Shifting Sands: Changing Regional and Gender-specific Patterns of HIV/AIDS Mortality in Canada, 1987 to 2008

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ABSTRACT

Objective: To assess patterns of HIV-related mortality by period, gender and age group in Canada from 1987 to 2008.

Methods: We applied standard demographic techniques to assess changes in HIV/AIDS mortality over five time periods: 1987-1991, 1992-1996, 1997-2001, 2002-2006, and 2007-2008. HIV/AIDS-related mortality was based on deaths in which HIV infection or AIDS was reported as the underlying cause of death. Population figures were obtained from annual estimates. Age-, sex- and province-specific crude and standardized HIV/AIDS mortality rates and ratios were used to examine changes in mortality.

Results: In the period from 1987 to 2008, there were 17,287 HIV/AIDS-related deaths; of these, 15,587 (90.2%) occurred among men and 1,700 (9.8%) among women. Standardized and age-specific death rates were generally higher in men than women. Among men, rates of mortality were highest in Quebec and British Columbia; and among women, rates increased over time in British Columbia and the Prairies and decreased in Quebec. In general, rates of death were highest in 1992-1996 and lowest in the latest period.

Conclusion: We observed a sharp decline in mortality rates with the introduction of HAART; however, the rates were higher among men in Quebec and British Columbia and among women in British Columbia, Quebec and the Prairies.

Key words: HIV; AIDS, mortality; Canada; demography

La traduction du résumé se trouve à la fin de l'article.

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There are approximately 65,000 people living with HIV in Canada, the majority residing in British Columbia, Ontario and Quebec. Nearly half of these infections (48%) are among gay and other men who have sex with men (MSM).[1,2] Other important groups include people who use injection drugs (IDUs), Aboriginal or First Nations people, and men and women from endemic countries.[1,2] MSM can be found in all three groups. On average, 2,300-4,300 new infections occur every year in Canada, with the number of infections exceeding the number of deaths.[1,2]

Since it was first made widely available in mid-1996, highly active antiretroviral therapy (HAART) has transformed HIV from a disease associated with high rates of mortality and short life span to one characterized by much lower rates of mortality where people can live for a much longer period of time and the infection can be treated as a manageable chronic condition.[3,4] HAART is made available in Canada through a variety of provincial and territorial programs, ranging from full coverage for all HIV-infected individuals in certain provinces to special coverage categories or coverage through programs with income-based deductibles.[1] The range of regimes available to those who need them also varies across the country.[5]

We undertook this study to characterize temporal, regional and demographic differences in HIV-related mortality from 1987 to 2008. Previous work has shown that rates of mortality vary by province, gender and calendar year; however, most of this work was done prior to the onset of HAART.[6-8] To our knowledge, this is one of the first studies to examine trends across provincial and territorial lines in Canada since the development of HAART and over such an extended period of time.

METHODS

Our analysis of HIV-related mortality rates in Canada over a 22-year period was based upon established demographic methods. These techniques have been described in detail elsewhere,[6,7] but below we briefly outline how they were used in this study.

Sources of data

HIV/AIDS mortality data were obtained from published reports produced by Statistics Canada for the calendar years 1987 to 2008,[9] in which HIV infection or AIDS was reported as the underlying cause of death. In these reports, deaths from HIV infection and AIDS were classified according to the International Classification of Diseases ICD 9, from 1987 to 1999 (codes 042 – 044),[10] or ICD 10, from 2000 to 2008 (codes B20 – B24).[11] Deaths were coded in this manner primarily by the manifestation of disease and were intended to pro-

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Table 1. Standardized Mortality Ratios and 95% CIs for HIV/AIDS in Canada by Gender and Period, 1987-2008

	1987-1991	1992-1996	1997-2001	2002-2006	2007-2008
Males					
Canada	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Atlantic	0.35 (0.29-0.42)	0.41 (0.36-0.46)	0.48 (0.38-0.60)	0.38 (0.29-0.50)	0.41 (0.25-0.63)
Quebec	1.31 (1.24-1.38)	1.22 (1.17-1.27)	1.15 (1.06-1.25)	1.18 (1.08-1.28)	0.97 (0.83-1.14)
Ontario	1.14 (1.09-1.20)	1.06 (1.03-1.10)	0.96 (0.89-1.03)	0.85 (0.78-0.92)	0.92 (0.80-1.04)
Prairies	0.44 (0.39-0.49)	0.46 (0.42-0.50)	0.58 (0.50-0.66)	0.55 (0.47-0.65)	0.87 (0.71-1.07)
British Columbia	1.50 (1.39-1.61)	1.44 (0.36-0.52)	1.64 (1.50-1.79)	2.01 (1.84-2.20)	1.77 (1.51-2.07)
Territories	–	0.20 (0.08-0.45)	0.27 (0.04-0.88)	0.20 (0.00-1.11)	0.53 (0.00-2.93)
Females					
Canada	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Atlantic	0.48 (0.24-0.86)	0.51 (0.33-0.76)	0.22 (0.09-0.45)	0.17 (0.05-0.39)	0.38 (0.12-0.88)
Quebec	2.27 (1.92-2.67)	1.86 (1.64-2.10)	1.44 (1.20-1.71)	0.98 (0.79-1.20)	0.99 (0.72-1.35)
Ontario	0.76 (0.59-0.95)	0.77 (0.66-0.90)	0.82 (0.68-0.99)	0.68 (0.55-0.82)	0.80 (0.61-1.04)
Prairies	0.27 (0.14-0.47)	0.33 (0.22-0.46)	0.48 (0.33-0.69)	1.22 (0.99-1.55)	1.19 (0.82-1.66)
British Columbia	0.45 (0.26-0.73)	1.13 (0.90-1.41)	1.76 (1.41-2.18)	2.18 (1.79-2.62)	1.68 (1.20-2.29)
Territories	–	1.73 (0.45-4.80)	0.84 (0.04-4.11)	1.86 (0.31-6.00)	2.01 (0.03-11.13)

mote comparability in the collection, processing, classification and presentation of mortality statistics.

Population figures for Canada and all provinces were obtained from annual estimates produced by Statistics Canada.[12] These estimates were obtained by five-year age groups for each gender and for all years under consideration.

Analytical approach

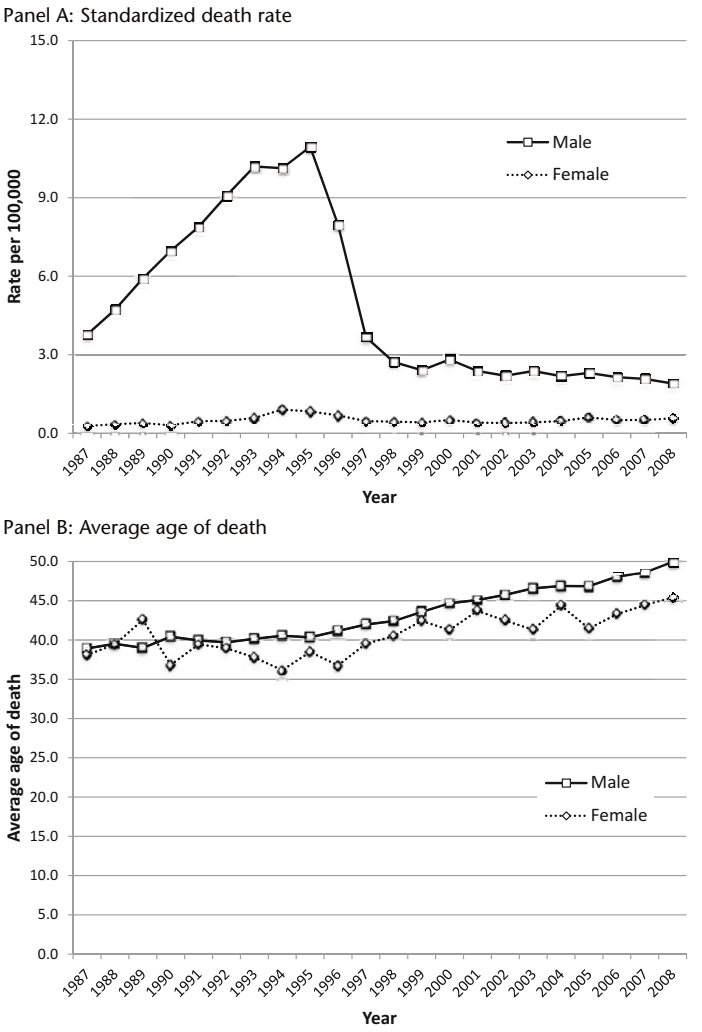
Age-, sex- and province-specific crude and standardized HIV/AIDS mortality rates were used to examine changes in mortality over five time periods: 1987-1991, 1992-1996, 1997-2001, 2002-2006, 2007-2008. Weighted averages were used to estimate the average age of HIV/AIDS-related deaths for Canadian men and women by year.[13] We also calculated standardized death rates for Canadian men and women by year, and indirect standardized death rates for each province, the Atlantic and Prairie regions and the territories, because we were unable to obtain information on the number of deaths in these geographical areas by age and sex.[14] Rates were expressed per 100,000 populations. Standardized mortality ratios (SMRs) were calculated to examine changes in mortality over the five time periods by geographical area, using Canadian mortality rates in each of the five periods as the reference standard. SMR was calculated by taking the ratio of the number of deaths observed to the number of deaths expected within a geographical area. The expected number of deaths was derived from the standard age-specific death rate and multiplied by the local population of that age group. The number of expected deaths in each age group was then summed across all ages to arrive at the expected number of deaths for the local population. Ratios were expressed per 100 and 95% confidence intervals were calculated.

RESULTS

A total of 17,287 deaths from HIV infection and AIDS occurred in Canada from 1987 to 2008. Of these, 15,587 (90.2%) occurred among men and 1,700 (9.8%) occurred among women. Deaths due to HIV/AIDS were highest in the 1992-1996 period [7,620 (44.1%)] and lowest in the 2007-2008 period [829 (4.8%)]. The greatest numbers of deaths occurred in Ontario [6,426 (37.2%)], Quebec [5,437 (31.4%)] and British Columbia [3,416 (19.8%)].

Table 1 provides information on standardized mortality ratios (SMRs) and corresponding 95% confidence intervals for HIV/AIDS in Canada by sex and region for the five time periods. Among men, rates of death observed were higher than expected in British Columbia and Quebec in all five time periods, with the highest

Figure 1. Standardized HIV/AIDS death rates and average age of death in Canada by gender, 1987-2008



SMRs being observed in British Columbia for the 2002-2006 period. In all periods, rates lower than expected were observed in the Prairies and the Atlantic provinces. Among women, the ratios of the expected versus the observed deaths steadily increased in British Columbia and the Prairies and notably decreased in Quebec over the study period. SMRs in British Columbia decreased for both men and women in the last period.

Figure 1 highlights temporal changes in standardized HIV/AIDS mortality rates in Canada (Panel A) and changes in the average age

Figure 2. Crude HIV/AIDS death rates, by Canadian province or region, 1987-2008

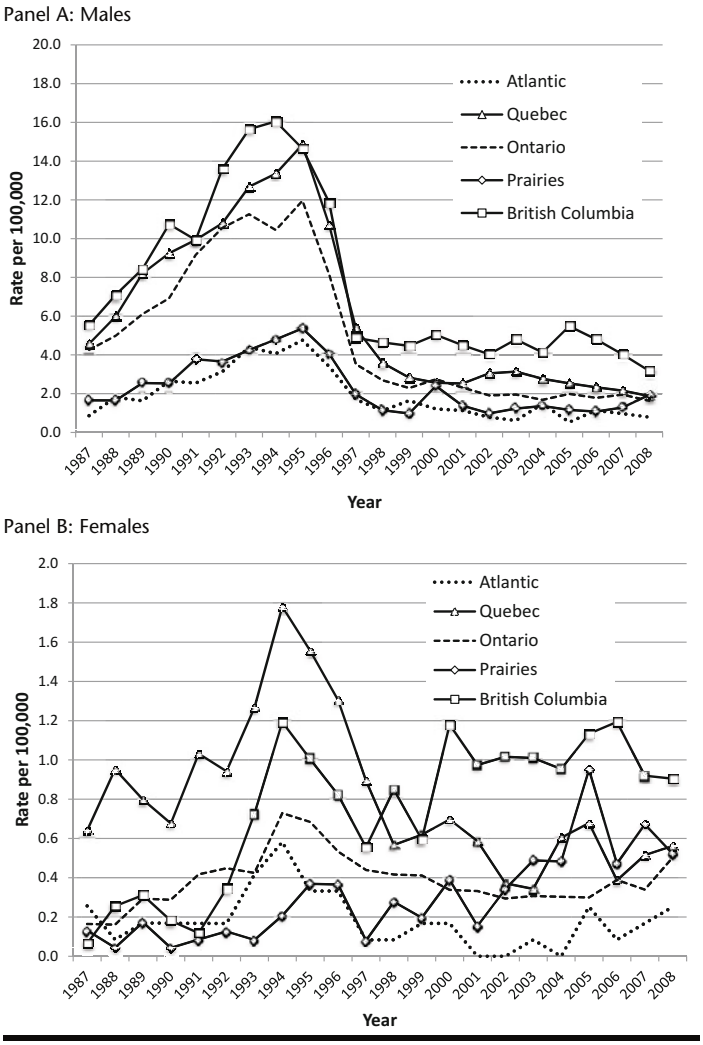
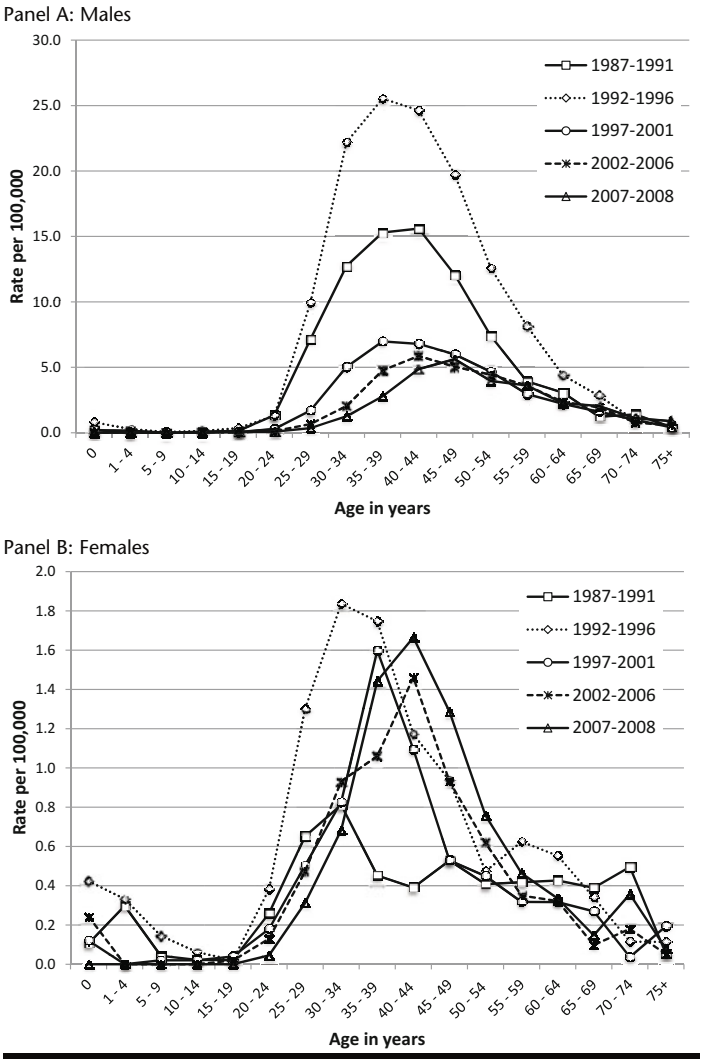


Figure 3. Age-specific HIV/AIDS death rates in Canada by gender and period, 1987-2008



at death by sex from 1987-2008 (Panel B). Among males, standardized rates steadily increased, peaking at 10.94 deaths per 100,000 population in 1995, and then declined over the subsequent period, reaching a rate of 1.90 deaths per 100,000 population in 2008. Among females, standardized death rates remained relatively constant over the study period, peaking at a rate of 0.91 deaths per 100,000 population in 1994 and decreasing to a rate of 0.57 deaths per 100,000 population in 2008. The average age at death, for both sexes, increased over the time period, with the greatest change being observed among males, where the age at death increased 11 years from 38.9 in 1987 to 49.9 years in 2008. Among females, the average age of death increased only 7 years from 38.1 to 45.4 years over the same time period.

Crude HIV/AIDS death rates, broken down by geographical area and sex, are shown in Figure 2 (Panels A and B). In both sexes, rates peaked in 1995 and then sharply declined over the subsequent time period. Among males, crude death rates were consistently higher in Quebec and British Columbia than in the other areas; among females, rates decreased in Quebec and increased in British Columbia and the Prairies over the study period. Due to small numbers, rates for the territories are not shown here. For the last few years, rates in British Columbia for both men and women are decreasing.

Figure 3 (Panels A and B) highlights age-specific death rates due to HIV/AIDS in Canada by five-year age group, sex and year. For both sexes, persons aged 25-59 years had the highest rate of death, independent of time period. For most age groups, male age-specific death rates due to HIV/AIDS were consistently higher than those for females. The highest death rates were observed in the 1992-1997 time period for both sexes and the lowest rates were observed in the 2007-2008 period.

DISCUSSION

There was a sharp decline in HIV-related mortality rates in Canada, as elsewhere in the world, with the introduction of HAART in the mid-1990s.[15] Following this sharp decline, mortality rates in most jurisdictions have remained surprisingly constant, with rates for men remaining much higher than those for women. Rates among men were highest in British Columbia and Quebec, while among women rates decreased in Quebec and increased in British Columbia and the Prairies. In recent years, rates in British Columbia have decreased.

Following the introduction of HAART in 1996, a significant decline in mortality due to HIV/AIDS was observed in men, but a similar decline was not observed in women.[1,16] Instead, the HIV-

related mortality rates for women have remained relatively constant throughout the entire study period. The high proportion of First Nations women infected with HIV may be one of the contributing factors associated with the lack of decline in HIV-related mortality in Canadian women, due to decreased access to HAART and other culturally relevant health services.[17-19] Between 1998 and 2006, women represented 48.1% of all positive HIV tests among First Nations Canadians, compared with only 20.7% of all positive HIV tests among non-First Nations Canadians.[20]

HIV-related mortality rates in some provinces were consistently above the national average. The reader must be cognizant that in some cases this may be explained by the fact that the actual population living with HIV is a higher proportion of total population in provinces with higher rates of mortality, like British Columbia and Quebec. What is not calculated or even inferred is that even when such provinces have the same or better life expectancy for people with HIV, they will appear to have higher SMR. This is simply because their denominators for SMR are based on total population (not population with HIV), while HIV deaths only occur among the population with HIV. In British Columbia, the higher rates may also be explained by the fact that a disproportionate number of those infected are injection drug users and First Nations peoples. In 2005, 14% of new HIV infections in Canada occurred in IDUs, compared with 31% of new HIV infections in British Columbia in the same year.[19-22] Also, 15% of new HIV infections in British Columbia occur in Aboriginal peoples, compared with 9% of new infections nationally.[21,22] Lack of access to and uptake of HAART within these populations[17-19] may explain why HIV-related mortality rates in British Columbia were higher. Recent vital statistics data available from British Columbia indicate that HIV mortality rates in this province for both men and women have continued to decrease, suggesting that access to HAART is increasing in this province.[23] Rates in Quebec, in both sexes, have also been high, as have those in the Prairies, especially among women. The changes in the Prairies suggest that new outbreaks in Alberta and Saskatchewan, mainly affecting First Nations, will likely have an impact on HIV-related mortality in this region unless increased access to culturally relevant HIV health services are developed in collaboration with affected communities.[24]

Our analysis has several limitations. First, HIV-related mortality rates are likely underestimated, as problems of misdiagnosis and under-reporting are common with HIV and AIDS, particularly with respect to the reporting of the underlying causes of death.[6,7] We have previously shown that physician reporting underestimates HIV mortality by up to 40%[25] and that a large proportion of HIV-positive men and women on HAART no longer die directly of HIV-related complications.[26] As such, the figures presented in this study may significantly underestimate the impact of HIV/AIDS on related mortality rates in Canada. Second, the reader must recognize that HIV death rates reported here are not specific to any one transmission group, but are a summation of these groups for a particular gender and region. Therefore, it is impossible to discern differences across transmission groups in this study. Third, although we used direct standardization to compare national rates, which is generally the best approach, we were limited by data for the regions and provinces, so indirect techniques were used here.

In conclusion, mortality due to HIV/AIDS in Canada has significantly declined since the introduction of effective HAART in the mid-1990s. However, like shifting sands, there is considerable variability in rates across the country. Men living in British Columbia and Quebec and women living in British Columbia and the Prairies continue to experience higher levels of HIV-related mortality than men and women in other parts of the country.

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RÉSUMÉ

Objectif : Analyser les courbes de la mortalité liée au VIH par période, par sexe et par groupe d'âge au Canada entre 1987 et 2008.

Méthode : Nous avons appliqué des techniques démographiques standard pour analyser les changements dans la mortalité due au VIH et au sida au cours de cinq périodes : 1987-1991, 1992-1996, 1997-2001, 2002-2006 et 2007-2008. La « mortalité liée au VIH et au sida » désigne les décès pour lesquels l'infection à VIH ou le sida était déclaré(e) comme cause de décès sous-jacente. Nos données démographiques proviennent d'estimations annuelles. Les rapports et les taux (bruts et standardisés) de mortalité due au VIH et au sida selon l'âge, le sexe et la province ont servi à examiner les changements dans la mortalité.

Résultats : Entre 1987 et 2008, il y a eu 17 287 décès liés au VIH et au sida; sur ces décès, 15 587 (90,2 %) sont survenus chez des hommes et 1 700 (9,8 %) chez des femmes. Les taux de mortalité standardisés et par âge étaient généralement plus élevés chez les hommes que chez les femmes. Chez les hommes, les taux de mortalité les plus élevés ont été déclarés au Québec et en Colombie-Britannique; et chez les femmes, les taux ont augmenté au fil du temps en Colombie-Britannique et dans les Prairies et diminué au Québec. Dans l'ensemble, les taux de mortalité les plus élevés ont été observés en 1992-1996, et les plus faibles, durant la période la plus récente.

Conclusion : Nous avons observé une baisse marquée des taux de mortalité avec l'introduction de la TAHA; cependant, les taux étaient supérieurs chez les hommes au Québec et en Colombie-Britannique et chez les femmes en Colombie-Britannique, au Québec et dans les Prairies.

Mots clés : VIH; sida, mortalité; Canada; démographie