefulness, was developed with stakeholders, validated and pre-tested. It was then disseminated to a convenience sample of health care providers across Canada between June and August 2016.

Results: A total of 1,075 participants representing all Canadian provinces and territories responded to the survey, with the majority being nurses (54%) and physicians (12%). About two-thirds of respondents (65%) were aware of the Guide; of those, approximately half used it. Thirty-five percent of participants were not aware of the Guide, including none of the 173 health care providers in primary care (family/general practice). Among participants who were aware of and used the Guide, over 80% reported incorporating recommendations from the Guide into their practice and 77% reported frequently or always being able to find information they were looking for.

Conclusions: The *HIV Screening and Testing Guide* appears to be very useful for those who are aware of it and use it; however, awareness of the Guide appears to be low in primary care. Although these results need to be interpreted in light of the convenience sample, it suggests broader dissemination efforts may be needed to reach all of the potential users of the Guide.

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Introduction

In 2014, the Joint United Nations Programme on HIV/AIDS (UNAIDS) announced the global 90-90-90 targets, which sought, by the year 2020, to diagnose 90% of all HIV-positive individuals, have 90% of these individuals on antiretroviral therapy (ART) and, of those on ART, have 90% attain viral suppression (1).

HIV screening and testing is needed in order to make the diagnosis of HIV infection, and, as such, comprehensive HIV screening and testing strategies are essential to reaching the UNAIDS targets. Screening and testing are the first steps to identifying individuals who are HIV-positive and unaware of their infection, which facilitates linkage to care, consequently decreasing morbidity and mortality associated with HIV/AIDS and preventing onward transmission.

At the end of 2014, an estimated 65,040 persons were living with HIV in Canada and an estimated 21% of those were

unaware of their infection (2). This is significant in that those who are unaware of their HIV status are unable to start treatment or take advantage of available support services. In addition, it is estimated that those who are unaware of their infection contribute to 30–50% of all new infections (3,4).

The Public Health Agency of Canada's (PHAC) *HIV Screening and Testing Guide* (the Guide) was released in 2013 to facilitate HIV testing in health service delivery settings (5). The Guide provides evidence-based recommendations regarding who, when and how often to screen for HIV, as well as general information about testing procedures.

The Guide is currently available online through PHAC's website and has been printed and distributed through stakeholders and non-governmental organizations, including the Canadian AIDS Treatment Information Exchange (CATIE). Little is known about

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health care providers' awareness and use of the Guide, and whether the Guide is useful to health care providers.

This article describes the results of Part 1 of a larger study assessing the uptake of the Guide. The objective of Part 1 was to evaluate the awareness, use and perceived usefulness of the Guide. The objective of Part 2 was to assess health care providers' knowledge, comfort and clinical practices related to HIV testing (6). The overall study is part of the work underway to inform potential updates of the Guide to support HIV screening and testing practices in Canada.

Methods

Information related to health care providers' awareness and use of the Guide were collected over a three month period (June–August 2016) as part of a larger anonymous online survey. *The Checklist for Reporting Results of Internet E-Surveys* was followed where applicable for the reporting of methodology and results (7). The study was approved by the Health Canada and PHAC Research Ethics Board.

Survey design

The survey was designed in consultation with evaluation, infectious disease and HIV content experts. The design was based on previous PHAC surveys with similar objectives, previous literature on survey design, factors that influence testing behaviour and known barriers and facilitators of testing (8-12). The survey and study protocol were externally peer-reviewed for face validity by an infectious disease physician and an expert in evaluation. Pilot testing of the questionnaire was then conducted with a panel of infectious disease experts prior to full-scale dissemination.

Awareness was assessed by asking participants whether they were aware of the Guide. Those who indicated being aware of the Guide were asked to identify the method (e.g., by email, word-of-mouth, PHAC's website or receiving a print copy of the Guide). Use was assessed by asking participants whether they had used the Guide. If respondents indicated having used the Guide ("users"), they were then asked to report on how often they used it. "Non-users" were defined as those who had not used the Guide, and may or may not have been aware of it. Usefulness was assessed by asking participants how often they were able to find the information they were looking for in the Guide, whether they identified any errors or out of date material in the Guide and whether they regularly incorporated recommendations from the Guide into clinical practice. Further details on these variables, as well as the full survey, are available upon request.

Recruitment and administration

Participants were recruited to the voluntary survey via a link attached to a bilingual (English and French) email invitation sent to online newsletters/listservs and CATIE. Participants were also recruited by email invitations distributed by contacts of other Government of Canada departments and regional offices. A link to the survey was also sent to 23 associations for health professionals (e.g., physicians, nurses, social workers

and community-based service providers). While only three of the professional associations agreed to disseminate the survey (Pacific AIDS Network, Canadian Public Health Association and Canadian AIDS Society), others may have disseminated the survey to their members without informing the research team. Individuals who received the survey via e-mail or newsletter may have also further disseminated the survey among their colleagues and networks so a participation rate cannot be calculated.

The survey was hosted on the Canadian Network for Public Health Intelligence Web Data online surveying tool and was available in English and French. Respondents were provided information related to privacy and data management/storage, length of the survey, purpose of the study and contact information for the principle investigator, prior to providing informed consent to participate. Participation was not incentivized. Participants' responses were included if they were 18 years of age or older, currently practicing and represented health care providers/professionals.

Data management and analysis

Survey responses were collected in a secure electronic database and then downloaded to a password-protected Microsoft Excel file. Responses were anonymous with no personal identifiers collected (e.g., names, addresses, email addresses or IP addresses). Descriptive statistics were used to calculate response frequencies. Analyses were completed using Microsoft Excel.

Results

In total, 1,075 health care providers completed the survey. Survey respondents self-identified from all 13 provinces and territories, with the majority from Ontario, British Columbia and Quebec (Table 1). The majority of respondents were nurses (54%), with physicians (12%) representing the second most common provider type.

Table 1: Demographics of survey participants—Canada, June-August 2016

Demographics	n	%
Province/territory of practice (n=1,069)		
Ontario	375	35.1
British Columbia	152	14.2
Quebec	149	13.9
Saskatchewan	107	10.0
Manitoba	91	8.5
Alberta	79	7.4
New Brunswick	30	2.8
Nova Scotia	29	2.7
Newfoundland and Labrador	22	2.1
Northwest Territories	14	1.3
Prince Edward Island	11	1.1
Yukon	7	0.7
Nunavut	3	0.3

Table 1: Demographics of survey participants—Canada, June-August 2016

Demographics (con't)	n	%
Type of provider (n=1,071)		
Nurse	577	53.9
Physician	127	11.9
Community health worker	95	8.9
Nurse practitioner	84	7.8
Social worker	52	4.9
Counsellor	39	3.6
Midwife	8	0.7
Medical resident	0	0.0
Other health care provider	89	8.3
Area of practice (n=1,055)		
STI/Public Health	455	43.1
Family/General practice	173	16.4
Specialist	114	10.8
Emergency/Urgent care	27	2.6
Other (please specify)	286	27.1
Setting (n=1,061)		
Large urban population centre (100,000+)	564	53.2
Medium population centre (between 30,000 and 99,999)	181	17.1
Small population centre (between 1,000 and 29,999)	234	22.1
Rural area (<1,000)	62	5.8
Geographically isolated/remote (not accessible by road or only by a dirt/winter road)	20	1.9
Years of practice (n=1,069)		
> 20 years	409	38.3
15 – 19 years	141	13.2
10 – 14 years	149	13.9
5 – 9 years	177	16.6
< 5 years	193	18.1

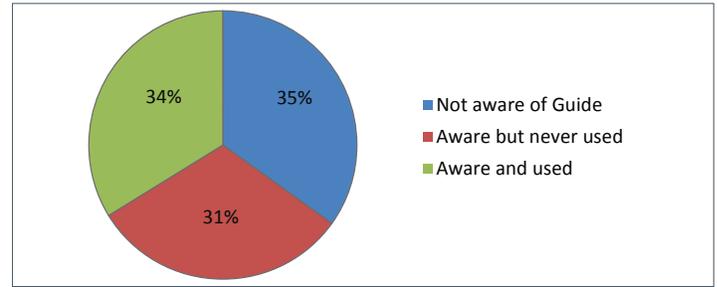
Abbreviation: n, number
 Note: Sample sizes varied between n=1055-1071 as individual questions were voluntary

Most respondents (43%) worked in the area of sexually transmitted infections (STIs) and public health. Over 25% of respondents indicated that their primary area was 'other,' such as corrections, health promotion and public health. Family/general practice (16%), specialist (10%) and emergency/urgent care (3%) made up the remainder of the responses (Table 1). The majority of participants practiced in large urban population centres (53%). More than a third of providers had been practicing for more than 20 years (Table 1).

Awareness

Approximately two-thirds of participants were aware of the Guide and, of those, half had used it (Figure 1). Nurses were the most aware of the Guide and health care providers who had been practicing for longer periods of time were more likely to be aware of the Guide. None of the health care providers who primarily practice in family/general care reported being aware of the Guide.

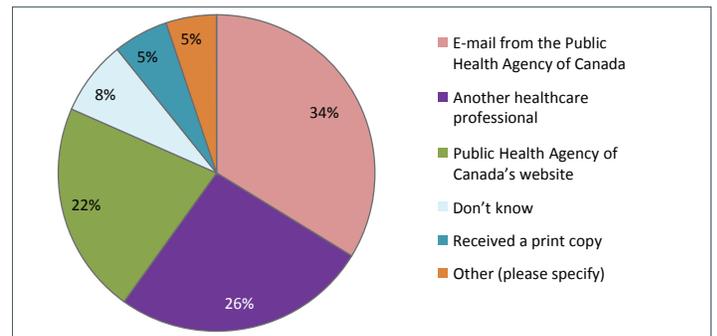
Figure 1: Percentage of respondents who are aware of and who use the Guide (n=1071)



Abbreviation: n, number

The most common ways of becoming aware of the Guide were via e-mail from PHAC (34%), a colleague (26%) or the PHAC website (22%) (Figure 2).

Figure 2: How respondents became aware of the Guide (n=696)

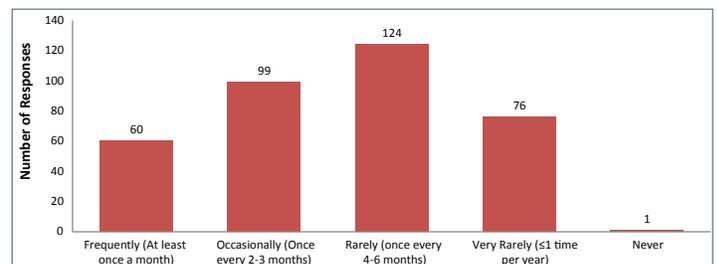


Abbreviation: n, number

Use

Of 359 users of the Guide, 16% reported using the Guide frequently (at least once a month), 28% reported occasional use of the Guide (once every two to three months), 35% reported rare use of the Guide (once every four to six months) and 21% reported very rare use of the Guide (less than once a year) and 0.3% reported never having used the Guide (Figure 3). Because they were not aware of the Guide, no health care providers in family/general practice had used it.

Figure 3: Frequency of use of the Guide by those who indicated having used it (n=359)



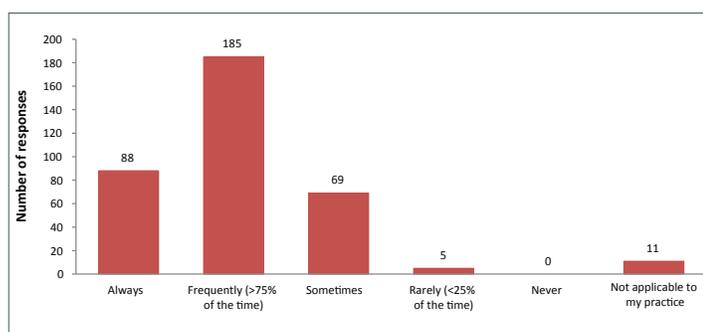
Abbreviation: n, number



Usefulness

Of those who used the guide, the majority (84%) reported that they regularly incorporated recommendations from the Guide in their practice. Most users (77%) indicated being able to find the information they were looking for at least 75% of the time (Figure 4). Only 13 users (3.6%) reported finding errors or out-of-date material in the Guide. This included concerns about the practicality and conciseness of the Guide and the need to update the Guide with respect to new technologies, such as point-of-care testing and pre-exposure prophylaxis (PrEP).

Figure 4: How often users of the Guide are able to find the information they were looking for when using it (n=358)



Abbreviation: n, number

Discussion

Overall, the results of this national survey suggest that health care providers have only moderate awareness of PHAC's *HIV Screening and Testing Guide* but those who had, reported that they regularly incorporated recommendations from the Guide in their practice. It was noted that in a few areas, improvements could be made in the practicality/conciseness of the Guide and incorporating information on new prevention technologies such as PrEP would be useful.

Awareness may have been impacted by the dissemination methods used when first distributing the Guide. Email, the PHAC website and word-of-mouth appear to be effective knowledge dissemination methods as many respondents indicated that they learnt about the Guide through these routes. The avenues of dissemination may have been more likely to target health care providers in the area of sexual health who would be more comfortable with HIV testing than other health care providers.

The strengths of the current study include the geographically representative sample, with respondents from all provinces and territories, and the diverse range of health care providers. Moreover, the survey was comprehensive, covering a number of areas that could be used to update the Guide.

Limitations include the use of a convenience sample, so that the participants may not be representative of all health care providers in Canada and it is not possible to generalize the results to all practitioners in Canada. This may have been particularly true of primary care health care providers. Moreover,

the use of self-reported measures with respect to use of the Guide could have been subject to recall bias.

Conclusion

Awareness of the PHAC's *HIV Screening and Testing Guide* among health care providers could be improved. Although the current results need to be interpreted in light of the convenience sample, it suggests broader dissemination efforts to reach all of the potential users of the Guide may be needed as part of the overall effort to eliminate HIV in Canada.

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Assessing uptake of national HIV screening and testing guidance—Part 2: Knowledge, comfort and practice

GP Traversy¹, T Austin¹, J Yau¹, K Timmerman^{1*}

Abstract

Background: The Public Health Agency of Canada's (PHAC) *HIV Screening and Testing Guide* (the Guide) provides guidance to health care providers regarding who, when and how often to screen for HIV. HIV screening and testing is important in meeting the Joint United Nations Programme on HIV/AIDS' (UNAIDS) 90-90-90 targets towards HIV elimination.

Objective: To determine health care providers' levels of knowledge about and comfort with aspects of HIV testing, and to determine whether their HIV testing practices are consistent with the recommendations in the Guide.

Methods: An open, anonymous online survey that included questions on knowledge, comfort and HIV testing practices was developed with stakeholders, validated and pre-tested. It was then disseminated to a convenience sample of health care providers across Canada between June and August 2016.

Results: A total of 1,075 participants representing all Canadian provinces and territories responded to the survey, with the majority being nurses (54%) and physicians (12%). Overall, knowledge related to HIV testing was substantial, but 37% of respondents underestimated the percentage of people living with HIV in Canada who are unaware of their HIV status and only 32% of respondents knew that HIV patients are frequently symptomatic during the acute infection. Most participants were comfortable with HIV testing and approximately 50% reported offering HIV testing regularly.

Conclusions: Although overall knowledge and practice were consistent with PHAC's *HIV Screening and Testing Guide*, some health care providers may underestimate the magnitude of undiagnosed HIV cases in Canada and may misinterpret the symptoms of acute HIV infection. While the amplitude of these results need to be interpreted in light of the convenience sample, addressing these knowledge gaps may facilitate earlier diagnosis of HIV among those who are unaware of their HIV status.

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Introduction

With appropriate care and treatment, HIV can be a chronic but manageable condition; however, according to 2014 estimates, just over one in five people living with HIV in Canada are unaware of their infection (1,2). This means they are not receiving the care that they need and may be transmitting HIV to others.

HIV screening and testing practices are important, not only for ensuring that people living with HIV are linked to appropriate care and treatment but also for reaching the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 targets for HIV elimination by 2020. This includes having 90% of individuals living with HIV aware of their infection, 90% of people who are diagnosed on antiretroviral therapy (ART) and 90% of those who receive ART virally suppressed (3).

To complement existing efforts to support health care providers involved in HIV testing, the Public Health Agency of Canada (PHAC) released the *HIV Screening and Testing Guide* (the Guide) in 2013 (1). The Guide is one of several products available to health care providers that provides evidence-based recommendations regarding who, when and how often to screen for HIV, as well as general information about testing and counselling procedures. Specifically, it recommends that health care providers discuss HIV testing as part of periodic routine medical care as a way to destigmatize and normalize testing and detect cases among the low risk population.

While some studies have been carried out in Canada to determine patterns of HIV testing practices by physicians and

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other health care providers, it is unclear the extent to which health care providers' clinical practices align with PHAC's screening recommendations and how comfortable they are with following these recommendations (4-6). To date, PHAC has not conducted an evaluation of guidance uptake with respect to health care providers' knowledge of HIV testing recommendations in the Guide.

This article describes the results of Part 2 of a larger study assessing the uptake of the Guide. The objective of Part 1 was to evaluate the awareness, use and usefulness of the Guide (7). The objective of Part 2 was to assess health care providers' knowledge, comfort and clinical practices related to HIV testing. The overall study is part of the work underway to inform potential updates of the Guide to support HIV screening and testing practices in Canada.

Methods

Information related to health care providers' knowledge, comfort and clinical practices were collected over a three-month period (June–August 2016) as part of a larger, anonymous online survey. *The Checklist for Reporting Results of Internet E-Surveys* was followed where applicable for the reporting of methodology and results (8). The study was approved by the Health Canada and Public Health Agency of Canada Research Ethics Board.

Survey design

The survey was designed in consultation with evaluation, infectious disease and HIV content experts. The questions were developed based on previous PHAC surveys with similar objectives and from previous literature on survey design (6,9-12). The survey and study protocol were externally peer-reviewed for face validity by an infectious disease physician and an expert in evaluation. Pilot testing of the questionnaire was then conducted with a panel of infectious disease experts prior to full-scale dissemination.

Provider knowledge was assessed in two ways. First, participants had to answer eight true/false statements about HIV and HIV testing. Second, participants had to indicate who should be offered HIV testing among five patient groups: individuals requesting an HIV test; individuals presenting with symptoms and signs of a weakened immune system; individuals who are sexually active and have never been tested; individuals who share drug-using equipment with a partner who is or may be HIV-positive; and pregnant women, or those planning a pregnancy, and their partners.

Provider comfort with aspects of HIV testing was assessed using the open-ended question, "How comfortable are you in discussing HIV overall with your patients, including risk factors; pre- and post-test counselling; providing test results; and complying with reporting requirements?" Responses were coded on a 5-point scale (very comfortable, comfortable, somewhat comfortable, not very comfortable, and not at all comfortable) independently by two reviewers. Disagreements were resolved through discussion.

To assess whether provider clinical practices were consistent with the Guide's recommendations, participants were asked to indicate to what percentage of patients they offer HIV tests

as part of routine care and how often they discussed six topics (i.e., HIV testing, HIV test window period, privacy/confidentiality, methods for risk reduction, positive results' reporting requirements and referrals to HIV support services if test results are positive) when performing pre- and post-test counselling for HIV. Participants were also asked to indicate whether a number of statements on the routine offer of care or counselling apply to them. Further details on these variables, as well as the full survey, are available upon request.

Recruitment and administration

Participants were recruited through online newsletters/listservs, the Canadian AIDS Treatment Information Exchange's (CATIE) website and email invitations distributed by contacts of other Government of Canada departments and regional offices. A link to the survey was also sent to 23 associations for health care providers (e.g., physicians, nurses, social workers and community-based service providers). While only three of the professional associations agreed to disseminate the survey (Pacific AIDS Network, Canadian Public Health Association and Canadian AIDS Society), others may have disseminated the survey to their members without informing the research team. Individuals who received the survey via e-mail or newsletter may have also further disseminated the survey among their colleagues and networks; therefore, a participation rate cannot be calculated.

The survey was hosted on the Canadian Network for Public Health Intelligence Web Data online surveying tool and was available in English and French. Respondents were provided information related to privacy and data management/storage, length of the survey, purpose of the study and contact information for the principle investigator, prior to providing informed consent to participate. Moreover, all questions (other than the consent and screening questions) were voluntary. Participation was not incentivized. Participants' responses were included if they were 18 years of age or older, currently practicing and represented health care providers/professionals.

Data management and analysis

Survey responses were collected in a secure electronic database and then downloaded to a password-protected Microsoft Excel file. Responses were anonymous with no personal identifiers collected (e.g., names, addresses, email addresses or IP addresses). Descriptive statistics were used to summarize the characteristics of the sample and responses to the survey questions. Analyses were carried out using Microsoft Excel.

Results

A total of 1,075 health care providers from the 13 provinces/territories participated in the survey (**Table 1**). Respondents included in the survey were nurses (53.9%), physicians (11.9%) and community health workers (8.9%); however, other health care providers were included, such as nurse practitioners (7.8%), social workers (4.9%), counsellors (3.6%) and midwives (0.7%). Many of the respondents worked in the area of sexually transmitted infections (STIs) and public health (43.1%); in large urban population centres (53.2%); and had more than 20 years of experience (38.3%).



Table 1: Demographics of survey participants—Canada, June-August 2016*

Demographics	n	%
Province/territory of practice (n=1,069)		
Ontario	375	35.1
British Columbia	152	14.2
Quebec	149	13.9
Saskatchewan	107	10.0
Manitoba	91	8.5
Alberta	79	7.4
New Brunswick	30	2.8
Nova Scotia	29	2.7
Newfoundland and Labrador	22	2.1
Northwest Territories	14	1.3
Prince Edward Island	11	1.1
Yukon	7	0.7
Nunavut	3	0.3
Type of provider (n=1,071)		
Nurse	577	53.9
Physician	127	11.9
Community health worker	95	8.9
Nurse practitioner	84	7.8
Social worker	52	4.9
Counsellor	39	3.6
Midwife	8	0.7
Medical resident	0	0.0
Other health care provider	89	8.3
Area of practice (n=1,055)		
STI/Public Health	455	43.1
Family/General practice	173	16.4
Specialist	114	10.8
Emergency/Urgent care	27	2.6
Other (please specify)	286	27.1
Setting (n=1,061)		
Large urban population centre (100,000+)	564	53.2
Medium population centre (between 30,000 and 99,999)	181	17.1
Small population centre (between 1,000 and 29,999)	234	22.1
Rural area (<1,000)	62	5.8
Geographically isolated/remote (not accessible by road or only by a dirt/winter road)	20	1.9
Years of practice (n=1,061)		
> 20 years	409	38.3
15 – 19 years	141	13.2
10 – 14 years	149	13.9
5 – 9 years	177	16.6
< 5 years	193	18.1

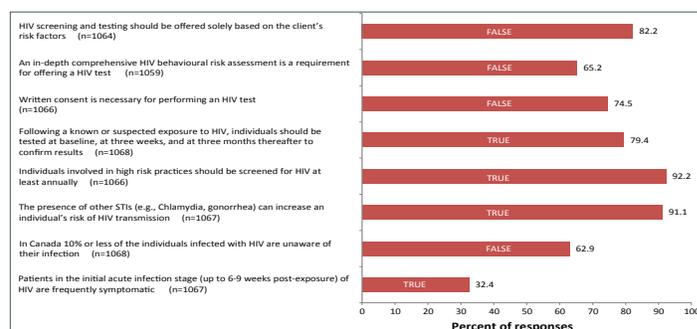
Abbreviation: n, number

*Note: Sample sizes varied between n=1,055-1,071 as individual questions were voluntary

Knowledge related to HIV testing

For the true/false questions, over 90% of participants knew that the presence of other sexually transmitted illnesses can increase an individual's risk of HIV transmission and that individuals involved in high risk practices should be screened for HIV at least annually (Figure 1). Approximately 75–80% knew that following a known exposure, baseline and follow-up testing was needed, that written consent was not needed for testing and that risk factors were not needed to provide a test. Only about one-third of respondents (32.4%) knew that patients are frequently symptomatic during acute infection and more than one-third of respondents (37.1%) estimated the rate of undiagnosed HIV in Canada was 10% or less when the actual rate of undiagnosed HIV is estimated at 21% (2). In the patient profile question, over 91% of respondents correctly indicated that all five patient groups listed should be offered an HIV test (data not shown).

Figure 1: Percentage of respondents who answered the true/false questions correctly (n= 1,059-1,068)



Abbreviations: n, number; STIs, sexually transmitted infections

Legend: The correct answer to each question is indicated on the bar chart

Comfort with aspects of HIV testing

When asked how comfortable they were discussing HIV with their patients (including risk factors; pre and post-test counselling; providing test results; and complying with reporting requirements), a little over half (55.9%) of respondents indicated that they were very comfortable with the elements of HIV testing. Only 6.0% of the sample was either not very comfortable or not at all comfortable with HIV testing (Table 2).

Table 2: Number and percentage of participants indicating different levels of comfort discussing HIV with patients (n=947)

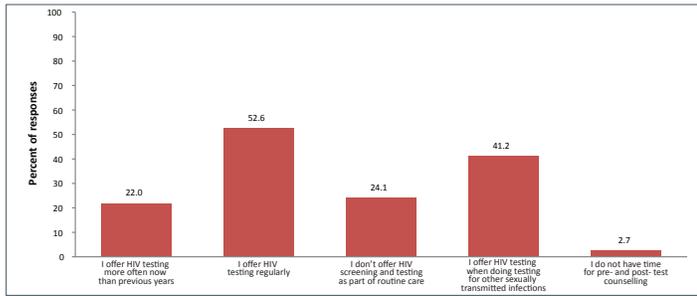
Level of comfort with discussing HIV with patients	n	%
Very/extremely comfortable	529	55.9
Comfortable	187	19.8
Somewhat comfortable	119	12.6
Not very comfortable	31	3.3
Not at all comfortable	24	2.5
Not applicable	57	6

Abbreviation: n, number

Note: Level of comfort with discussing HIV with patients, including risk factors, pre- and post-test counselling, providing test results, and complying with reporting requirements



Figure 2: Percentage of respondents who indicated that the above statements apply to them (n=1,075)



Abbreviation : n, number

Clinical practises related to HIV testing

Over half of respondents (52.6%) reported offering HIV testing and 41.2% indicated that they offer HIV testing when testing for other STIs (Figure 2). In contrast, almost one-quarter of participants (24.1%) reported they offer routine testing to less than 25% or none of their patients.

When asked how often they offer HIV tests as part of routine care, 48.6% reported offering this 75-100% of the time (Table 3).

Table 3: The percentage of patients offered HIV tests as part of routine care (n=621)

To what percentage of patients do you offer HIV tests as part of routine care? (e.g., annual check-ups, physicals)	n	%
75–100%	302	48.6
50–75%	100	16.1
25–50%	57	9.2
Less than 25%	83	13.4
I do not offer routin HIV testing to any of my patients	79	12.7

Abbreviation: n, number

Discussion

Overall, the results of this national survey suggest that health care providers have good knowledge about HIV testing and are comfortable with testing; however, there are a few knowledge gaps. The two gaps in knowledge—underestimating the percentage of people living with HIV who are unaware of their HIV status and lack of awareness that HIV patients are frequently symptomatic during acute infection—along with half of participants reporting they did not offer HIV screening and testing as part of routine care, may result in missed opportunities for early diagnosis of HIV. A lack of perceived risk has been previously identified as a key barrier to HIV testing (11).

The strengths of the current study include the geographically representative sample, with respondents from all provinces and territories, and the diverse range of health care providers. Moreover, the survey was comprehensive, covering a number of areas that could be used to update the Guide.

The limitations include the use of a convenience sample, which means the responses of the sample may not be representative

of all health care providers in Canada who offer HIV testing. Some of our avenues of dissemination may have been more likely to target health care providers in the area of sexual health who would be more knowledgeable about and comfortable with HIV testing than other health care providers. In addition, the use of self-reported measures of clinical practice with respect to HIV testing practices could have introduced recall bias into the study.

Conclusion

HIV testing is the first step towards initiation of HIV treatment to improve the lives of people living with HIV and their sexual partners and reach the UNAIDS’ 90-90-90 targets. The results of this survey could be used to inform future iterations of the Guide and other knowledge translation initiatives to improve provider awareness and comfort with testing as part of the overall effort to work towards HIV elimination in Canada.

Authors’ statement

GT—conceptualization, methodology, data collection and curation, formal analysis, writing—original draft, writing—review and editing, supervision, project administration
TA—methodology, data collection and curation, writing—original draft, writing—review and editing
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Conflict of interest

None.

Contributors

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Setting the stage for expanding HIV pre-exposure prophylaxis use in Canada

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Abstract

Human immunodeficiency virus (HIV) infection continues to disproportionately affect vulnerable populations in Canada; particularly men who have sex with men (MSM). Novel HIV prevention strategies have recently expanded from the use of non-occupational post-exposure prophylaxis (nPEP) after high risk exposures to the use of pre-exposure prophylaxis (PrEP) in which individuals reduce risk of HIV infection through use of combination antiretrovirals taken prior to risk exposure. With approval of tenofovir/emtricitabine (TDF/FTC) for use as PrEP only in early 2016, and with limited public funding to date, uptake in Canada is in its preliminary stages. These biomedical prevention strategies have proven efficacy for MSM, and they may have potential for other at-risk populations. With generic formulations of TDF/FTC now available in Canada, there is an opportunity for widespread implementation. Expanding knowledge of health care providers across Canada on how best to assess, refer for or prescribe and monitor PrEP will contribute to the current efforts to reach the global goal of eliminating new HIV infections.

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Introduction

It has been over 40 years since the HIV epidemic first drew clinical attention, with reports of opportunistic infections and cancers occurring in young, otherwise healthy gay, bisexual and other men who have sex with men (MSM) (1,2). Despite tremendous advances in HIV diagnostics, HIV care and management and three decades of educational campaigns, MSM continue to bear the brunt of the HIV epidemic in Canada (3). MSM in Canada are now 171 times more likely to acquire HIV infection than men in the general population. The bulk of these infections are now concentrated in urban areas where, in cities such as Vancouver and Toronto, MSM consistently constitute approximately 70% of all new HIV diagnoses each year (4). In addition, Canada has witnessed a dramatic rise in new HIV diagnoses amongst Indigenous individuals living in the Prairie provinces, attributed to injection drug use (IDU) and heterosexual transmission (5).

In countries such as England that have begun to roll out biomedical prevention strategies such as pre-exposure prophylaxis (PrEP), there have been substantial decreases in new infections, with most of this experience to date being amongst MSM (6). The evidence of efficacy and the promising results from early uptake of both pre- and post-prophylaxis medication to prevent the transmission of HIV marks an important new opportunity for HIV prevention strategies in Canada.

Context

HIV prevention strategies have traditionally relied on individual level behavioural interventions, such as improved condom use or sexual health counselling, as well as community level interventions to decreasing risk for marginalized populations, such as needle exchange or harm reduction services for those who inject drugs (7). The emergence of improved HIV testing strategies, including assays with shorter window periods or point-of-care delivery, have led to more HIV infections being diagnosed earlier in the course of disease, with the potential to limit onward transmission of the virus. Suppressive antiretroviral therapy (ART) has been shown to prevent the transmission of HIV from an HIV-positive individual to an uninfected sexual partner (8,9). Expansion of ART programs, in combination with harm reduction programming, has significantly reduced HIV infections amongst those who inject drugs in Vancouver's inner city, with a drop in new diagnoses from over 350 in 1996 to below 30 in 2012 (10).

Despite the significant expansion of ART in Canada, sexual transmission prior to diagnosis, particularly amongst MSM individuals experiencing acute seroconversion, contributes to Canada's ongoing epidemic (11-14). There is emerging global consensus that a combination approach that packages current prevention strategies with emerging biomedical prevention interventions offers the best hope of reducing new HIV infections (15). The objective of this article is to describe the PrEP and non-occupational post-exposure prophylaxis (nPEP) treatments, and the challenges and opportunities for these biomedical



HIV prevention strategies that have the potential to alter the trajectory of the HIV epidemic in Canada and around the world.

Pre- and post-prophylaxis medication strategies

Use of antiretroviral medications for post-exposure prophylaxis has been the standard of care for several decades for high risk exposures occurring in occupational settings (such as hospitals). Use for non-occupational high risk exposures, such as consensual sexual exposure or needle sharing (nPEP), has been endorsed by guidelines in the United States beginning in 2005 (16), and is now standard of care in most jurisdictions in the developed world. Individuals with potential risk exposure are assessed based on the likelihood the source of the exposure could be HIV-positive and the risk of the nature of the exposure itself. If the source is not known to be HIV-positive, local epidemiology of HIV prevalence amongst at-risk populations, such as MSM or people who inject drugs (PWID), is important to assess risk. High risk exposures would include needle sharing and condomless receptive anal sex; moderate risk exposure includes condomless insertive anal or vaginal sex and condomless receptive vaginal intercourse. Individuals found to have had a high or moderate risk exposure from a source with significant likelihood of being HIV-positive are eligible for nPEP. In this setting, individuals receive a 28-day course of standard combination antiretroviral medications to decrease likelihood of infection. Medications must be started as soon as possible after exposure and no later than 72 hours after exposure (17). Individuals should undergo HIV testing at 12 weeks post-exposure to ensure they remain HIV-negative, and should be offered immediate referral for HIV therapy if found to be HIV-positive.

In contrast, PrEP refers to the daily use of the fixed-dose combination of tenofovir disoproxil fumarate (TDF) and emtricitabine (FTC) in conjunction with ongoing safer sex practices in HIV-negative individuals. Here, therapy is used on an ongoing basis, prior to a potential HIV exposure and continued afterwards to prevent infection. Individuals at potential risk for HIV acquisition should undergo a baseline assessment to ensure they are HIV-negative. Use of a fourth generation HIV assay is recommended for screening due to its reduced window period. Individuals with signs or symptoms of acute HIV infection, or with exposure within the window period (up to 21 days following exposure) of the assay, should be tested with other modalities such as the HIV (RNA) nucleic acid amplification test (NAAT) or be retested 14–21 days later to be sure of an accurate result. Individuals with undiagnosed HIV infection who are started on PrEP may be at risk for development of HIV drug resistance since they do not receive a standard triple antiretroviral regimen. Individuals should be counselled regarding the need for complete adherence to have full protective benefit, and that protective levels are reached after seven days of daily use. PrEP is very well tolerated, with a small risk of gastrointestinal side effects in the first few weeks, and a potential risk of reversible renal and bone toxicity. A meta-analysis of ten placebo-controlled trials has shown that the frequency of adverse events is similar to placebo (OR=1.01, 95%CI=0.99-1.03)(18). Individuals using PrEP undergo regular monitoring every three months with updated HIV testing, renal function testing and screens for sexually transmitted infections. See **Table 1** for a

summary of pre- and post-exposure prophylaxis treatments for HIV.

Table 1: Summary of pre- and post-exposure prophylaxis treatments for HIV

Description	Pre-exposure prophylaxis (PrEP)	Non-occupational post-exposure prophylaxis (nPEP)
Labelled indication	Yes	No
Population	Individual at high risk of HIV exposure through sex or needle sharing	Individual who has experienced a high or moderate risk exposure from an individual at significant risk for having transmissible HIV within the preceding 72 hours
Medications used	Tenofovir DF/emtricitabine	Variable, but current data support the combination of, 1) tenofovir DF, 2) emtricitabine or lamivudine and 3) either an integrase strand transfer inhibitor (raltegravir or dolutegravir) or a boosted protease inhibitor (darunavir/ritonavir)
Duration	Indefinite while risk of exposure continues Medication is taken daily	Daily for 28 days
Common side-effects	Nausea, GI upset, small risk of reversible nephrotoxicity and decreases in bone density	Regimen-specific, but may include nausea, GI upset, headache, rare risk of renal or liver toxicity, risk of drug interactions if boosted protease inhibitors are used
Monitoring	Baseline HIV, liver, renal and STI screens Followup testing one month after use and quarterly thereafter	Baseline HIV, liver, renal and STI screens Followup testing at two and four weeks after initiation if symptoms arise or if baseline abnormalities detected HIV testing 12 weeks after exposure

Abbreviations: GI, gastrointestinal; STI, sexually transmitted infections; Tenofovir DF, tenofovir disoproxil fumarate

Evidence for PrEP

Use of TDF/FTC for PrEP in HIV-negative individuals at high ongoing risk of HIV acquisition has been rigorously evaluated in randomized clinical trials and has been found to be highly effective, particularly in MSM (**Table 2**). Daily use has been evaluated in two trials, while the Ipergay trial studied “on-demand” PrEP, where TDF/FTC was used 2–24 hours prior to exposure (loading dose of two tablets) followed by daily use until 48 hours after last sexual exposure (19).

**Table 2: Summary of HIV pre-exposure prophylaxis trials in men who have sex with men (MSM)**

Study	Inclusion criteria	Intervention	HIV incidence rate (Control arm)	Risk reduction	Number needed to treat per year
iPrEx (20,21)	High risk for HIV: Anal sex with >4 partners UAI with HIV+/unknown partner Prior STI Transactional Sex	Daily tenofovir/emtricitabine vs. placebo	3.9/100 person-years (95% CI 3.17 – 4.87)	Intention to treat: 44% (95%CI 15 – 63) On treatment with detectable drug: 92% (95% CI 40 – 99)	Overall: 62 (95% CI 44 – 147) With UAI: 36 With STI: 41
PROUD (22)	UAI last 90 days	Immediate vs. deferred daily tenofovir/emtricitabine	8.9/100 PY (95% CI 6 – 12.7)	Overall: 86% (95% CI 58 – 96)	Overall:13 (95% CI 9 – 25)
Ipergay (19)	UAI with >2 partners in last 6 months	On-demand tenofovir/emtricitabine vs. placebo	6.6/100 PY	Overall: 86% (95% CI 40 – 99)	Overall: 18

Abbreviations: CI, confidence interval; HIV, human immunodeficiency virus; PY, person years; STI, sexually transmitted infection; UAI, unprotected anal intercourse

Use of both TDF alone and TDF/FTC has been evaluated for use in preventing HIV transmission amongst heterosexual serodiscordant couples and in other heterosexuals in highly endemic areas (23-26). Findings of these studies are conflicting, with some studies showing protective benefit and others not. This seems to be largely driven by poor adherence to the study drug(s) (26).

Use of TDF alone as PrEP in PWID demonstrated a 48.9% decrease in HIV incidence overall in a study conducted in Bangkok (27). A limitation of that study is that under Thai law, sterile needles could not be provided to study participants, meaning that the incremental benefit of PrEP when a full package of evidence-based prevention strategies for PWID is also implemented remains unknown.

Challenges and opportunities for biomedical prevention

Identifying populations for PrEP

Mathematical modelling studies have clearly shown that PrEP is most cost-effective when given to those at greatest HIV risk (28,29). To date, PrEP scale-up in Canada has focused primarily on MSM because of the availability of clear data on how to identify high-incidence subpopulations and on the feasibility of PrEP implementation. The use of clinical markers, such as antecedent sexually transmitted infection or use of validated risk calculators (30-34) allows for the identification of Canadian MSM with HIV incidence rates well over internationally-recommended thresholds of 2–3% per year (35,36). Awareness of PrEP amongst MSM in urban areas has climbed substantially over the last few years. Recent studies have shown 91.3% of MSM undergoing anonymous HIV testing at a sexual health clinic in Toronto and 80% of MSM engaged in a cohort study in Vancouver were aware of PrEP (37).

Demonstration projects have shown the feasibility of achieving high adherence and ‘real-world’ implementation data suggest the potential for considerable impact on the HIV epidemic. Daily use of TDF/FTC eliminated new HIV infections amongst MSM receiving PrEP in a health maintenance organization in San Francisco (38,39). Similarly, use of PrEP as a component of comprehensive HIV services led to a 32% reduction in new diagnoses in clinics providing MSM services in London (6). In New South Wales, Australia, a 40% reduction in recent HIV infections in MSM has been ascribed to increased PrEP use (40).

Use in PWID or settings of heterosexual transmission also has potential, but presents different challenges. For instance it would require real-time integration with surveillance programs to identify communities with active transmission, and practical new strategies will be needed for identifying those who are most at-risk. Integrating biomedical prevention into harm reduction strategies for PWID where clear impact on HIV transmission has already been demonstrated has not yet been evaluated. An intriguing possibility evaluated in the Partner Demonstration Project in Africa is to offer PrEP to HIV-negative partners of newly diagnosed individuals initiating ART, serving as a short-term bridge while viral load suppression is achieved in the HIV-positive partner (41). This strategy may be useful in localized communities with ongoing HIV transmission. Similar implementation science initiatives are needed in Canada to better understand the acceptability, feasibility and real-world health outcomes as PrEP is rolled out in high risk populations.

Expanding access to PrEP

Currently, PrEP is prescribed primarily by specialist physicians, but this practice creates a bottleneck. Expanding access to PrEP could be done through building capacity with primary care providers. Given that primary care providers already offer other evidence-based primary prevention strategies for chronic diseases, PrEP prescribing is a logical extension of this role.

Physician surveys support the concept of primary care as an appropriate setting for PrEP delivery (42). Primary care providers give longitudinal care to large numbers of at-risk, HIV-negative persons and have expertise in other components of HIV prevention, such as counselling, substance use and mental health.

Recent studies in the United States (US) have found that awareness of PrEP amongst primary care providers has grown in the years following publication of clinical guidelines by the US Centers for Disease Control and Prevention (76–93% aware), with 17–34% of those surveyed now prescribing PrEP (43-45). Unlike the United States, Australia and the United Kingdom, which have regularly updated national guidelines for HIV treatment and nPEP, Canada has neither. This is in part because health care is a provincial/territorial jurisdiction. Currently only British Columbia and Quebec have issued clinical guidance for physicians prescribing PrEP (46,47). In British Columbia, there are no provincial restrictions regarding type of physician who can prescribe PrEP, while in Quebec, current guidance suggests PrEP should be prescribed only by physicians who already have experience prescribing antiretroviral therapy.

A lack of overall PrEP knowledge has been identified by physicians as a potential barrier to prescribing (44). Other



barriers that may prevent physician uptake of PrEP could include misperceptions regarding potential side effects of PrEP, concerns regarding risk compensation (the notion that individuals may increase risky behaviour if they believe they are being protected against HIV, and thus may overcome protective benefits) and increased sexually transmitted infections amongst PrEP users. These barriers can be readily addressed (48) or are amenable to screening interventions (49).

Increasing physician education and engaging primary care physicians to either prescribe or refer for PrEP will help to expand the reach of this primary prevention strategy.

What about public reimbursement?

Health Canada authorized the use of TDF/FTC in conjunction with ongoing safer sex practises for HIV prevention only in 2016. Until recently, only Quebec had offered public re-imbusement for PrEP. Elsewhere, individuals wishing to use PrEP had been limited to coverage via private third-party insurance, or through use of so-called “buyers clubs”, which promote access via online pharmacies (50). In August 2016, as part of the Common Drug Review process of the Canadian Agency for Drugs and Technology in Health (CADTH), the Canadian Drug Expert Committee (CDEC) provided a formal recommendation to participating Canadian federal, provincial and territorial public drug plans that TDF/FTC be listed on their formularies for a PrEP indication according to the Health Canada indication if the following two conditions were met:

- it is provided in the context of a sexual health program by a prescriber experienced in the treatment and prevention of HIV-1 infection
- the price is reduced (51)

However, the first condition is itself a barrier to expanding PrEP uptake, as it implies that only prescribers experienced in HIV prevention or management should prescribe PrEP.

With the very recent entrance of generic TDF/FTC onto the Canadian market, options for lower drug pricing and expanded access are already in place in some areas. In September 2017, Ontario announced coverage of PrEP via the Ontario Drug Benefit Program, with no restrictions on who might prescribe. British Columbia is currently reviewing PrEP coverage in light of new generic pricing (52).

Next steps

We are entering a new era in HIV elimination efforts with access to biomedical prevention strategies. These strategies have proven effectiveness in MSM who continue to be over-represented in the Canadian HIV epidemic, and may also have a role in decreasing transmission in other at-risk populations.

To realize the full benefits of biomedical prevention, a number of steps are needed. The publication of clinical guidelines would increase health care provider comfort levels with PrEP prescribing. Continuing medical education, summarizing the evidence on PrEP and increasing awareness of the guidelines, will improve health care provider knowledge, and transition PrEP into the repertoire of services offered by primary care providers.

In those provinces where PrEP initially may be provided only by those experienced in the treatment and prevention of HIV-1 infection, other primary care clinicians can still identify at-risk individuals, inform them of PrEP and provide opportunities for referral. PrEP referral could also be integrated into existing STI programs, public health partner notification programs or linking to existing programs that see at-risk individuals presenting for assessment for post exposure prophylaxis. Closer linkage of public health programs and clinical services for HIV prevention and care could also enhance knowledge of and acceptance of PrEP.

Conclusion

Biomedical prevention strategies have the potential to alter the trajectory of the HIV epidemic in Canada and around the world. The successful integration of PrEP into existing HIV screening and prevention practices will undoubtedly contribute to the global goal of eliminating new HIV infections.

Authors' statement

MH and DT jointly conceived and contributed to the writing of this article.

Conflict of interest

MH: has received honoraria for delivering educational lectures of his own design (Gilead, Merck and Janssen) or attending advisory boards from BMS, Gilead, Merck, Janssen and Viiv Healthcare. All monies were paid to his institution.

DT: has received honoraria from Viiv Healthcare and Merck for delivering educational lectures of his own design; DT's institution has received support from Gilead and Viiv Healthcare for investigator-initiated research grants; DT is a site Principal Investigator for clinical trials sponsored by GSK.

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Canadian Public Health Laboratory Network position statement: Non-culture based diagnostics for gastroenteritis and implications for public health investigations

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Abstract

As clinical laboratories transition to using culture-independent detection test (CIDT) panels for cases of acute gastroenteritis, culture of clinical specimens is becoming less common. The reduction in bacterial cultures available for public health activities is expected to hinder surveillance and outbreak response by public health laboratories at the local, provincial, national and international levels. These recommendations are intended to serve as guidelines for the implementation of CIDT panels in frontline laboratories in Canada. The United States of America has already seen a significant reduction in culture of stool specimens despite the Association of Public Health Laboratories recommendation to perform reflex culture on positive CIDT specimens. Priority public health organisms addressed in these Canadian guidelines include Shiga toxin-producing *Escherichia coli*, *Shigella* and *Salmonella* and, under regional circumstances, other organisms such as *Campylobacter jejuni/coli* and *Yersinia enterocolitica*. These recommendations suggest active engagement between primary diagnostic laboratories and provincial public health laboratories to determine the workflow and protocols for reflex or parallel culture. Consequently, notifiable disease definitions will also need modification, with consultation of all stakeholders. Stakeholders need to work together to enhance recovery of bacterial isolates with best practices used for stool transport and storage.

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Introduction

Diagnostic testing of enteric bacteria informs both individual clinical decisions and serves as a critical surveillance mechanism to detect outbreaks, protect populations and to mitigate further spread of disease. Generally, front line diagnostic microbiology laboratories detect the presence of enteric pathogens for clinical purposes and forward isolates to a provincial public health laboratory for confirmation and typing. Typing results are then compared with databases of other isolates via PulseNet Canada (and internationally, as needed) to inform public health actions and interventions within and across jurisdictions. Results are also integrated with sentinel-site surveillance programs targeting broad food safety-related issues (i.e., FoodNet Canada). Clusters

of clinical cases and outbreaks detected and linked by genetic comparison of isolates from patients, the environment, food and animals drive most foodborne disease outbreak investigations. From 2008 to 2014, 115 foodborne outbreaks were detected in Canada via these surveillance mechanisms (1). Submission of isolates to a provincial public health laboratory also enables access to information on predominant circulating strains and antibiotic resistant profiles.

This crucial public health surveillance and protection mechanism and its effectiveness is under threat from the implementation of culture-independent diagnostic tests (CIDTs), which were



developed for diagnostic application in the front line laboratory setting and which bypass the need to recover the bacteria necessary for public health surveillance (2). In the United States, many laboratories have discontinued culture altogether and the Centers for Disease Control and Prevention has reported a drastic reduction in the submission of isolates to state public health laboratories since the introduction of CIDT (3). The United States FoodNet surveillance system found that there was no reflex culture attempted in 35.6% of bacterial gastroenteritis cases diagnosed by CIDT (4) and that CIDT-positive diagnoses that were not confirmed by culture increased by 114% in 2016 compared to the previous three years (5).

In response to this decrease in culture results, the Association of Public Health Laboratories has released interim recommendations for CIDT testing. In brief, these interim recommendations for enteric pathogens ask each clinical laboratory to:

- Continue to obtain and submit isolates of foodborne pathogens to local and state public health laboratories
- Submit the CIDT-positive specimen to a public health laboratory if unable to culture the isolates themselves
- Maintain effective and open communication with public health laboratories in their state or jurisdiction, including notifying the public health laboratories of the intent to implement a CIDT for foodborne pathogens, and to delineate the increased responsibilities of state public health departments and laboratories as well as national authorities

This guideline presents the recommendations of the Canadian Public Health Laboratory Network for the implementation of CIDT in Canadian laboratories.

Recommendations

Primary recommendation

1. If a CIDT is used as a primary screening tool for bacterial gastroenteritis, culture is to be performed on stools positive for a bacterial pathogen.

Culture, using appropriate methods, should be performed on CIDT-positive stools for bacterial pathogens of public health significance and when an isolate is required for antibiotic susceptibility testing to guide clinical treatment.

In Canada, organisms of public health significance include Shiga toxin-producing *Escherichia coli*, *Shigella* and *Salmonella*. These organisms are currently part of surveillance performed at provincial public health laboratories and the Public Health Agency of Canada's National Microbiology Laboratory. Genotyping (i.e., using pulsed-field gel electrophoresis and whole-genome sequencing) on pure cultures of these species is required for cluster and outbreak detection through PulseNet. Depending on the jurisdiction that the laboratory services, additional organisms may need to be submitted to the public health laboratory (e.g., *Campylobacter jejuni/coli* and *Yersinia enterocolitica*).

Additional recommendations

2. Consultation between primary diagnostic laboratories and provincial public health laboratories should occur in order to define the roles and responsibilities that optimize surveillance workflow.

Targeted reflex culture on CIDT-positive stools, or parallel culture should be performed by the designated laboratory. Specific protocols should be developed at the regional level.

3. To determine if notifiable disease definitions need to be modified following the implementation of CIDT, consultation between stakeholders (public health authorities, public health laboratories, primary diagnostic laboratories and clinicians) should occur.

Depending on the province, notifiable disease case definitions may require culture of a bacterial agent to identify a case and trigger investigation; therefore, modification of case definitions may need to occur to account for cases identified with CIDT. Focus should be placed on determining how to deal with cases that are CIDT-positive and culture-negative. At the time of writing, the evidence is insufficient to determine if molecular detection with culture negativity indicates infection. A CIDT-positive and culture-negative result may indicate sampling error, low organism burden or dead organism due to antibiotic administration or loss of viability (e.g., due to long transportation time from collection to culture).

We recommend that CIDT-positive and culture-negative cases are deemed probable cases under provincial and national notifiable disease definitions. In cases where it is necessary to determine if the patient has viable organisms or confirms that this is indeed a case, repeat culture of the initial stool specimen is recommended. A second stool specimen for repeat culture and CIDT testing may also be useful in trying to obtain an isolate for typing. If resources are available, a confirmatory polymerase chain reaction (PCR) with a different target should be used if a false-positive or unusual molecular result is suspected.

4. Consult with stakeholders to determine the appropriate frontline CIDT panel and which front line cultures need to be maintained.

Many CIDT commercial panels do not test for some of the organisms that are required for routine stool culture reports and different CIDT panels may test for different organisms. Thus, the specific panel for the specific population serviced by the relevant laboratories must be determined. Primary culture screening for some organisms may still be needed. The indications and locations of primary culture for these additional organisms need to be determined in advance of CIDT implementation.

Some pathogens screened for by culture may be of questionable pathogenicity (e.g., *Aeromonas* spp.); laboratories and stakeholders may or may not choose to maintain testing for these organisms. Alternatively, cultures of these organisms could be required under prescribed circumstances.

The CIDT test panels may also include other pathogens not included in a routine bacterial gastroenteritis culture, such as viruses or *Clostridium difficile*. The appropriateness of testing and reporting of multiple pathogens in different clinical scenarios needs to be carefully considered. It should be noted



that asymptomatic patients can be positive for some of these pathogens and the clinical impact on the patient needs to be considered (6).

- To enhance recovery of bacterial isolates, best practices should be used for stool transport and storage.

A variety of pre-analytical factors can impair recovery of bacterial isolates, including long transportation times and storage at ambient temperatures. Cary-Blair, modified Cary-Blair and similar transport media are often recommended to improve recovery of organisms and should be considered when samples are collected at remote sites or turnaround times are long. Storage at 4°C will prevent overgrowth and enhance recovery of organisms. For long-term storage, freezing is preferable to 4°C. If practical, labs may consider storing stool specimens in the freezer while awaiting CIDT results (7,8).

Conclusion

These guidelines are the critical first step to moderating the public health impact of acute gastroenteritis assays on the market in Canada. It is imperative that each front line and public health laboratory engage with their counterpart laboratories to develop a test strategy that serves both clinical diagnostics and public health purposes.

Authors' statement

All authors were members of the Canadian Public Health Laboratory Network (CPHLN) Culture Independent Diagnostic Testing Working Group. This group was chaired by AR Reimer (Federal) and V Allen (Provincial).

Conflict of Interest

None.

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Addendum to the NACI Statement on Seasonal Influenza Vaccine for 2017–2018

Source: National Advisory Committee on Immunization. Addendum—Influvac® Use in Children. <https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci.html> [In press].

The recent authorization by Health Canada, extending the indication for the use of Influvac® (BGP Pharma ULC) to include children 3–17 years of age, provided the impetus for the National Advisory Committee on Immunization (NACI) to review the recommendation on the use of the vaccine. After careful review of available evidence, NACI has revised its recommendation on the use of Influvac, a trivalent inactivated influenza vaccine (TIV).

NACI recommends that Influvac should be considered among the TIVs offered to children 3–17 years of age when a quadrivalent influenza vaccine is not available (Strong NACI Recommendation).

NACI concludes that there is fair evidence of vaccine effectiveness, immunogenicity and safety to recommend the use of Influvac for children 3–17 years of age (Grade B Evidence). There is insufficient evidence, in quantity and quality, to recommend the use of Influvac for children younger than three years of age (Grade I Evidence). The recommendation on the use of Influvac in children is a change from previous NACI statements, as Influvac was not previously recommended by NACI for use in persons younger than 18 years of age.

Notwithstanding this new recommendation on the use of Influvac (a TIV), NACI continues to recommend that a quadrivalent formulation of influenza vaccine be used for children younger than 18 years of age. If a quadrivalent vaccine is not available, a TIV should be used.

Details supporting this recommendation will be published on the NACI website as an addendum to the NACI Statement on Seasonal Influenza Vaccine for 2017–2018.



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