NOVA SCOTIA
Health and Wellness

Surveillance Report on HIV/AIDS in Nova Scotia: 1983 to 2011

Population Health Assessment and Surveillance

ACKNOWLEDGEMENTS

Provincial HIV/AIDS surveillance would not be possible without the timely and complete case reporting completed by laboratories, health care providers, and public health professionals in the province. Additionally, HIV strain and drug resistance surveillance is made possible through a partnership between the province and the Centre for Communicable Disease and Infection Control, Public Health Agency of Canada. The Nova Scotia Department of Health and Wellness extends its thanks to all those whose contributions have helped make this report possible.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The purpose of this report is to describe trends in HIV/AIDS diagnoses reported to public health in Nova Scotia since the first person was diagnosed with AIDS in the province in 1983. The report examines cases newly diagnosed in Nova Scotia, focusing on cases reported in the last ten years (2002-2011). As well, enhanced surveillance information on HIV-1 subtypes, transmitted drug resistance mutations, and HIV disease progression at diagnosis is also presented. Below are highlights of findings from each section of the report.

HIV Reports

Reports by year

- Since the first reported HIV diagnosis in 1985, there have been 766 newly-diagnosed cases of HIV reported to public health in Nova Scotia.
- The peak number and rate of reported cases in Nova Scotia was in 1987. There were 52 reported HIV cases, corresponding to a rate of 5.8 cases per 100,000 population. Since that year, HIV case counts and rates have declined over time, to a low of 13 cases and a rate of 1.4 cases per 100,000 population in 2009.
- The age-standardized rate of HIV cases reported in Nova Scotia has been consistently lower than the Canadian rate. In 2009, the Canadian rate was 7.6 cases per 100,000 population.
- Over the last ten years, there was a peak in the provincial age standardized rate of reported HIV cases in 2004, where there were 3.5 cases reported per 100,000 population. An outbreak of syphilis occurred in Nova Scotia during this year, so this peak may be related to increased awareness of, and testing for, sexually transmitted and blood borne pathogens.

Reports by geography

Rates in Nova Scotia were highest in the Capital region, followed by the Eastern, Northern, and Western regions. Differences in the rate of reported cases in each geographic region may result from differences in HIV prevalence, prevalence of at-risk populations, availability of testing options, or differences in testing practices.

Reports by age and sex

- Cases of HIV reported between 2002 and 2011 were significantly older than those reported between 1985 and 2001. Rates were generally highest for those 20 to 49 years of age in the last ten years, and no cases under 20 years of age were reported. In all age groups, rates were significantly higher for males compared to females.
- The proportion of reported female HIV cases in Nova Scotia has increased slightly over time. From 2002 to 2011, 17.5% of all reported HIV cases were female, compared to 12.6% of cases reported between 1985 and 2001. The increasing trend in the proportion of female cases since 1985 was also observed for Canada as a whole.

Reports by exposure category

- In the first years of the HIV epidemic in Nova Scotia, nearly all cases were among men who have sex with men (MSM). This proportion of cases has declined over time and between 2002 and 2011, MSM accounted for 49.0% of all cases. The proportion of cases among injection drug users (IDU) and all types of heterosexual contact has increased over time. Between 2002 and 2011, 17.0% of cases reported IDU, 12.9% reported heterosexual contact with a person at risk for infection, 11.3% reported low-risk heterosexual contact, and 6.7% reported origin from a country where HIV is endemic (HET-Endemic). Cases in the

HET-Endemic category may have acquired their infections outside of Nova Scotia, and so it is likely that some of these cases are not reflective of disease acquisition within the province.

- Male cases were predominantly in the MSM exposure category, which accounted for 59.4% of all male cases. Injection drug use and heterosexual contact with no identified risk were the next most common exposure categories among males, each accounting for 12.5% of cases. In females, the heterosexual contact with a person at risk for infection (41.2%), IDU (29.4%), and origin from an HIV-endemic country (20.6%) exposure categories accounted for nearly all female HIV cases.
- In all age groups, the MSM exposure category accounted for the highest proportion of cases, ranging from 40.8% in those 30 to 39 years of age to 52.9% of cases 50 years of age and over. Similar proportions of cases who reported IDU or heterosexual contact with no identified risk were noted for all groups. Origin from an HIV-endemic country was more common among cases in younger age groups, and the proportion of cases who reported heterosexual contact with a person at risk for infection increased with increasing age.

Reports by race/ethnicity

- In the first years of the HIV epidemic in Nova Scotia, nearly all cases in Nova Scotia with reported race/ethnicity information were White. Since that time, the number and proportion of White cases has declined. While the proportion of cases in non-White race/ethnicity groups has increased over time, the absolute number of these cases has remained relatively constant, with an average of 3 cases reported per year.
- Between 2002 and 2011, 81.9% of reported HIV cases were White. Black cases accounted for the next largest race/ethnicity group, at 10.6% of all cases. Cases reporting an Aboriginal race/ethnicity accounted for 3.2% of all cases during this time period, and all other ethnicities each accounted for about 2% of the cases or less. It appears that the non-White populations are overrepresented in HIV cases when comparing these proportions to the ethnic distribution of the Nova Scotia population; however, differences between the race/ethnicity data sources makes this comparison difficult to interpret. Demographics and exposure categories for HIV cases can provide some insight into trends in reported cases by race/ethnicity and are discussed further within the report.

HIV-1 Subtypes

- In Nova Scotia, the prevalence of non-B HIV-1 subtypes and circulating recombinant forms (CRFs) was 14.5% between 2002 and 2011. The number and prevalence of cases with non-B subtypes or CRFs remained fairly constant over time, with 3 or fewer cases reported each year.
- Significant differences in the characteristics of cases with HIV-1 B subtypes versus those with non-B subtypes or CRFs indicate that cases with non-B subtypes may have acquired their infection prior to arriving in Nova Scotia from countries where non-B subtypes are more prevalent.

HIV-1 Transmitted Drug Resistance

- In Nova Scotia, the prevalence of transmitted drug resistance mutations was 9.2% between 2002 and 2011, which is similar to the prevalence of 10.3% for five Canadian provinces between 2002 and 2008. Mutations associated with resistance to nucleoside reverse transcriptase inhibitors (NRTIs) were most commonly reported (7.2% of cases).
- The prevalence of multidrug resistance for the Nova Scotia cases was 1.3%, which is similar to the 1.0% prevalence for five

Canadian provinces observed between 2002 and 2008.

- There were no significant differences between cases with transmitted drug resistance mutations and those with wild type virus for all characteristics examined.

HIV Disease Progression at Diagnosis

Reports by recency of infection

- Between 2001 and 2010, 27.5% of HIV cases diagnosed in Nova Scotia were recently infected (up to 170 days before diagnostic sample collection). This proportion is similar to the proportion of recently infected cases (31.5%) reported for four western Canadian provinces between 2000 and 2008.
- There was a significantly lower proportion of cases with recent infections from Capital (23.1%) compared to cases from outside Capital (43.3%). It is possible that those in regions outside Capital may have been more likely to seek testing closer to the time of their infection, which could be due to increased awareness about HIV transmission and symptoms or to differences in testing practices.

Reports by late presentation

- The proportion of HIV cases with an AIDS diagnosis within one year of their first positive HIV test has varied over time. The proportion reached a peak in 1993-1994 at 45.9% of cases and has gradually declined since that time to 14.3% of cases in 2009-2010.
- Between 2001 and 2010, 31.4% of cases met the definition for late presentation to HIV diagnosis (which is an AIDS diagnosis within one year after their first positive HIV test and/or initial CD4+ T-cell count less than 200 cells/µl within 6 months of HIV diagnosis). This proportion appeared to be slightly higher than what has been observed in other Canadian and international studies. Possible explanations for the higher proportion of Nova Scotia cases meeting a late presentation definition compared to other jurisdictions include a greater likelihood of testing for CD4 counts within 6 months of HIV diagnosis for late-stage patients in Nova Scotia compared to other jurisdictions, or that the prevalence of cases presenting late to diagnosis is truly higher
- Late presentation to HIV diagnosis was significantly more likely among older cases. No other characteristics were found to be significantly associated with late presentation to diagnosis.

AIDS Reports

- Since the first reported AIDS diagnosis in 1983, there have been 348 newly-diagnosed cases of AIDS reported to public health in Nova Scotia.
- The peak number and rate of reported AIDS diagnoses in Nova Scotia was in 1994. There were 37 reported cases, corresponding to a rate of 4.0 cases per 100,000 population. Since that year, AIDS case reports have decreased over time, to a low of 2 cases in 2009. This decline is likely a result of the availability of Highly Active Antiretroviral Therapy (HAART) in the late 1990's, which can prevent the onset of AIDS in HIV-infected persons.
- The age-standardized rate of AIDS cases reported in the last ten years in Nova Scotia is similar to the national rate.
- The characteristics of AIDS cases between 2002 and 2011 were similar to those of HIV cases reported during the same period and to AIDS cases reported for Canada as a whole.
- A higher proportion of cases diagnosed with AIDS between 2002 and 2011 developed AIDS five or more years after their HIV diagnosis (31.2%) compared to AIDS cases diagnosed between 1983 and 2001 (16.2%).

This increase can likely be attributed to the increased effectiveness of HIV treatment in delaying disease progression and the onset of AIDS.

HIV/AIDS Mortality

- Since the first reported death in 1985, there have been 318 deaths in HIV/AIDS cases reported to public health in Nova Scotia.
- The number of reported deaths reached a plateau between 1993 and 1996 (ranging from 22 to 29 deaths reported per year), and have declined since that time. This decline is likely a result of the availability of HAART in the late 1990's.
- The proportion of deaths between 2002 and 2011 for persons in the IDU exposure category (22.6%) appeared to be slightly higher than this proportion for HIV and AIDS cases reported during this time period (15.5% and 9.4%, respectively), as well as for cases reported before 2001. This higher proportion of deaths among IDU could result from risk factors associated with intravenous drug use that may result in premature death, confections with other blood-borne pathogens that accelerate disease progression and increase the risk of complications and death, delayed access to treatment, or reduced adherence to treatment.
- Between 2002 and 2011, nearly half of all deaths occurred ten or more years after HIV diagnosis. In contrast, only 4.7% of deaths between 1985 and 2001 fell into this category. Similarly, the proportion of deaths where the case had an AIDS diagnosis declined from 91.0% to 51.2% between these two periods. These differences reflect the effect of HAART in preventing the development of AIDS and extending the lives of those with HIV/AIDS.

INTRODUCTION

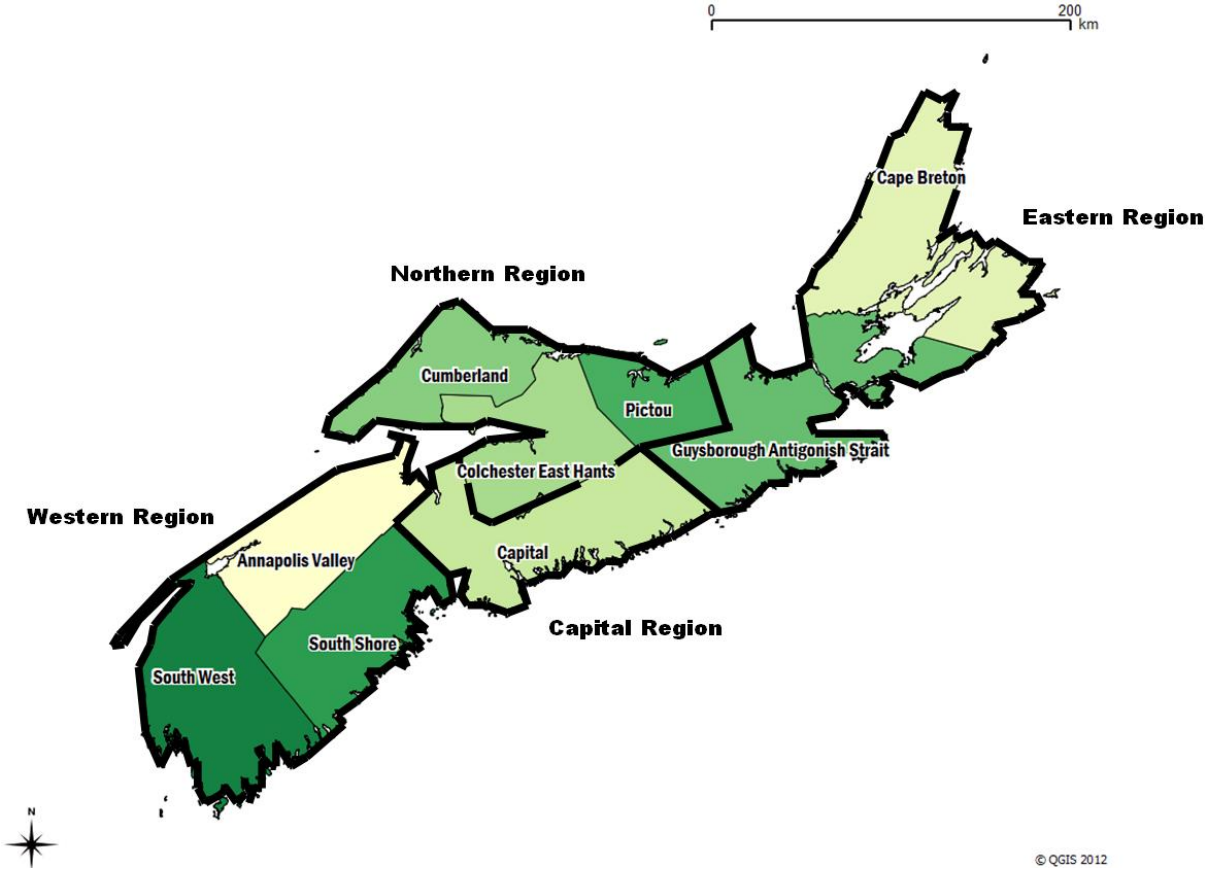
The purpose of this report is to describe trends in HIV/AIDS diagnoses reported to public health in Nova Scotia since the first person was diagnosed with AIDS in the province in 1983. The report examines cases newly diagnosed within Nova Scotia, focusing on cases reported in the last ten years (2002-2011). The report will examine trends in the following areas:

- HIV case reports
- HIV-1 strain types and transmitted drug resistance in treatment-naïve cases
- HIV progression at time of diagnosis (for cases reported between 2001 and 2010)
- AIDS case reports
- HIV/AIDS mortality for cases diagnosed within the province

This comprehensive report is intended to summarize and document surveillance information on all HIV/AIDS diagnoses reported to date in Nova Scotia. Future years of HIV/AIDS surveillance information will be included in the annual Notifiable Diseases in Nova Scotia Surveillance Report (1), but will have a more limited scope with respect to the time frame and enhanced information presented.

The HIV/AIDS surveillance information used for this report was obtained from a number of data sources available to the Nova Scotia Department of Health and Wellness (DHW). Background information on each data source is provided within each section, along with notes on known limitations for each source. Information is summarized provincially as well as by region and District Health Authority (DHA), boundaries for which are shown in Figure 1.

Figure 1: Map of District Health Authority and region boundaries, Nova Scotia.



HIV REPORTS

General Information

Human Immunodeficiency Virus (HIV) is a bloodborne virus that can be transmitted through unprotected sexual activity, contaminated needles used for injecting drugs or tattooing, pregnancy and breastfeeding, and other means of exposure to blood from an infected person. HIV results in a chronic, episodic illness that impairs a person's immune function, which can lead to opportunistic infections and the development of Acquired Immunodeficiency Syndrome (AIDS) and possibly death. HIV is a preventable disease; however, transmission continues to occur in Nova Scotia and other parts of the world (2).

Routine HIV surveillance is essential for describing who is being diagnosed with HIV, trends in diagnoses over time, and to understand factors surrounding disease transmission. This information is used to guide public health planning and policies for the prevention, control, and management of HIV.

The purpose of this section is:

- To examine trends in Nova Scotia HIV diagnoses over time
- To describe the characteristics of HIV cases diagnosed within Nova Scotia, with a particular focus on cases diagnosed in the last ten years (2002 to 2011)

Data Sources, Definitions, and Technical Notes

General information

In Nova Scotia, HIV diagnoses must be reported to public health as required by the Health Protection Act (3). HIV has been reportable in the province since 1985.

As part of public health HIV case follow-up, public health staff or the case's physician complete a case report form that captures demographic, risk factor, and clinical information about the case. This information is reported to the Nova Scotia Department of Health and Wellness (DHW) for provincial surveillance purposes. Provincial surveillance data for HIV capture Nova Scotia residents with a first-time HIV diagnosis.

Further information on HIV surveillance case definitions, reporting procedures, and forms can be found in the Nova Scotia Surveillance Guidelines for Notifiable Diseases and Conditions (4). Information on HIV public health case management and control measures used in the province can be found in the Nova Scotia Communicable Disease Control Manual (5).

All population counts used in this section were obtained from Statistics Canada, and are estimates based on the 2006 Census. Population counts for the race/ethnicity analysis were based on the Visible Minority and Aboriginal Identity information collected by the Census (6, 7). All national HIV surveillance information presented in this section was obtained from the Public Health Agency of Canada (PHAC) HIV/AIDS Surveillance Report (8). Age-standardized rates for Nova Scotia and national data were calculated using the 1991 population of Canada as the standard

population. This type of rate is used to remove the effect of differences in the age structure of these two populations when comparing their rates. All other data used in this section are cited where appropriate.

Exposure category classification and definition of HIV-endemic countries

While multiple risk factors for HIV infection can be reported, each case is assigned to one exposure category using a hierarchy of exposure categories. The hierarchy order is reflective of infection risk, and cases with multiple risk factors are assigned to the exposure category that appears highest in the hierarchy. The exposure category hierarchy used in Nova Scotia is identical to what is used at the national level (8), and includes the following exposure categories:

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

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

IDU: Persons who inject drugs.

Blood/Blood Products:

- **Recipient of Blood**: Received transfusion of whole blood or blood components, such as packed red cells, plasma, platelets or cryoprecipitate.
- **Recipient of Clotting Factor:** Received pooled concentrates of clotting factor VIII or IX for treatment of hemophilia/coagulation disorder.

High-Risk Heterosexual Contact (HET-HR):

- **Origin from an HIV-Endemic Country (HET-Endemic)**: People who were born in a country where HIV is endemic. An HIV-endemic country is defined as having an adult prevalence (ages 15-49) of HIV that is 1.0% or greater and one of the following:
    - Fifty percent or more of HIV cases attributed to heterosexual transmission;
    - A male to female ratio of 2:1 or less; or
    - HIV prevalence greater than or equal to 2% among women receiving prenatal care.

  A list of the current HIV-Endemic countries is provided in the national HIV/AIDS surveillance report (8).
- **Sexual Contact with a Person at Risk for Infection (HET-IR)**: People who report heterosexual contact with someone who is either HIV-infected or who is at increased risk for HIV infection (e.g. person who injects drugs, person from an HIV endemic country).

Heterosexual Contact with No Identified Risk (HET-NIR): If heterosexual contact is the only risk factor reported and nothing is known about the HIV-related factors associated with the partner.

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

Perinatal Transmission: The transmission of HIV from a woman infected with HIV to her infant either in utero, during childbirth, or through breastfeeding.

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

No Identified Risk (NIR): The history of exposure to HIV through any of the modes listed is unknown, or there is no reported history. This exposure category may include cases that are currently being followed up by local health department officials; people whose exposure history is incomplete because they

died, declined to be interviewed or were lost to follow-up; and people who cannot identify any mode of transmission.

For the purpose of this report, recipients of blood and clotting factor as well as perinatal transmission cases are grouped into the Other category due to the low number of cases reported for these categories.

Statistical analysis

Comparisons were made between cases diagnosed in 1985-2001 and 2002-2011 using the χ^2 test (or Fisher's exact test, where appropriate) for categorical variables, and using the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05, or by non-overlapping 95% confidence intervals (for data shown in figures).

Data limitations

- The HIV surveillance information presented in this report includes only Nova Scotia residents with a first-time HIV diagnosis in the province. This means that people who are not aware they are infected with HIV, as well as current residents who were previously tested and diagnosed before arriving in Nova Scotia are not included. As a result, this report cannot provide information on HIV prevalence in Nova Scotia.
- Anonymous HIV positive laboratory test results are not counted in provincial surveillance data and therefore are not captured in this report. However, because cases must be tested nominally before receiving treatment for their infection, it is assumed that most HIV positive persons who first test anonymously are reported nominally to public health and in turn are included in HIV surveillance data.
- Because individuals may not be tested for years after HIV infection, routine surveillance data likely do not reflect trends in infection incidence. As a result, these data can only be used to describe trends in reports of HIV diagnoses. However, testing completed at the National HIV and Retrovirology Laboratories as part of the Public Health Agency of Canada HIV Strain and Drug Resistance Program (described in the HIV-1 Subtypes section of the report) can provide an indication of the recency of HIV infection in reported cases. This information will be summarized in the HIV Disease Progression at Diagnosis section of this report.
- Regarding the exposure category information presented in this report:
    - The exposure category hierarchy used in this report is thought to reflect the gradient of infection risk for HIV. However, various behavioral factors (e.g. sexual and drug use practices) may influence the actual infection risk for individual cases. Because detailed information on such practices is not systematically collected and analyzed by public health, this information cannot be taken into account in this analysis and so the exposure category assignment may not actually reflect the likely source of infection for a case.
    - Information on a case's HIV-related risk factors is obtained during follow up by public health staff or the case's physician. Cases may not report certain risk factors due to a social desirability bias, which may result in misclassification of exposure category.
- Regarding the race/ethnicity information presented in this report:
    - Information on a case's race/ethnicity is obtained by public health staff or the case's physician during follow up. The HIV/AIDS case report form prompts the person completing the form to ask the case to assist with providing information about their race/ethnicity. However, it is possible that the person completing the

form may not obtain this information directly from the client. Therefore, the race/ethnicity data for cases presented in this report may be a combination of self-reported race/ethnicity and race/ethnicity as determined by the person completing follow up.

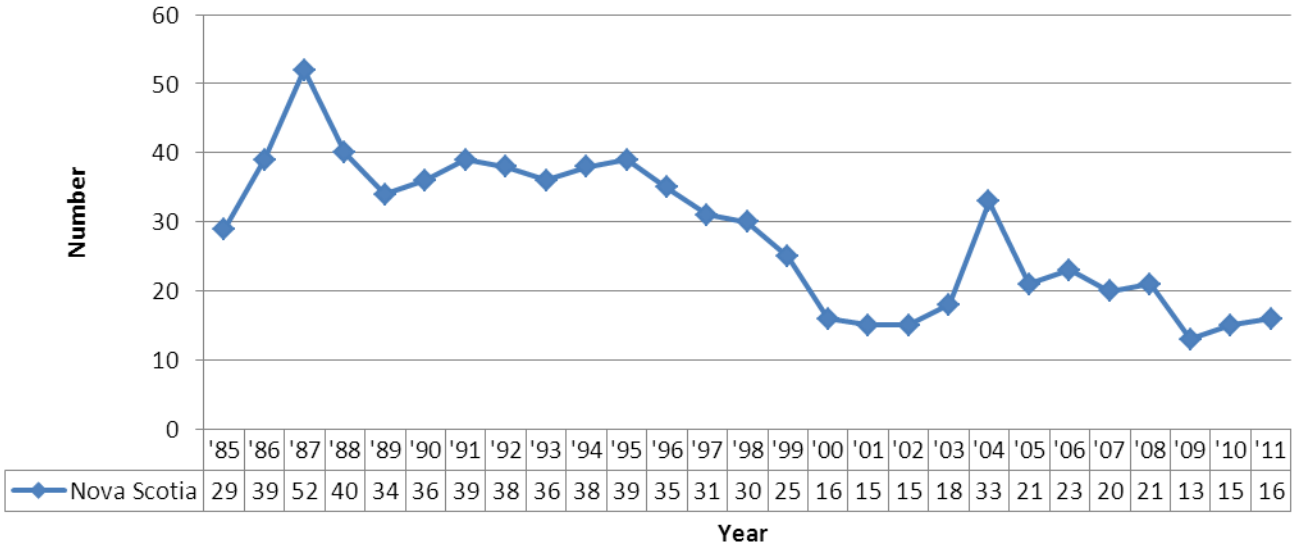
- There may be differences in the definitions, method of collection, and response rates for race/ethnicity data captured for HIV cases compared to what is captured by the Census. As a result, comparisons between these two data sources are difficult to interpret.

- Because only cases first testing positive for HIV within Nova Scotia are counted in provincial HIV surveillance data, HIV cases testing positive during their immigration medical examination before arriving in Nova Scotia are not captured in this report. However, cases testing positive for the immigration medical examination while in Nova Scotia are included. As a result, with all other factors constant, case counts and rates for Nova Scotia may appear lower compared to other jurisdictions that include all cases testing positive for HIV during the immigration process (regardless of the location of testing) in their surveillance counts.

Reports by Year

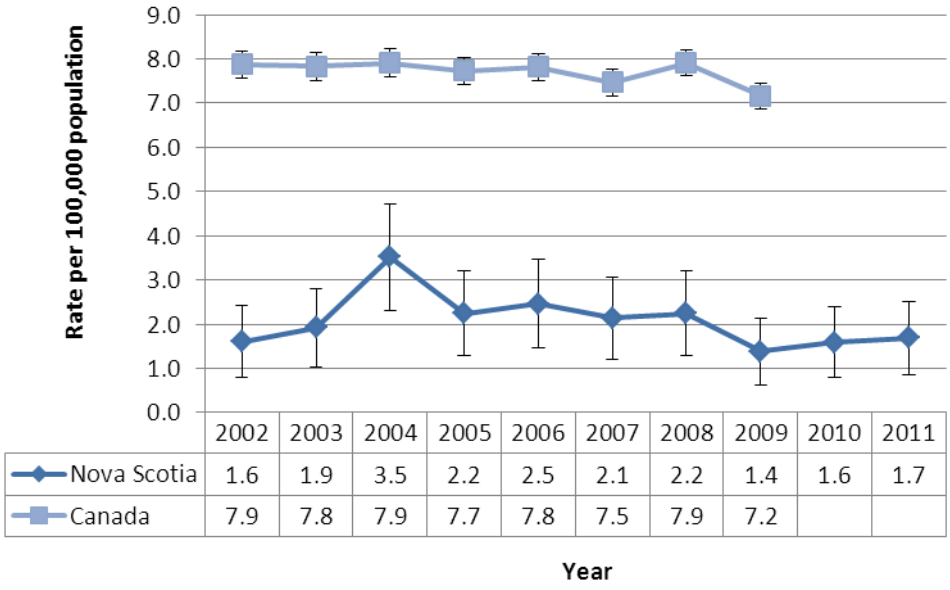
Since the first reported HIV diagnosis in 1985, there have been 766 newly-diagnosed cases of HIV reported to public health in Nova Scotia (Figure 1.1). The peak number and rate of reported cases in Nova Scotia was in 1987. There were 52 reported HIV cases, corresponding to a rate of 5.8 cases per 100,000 population. Since that year, HIV case counts and rates have declined over time, to a low of 13 cases and a rate of 1.4 cases per 100,000 population in 2009.

Figure 1.1: Number of reported HIV cases by year of diagnosis, Nova Scotia, 1985 to 2011.



As shown in Figure 1.2, the age-standardized rate of HIV cases reported between 2002 and 2011 is significantly lower compared to Canada as a whole. Rates in Canada remained fairly constant over this ten-year period, ranging from 7.2 to 7.9 cases per 100,000 population. Rates in Nova Scotia remained between 1.4 and 2.5 cases per 100,000 population, with the exception of 2004, where Nova Scotia saw a peak in the age-standardized rate (at 3.5 cases per 100,000 population). However, this rate was not significantly greater than the adjoining two years. In comparison, the age-standardized rate for Canada in the same year was 8.2 cases per 100,000 population. An outbreak of syphilis occurred in Nova Scotia during this year, so the peak in HIV cases in 2004 may be related to an increase in disease incidence or due to increased awareness of, and testing for, sexually transmitted and blood borne pathogens.

Figure 1.2: Age-standardized rate (per 100,000 population) of reported HIV cases by year of diagnosis, Nova Scotia and Canada, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nova Scotia	1.6	1.9	3.5	2.2	2.5	2.1	2.2	1.4	1.6	1.7
Canada	7.9	7.8	7.9	7.7	7.8	7.5	7.9	7.2		

Notes: Vertical bars denote the 95% confidence interval on the rate. 2010-2011 data for Canada not available at time of report.

Table 1.1 compares characteristics of HIV cases diagnosed between 1985-2001 and 2002-2011. Compared to cases reported between 1985-2001, the latest ten year period had significantly different distributions for age, geographic region, exposure category, and race/ethnicity. These differences will be discussed in more detail later in this section. However, changes in geographic region of residence at diagnosis and race/ethnicity are difficult to interpret due to the high proportion of cases diagnosed between 1985-2001 who are missing this information. As a result, differences between the two time periods for these characteristics will not be discussed further.

Table 1.1: Comparison of characteristics of HIV cases diagnosed between 1985-2001 and 2002-2011, Nova Scotia.

	Year of Diagnosis				P value
	1985 to 2001		2002 to 2011		
	Number	(% within time period)	Number	(% within time period)	
Sex					
Male	500	(87.4)	160	(82.5)	0.09
Female	72	(12.6)	34	(17.5)	
Median age at diagnosis	34 years	(IQR 28-40)	41 years	(IQR 31-47)	**< 0.01**
Geographic region					
Western	35	(6.1)	6	(3.1)	**< 0.01**
Northern	36	(6.3)	11	(5.6)	
Eastern	54	(9.4)	29	(14.9)	
Capital	354	(61.9)	146	(75.3)	
Unknown/Missing	93	(16.3)	2	(1.0)	
Exposure category					
MSM or MSM/IDU	390	(68.2)	98	(50.5)	**< 0.01**
IDU	53	(9.3)	30	(15.5)	
HET-Endemic	22	(3.8)	13	(6.7)	
HET-IR	51	(8.9)	25	(12.9)	
HET-NIR	18	(3.1)	22	(11.3)	
Other	32	(5.6)	0	(0.0)	
NIR	6	(1.0)	6	(3.1)	
Race/ethnicity					
Aboriginal	4	(0.7)	6	(3.1)	**< 0.01**
Black	37	(6.5)	20	(10.3)	
White	377	(65.9)	154	(79.4)	
Other/Mixed Race/Ethnicity	3	(0.5)	9	(4.6)	
Unknown/Missing	151	(26.4)	5	(2.6)	
TOTAL	**572**		**194**		

Notes: A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

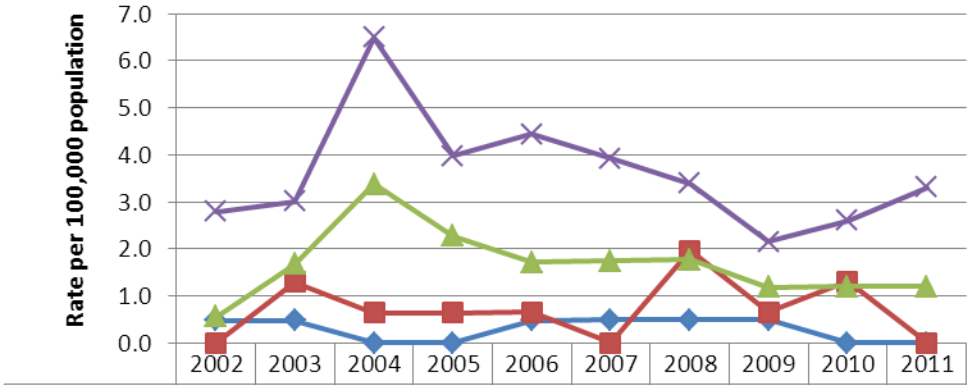
Reports by Geography

Looking at HIV cases by region of residence at diagnosis, rates of reported cases were highest in Capital, followed by Eastern, Northern, and Western regions (Figure 1.4). Both Capital and Eastern regions had a peak in the rate of reported HIV cases in 2004, at 6.5 and 3.4 cases per 100,000 population in each respective region. Rates remained relatively stable in Northern and Western over this time period.

Looking at each individual District Health Authority (DHA), the average annual rate of reported HIV cases was significantly higher in Capital District Health Authority compared to all other districts over this ten year period, at 3.3 cases per 100,000 population (Figure 1.5). Rates ranged between 1.1 and 1.6 cases per 100,000 population in Colchester East Hants, Guysborough Antigonish Strait, and Cape Breton District Health Authorities. All other districts reported less than 1 case per 100,000 population. Differences in the rate of reported cases in each geographic region may result from differences in HIV prevalence, prevalence of at-risk populations, availability of testing options, or differences in testing practices.

To better understand trends in HIV transmission, it is important to consider the place of likely acquisition of infection. This is often difficult to determine for HIV cases due to the long latent period of the disease and the potential complexity of the case's sexual history. Being born in a country where HIV is endemic is thought to be a potential indication of the case's place of likely acquisition, and this information is routinely collected for newly-diagnosed HIV cases in Nova Scotia and available for analysis. This topic will be further explored in the exposure category and race/ethnicity sections below.

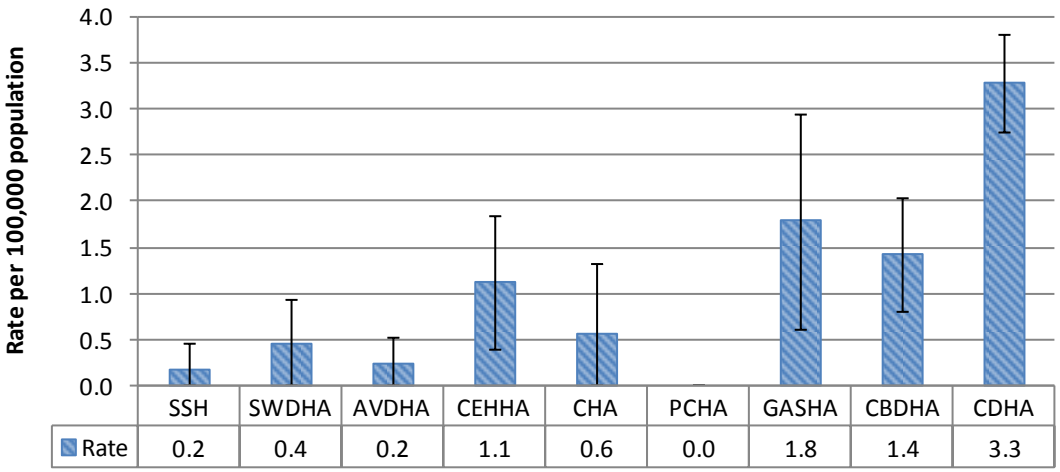
Figure 1.4: Crude rate (per 100,000 population) of reported HIV cases by region and year of diagnosis, Nova Scotia, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Western	0.5	0.5	0.0	0.0	0.5	0.5	0.5	0.5	0.0	0.0
Northern	0.0	1.3	0.6	0.6	0.7	0.0	2.0	0.7	1.3	0.0
Eastern	0.6	1.7	3.4	2.3	1.7	1.7	1.8	1.2	1.2	1.2
Capital	2.8	3.0	6.5	4.0	4.4	3.9	3.4	2.2	2.6	3.3

Notes: Excludes 2 cases with unknown/missing region. Vertical bars denote the 95% confidence interval on the rate.

Figure 1.5: Crude average annual rate (per 100,000 population) of reported HIV cases by District Health Authority (DHA), Nova Scotia, 2002 to 2011.



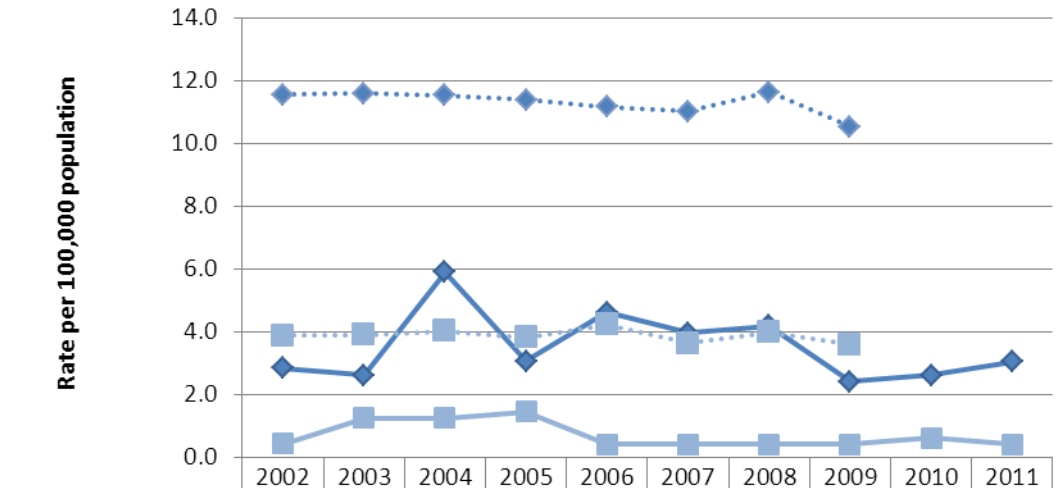
Notes: Excludes 2 cases with unknown/missing DHA. Vertical bars denote the 95% confidence interval on the rate. SSH = South Shore Health, SWDHA = South West District Health Authority, AVDHA = Annapolis Valley District Health Authority, CEHHA = Colchester East Hants Health Authority, CHA = Cumberland Health Authority, PCHA = Pictou County Health Authority, GASHA = Guysborough Antigonish Strait Health Authority, CBDHA = Cape Breton District Health Authority, CDHA = Capital District Health Authority.

Reports by Age and Sex

The proportion of reported female HIV cases in Nova Scotia has increased slightly over time. From 2002 to 2011, 17.5% of all reported HIV cases were female, compared to 12.6% of cases reported between 1985 and 2001 (Table 1.1). However, the absolute number of cases in females has remained constant over time, with no more than 7 HIV cases in females reported in any given year. The increasing trend in the proportion of female cases was also observed for Canada as a whole. However, there was a higher proportion of reported female cases for Canada as a whole, as 26.0% of all Canadian HIV cases reported in 2009 were female (8). This higher proportion was likely influenced by several provinces where the proportion of female cases as reached nearly 50% in recent years (9, 10).

Figure 1.6 shows the sex-specific rate of reported HIV cases by year in Nova Scotia and Canada. Male- and female-specific rates were significantly lower for Nova Scotia compared to Canada in all ten years. Rates for Nova Scotia females remained fairly constant over time, ranging from 0.4 to 1.5 cases per 100,000 females per year. Rates for Nova Scotia males peaked in 2004 at 5.9 cases per 100,000 males, but have since declined to 2.8 cases per 100,000 males in 2010. The distribution of exposure categories among males and females will be explored later in this section.

Figure 1.6: Sex-specific rate of reported HIV cases by year of diagnosis, Nova Scotia and Canada, 2002 to 2011.



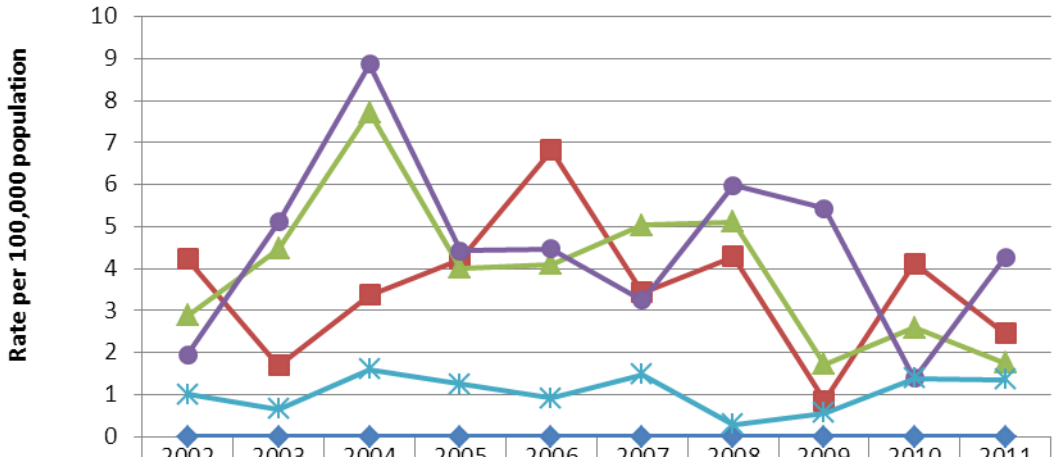
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
NS - Male	2.8	2.6	5.9	3.1	4.6	4.0	4.2	2.4	2.6	3.0
NS - Female	0.4	1.3	1.2	1.5	0.4	0.4	0.4	0.4	0.6	0.4
CAN - Male	11.5	11.6	11.5	11.4	11.2	11.0	11.6	10.5		
CAN - Female	3.9	3.9	4.0	3.8	4.2	3.6	4.0	3.6		

Notes: 2010-2011 data for Canada not available at time of report.

Cases of HIV reported between 2002 and 2011 were significantly older than those reported between 1985 and 2001. The median age of cases reported between 2002 and 2011 was 41 years (interquartile range 31-47 years) compared to 34 years (interquartile range 28-40 years) between 1985 and 2001 (Table 1.1). A trend in increasing age of HIV cases has also been noted at the national level, where the proportion of cases over 40 years of age has increased over time (8).

Figure 1.7 shows the age-specific rates of reported HIV cases in Nova Scotia by year between 2002 and 2011. Rates were generally highest for those 20 to 49 years of age. No cases under 20 years of age were reported during this time period, and rates in those 50 years of age and over remained below 1.7 cases per 100,000 population. Rates peaked in 2004 for those 30 to 39 and 40 to 49 years of age in 2004, at 7.7 and 8.9 cases per 100,000 population, respectively. The peak in these age groups is similar to what was observed for syphilis cases reported in 2004, where the majority of cases were between 20 and 49 years of age. This similar peak may be related to increased awareness of, and testing for, sexually transmitted and blood borne pathogens in these age groups resulting from the syphilis outbreak. Rates have since declined in both age groups, to 1.8 and 4.3 cases per 100,000 population in 2011. The distribution of exposure categories among the different age groups will be explored later in this section.

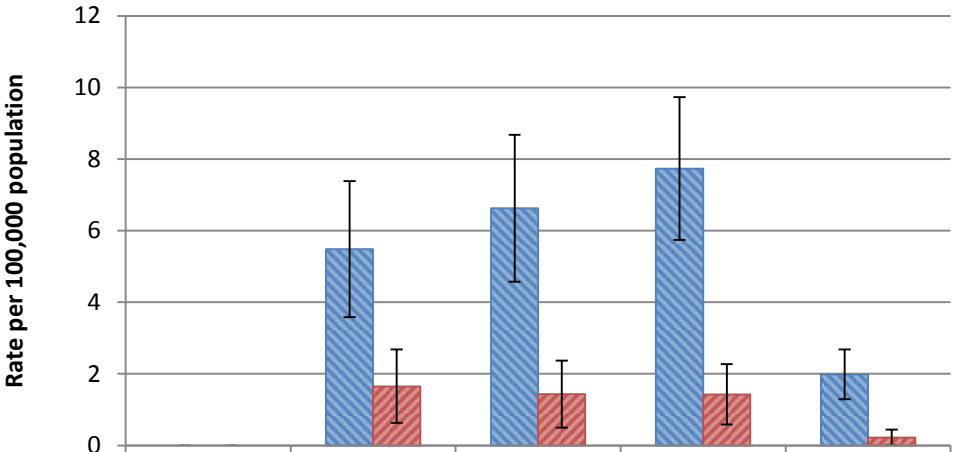
Figure 1.7: Age-specific rates of reported HIV cases by year of diagnosis, Nova Scotia, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
< 20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20 to 29	4.2	1.7	3.4	4.2	6.8	3.4	4.3	0.8	4.1	2.4
30 to 39	2.9	4.5	7.7	4.0	4.1	5.0	5.1	1.7	2.6	1.8
40 to 49	1.9	5.1	8.9	4.4	4.5	3.2	6.0	5.4	1.4	4.3
50 +	1.0	0.7	1.6	1.2	0.9	1.5	0.3	0.6	1.4	1.3

Figure 1.8 shows the average annual age- and sex- specific rates of reported HIV cases between 2002 and 2011. In all age groups, rates were significantly higher for males compared to females. For males, the average annual rates were highest for those between 20 and 49 years of age, ranging from 5.5 per 100,000 males aged 20 to 29 years to 7.7 cases per 100,000 males between 40 and 49 years of age. However, the difference in rates between these age groups was not significant. Rates in females showed less variability for cases between 20 and 49 years of age, ranging from 1.4 to 1.7 cases per 100,000 population. The rate was significantly lower for females over 50 years of age, at 0.2 cases per 100,000 population.

Figure 1.8: Average annual age- and sex- specific rates (per 100,000 population) of reported cases of HIV, Nova Scotia, 2002 to 2011.



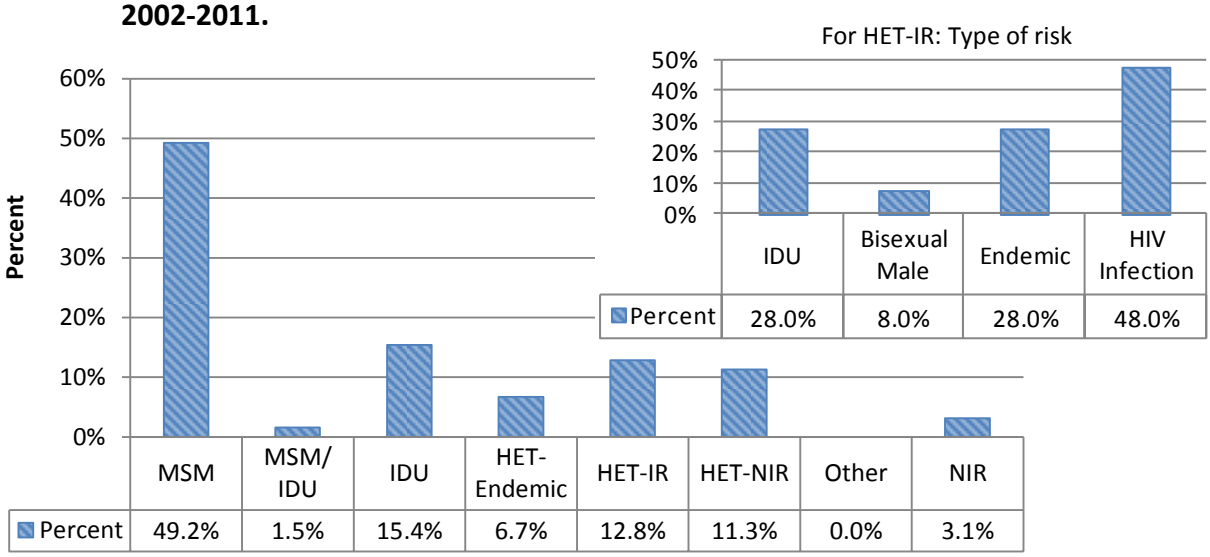
	< 20	20 to 29	30 to 39	40 to 49	50 +
Male	0.0	5.5	6.6	7.7	2.0
Female	0.0	1.7	1.4	1.4	0.2

Note: Vertical bars denote the 95% confidence interval on the rate.

Reports by Exposure Category

In the first years of the HIV epidemic in Nova Scotia, nearly all cases were among men who have sex with men (MSM) (Table 1.1). This proportion of cases has declined over time and between 2002 and 2011, MSM accounted for 49.0% of all cases (Figure 1.9). Cases who reported exposure to blood or a blood product were reported throughout the 1980's and into the mid 1990's, but no cases have been reported since that time. Additionally, no cases in the perinatal transmission exposure category have been reported in Nova Scotia since the early 1990's.

Figure 1.9: Percent distribution of reported HIV cases by exposure category, Nova Scotia, 2002-2011.



Notes: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8). The figure inset indicates the type of reported high-risk heterosexual contact for HET-IR cases. Endemic = sex with a person born in an HIV-endemic country, HIV Infection = sex with a person with a confirmed or suspected HIV infection. Note that percentages for the HET-IR inset do not total 100 since more than one type of high-risk heterosexual contact can be reported.

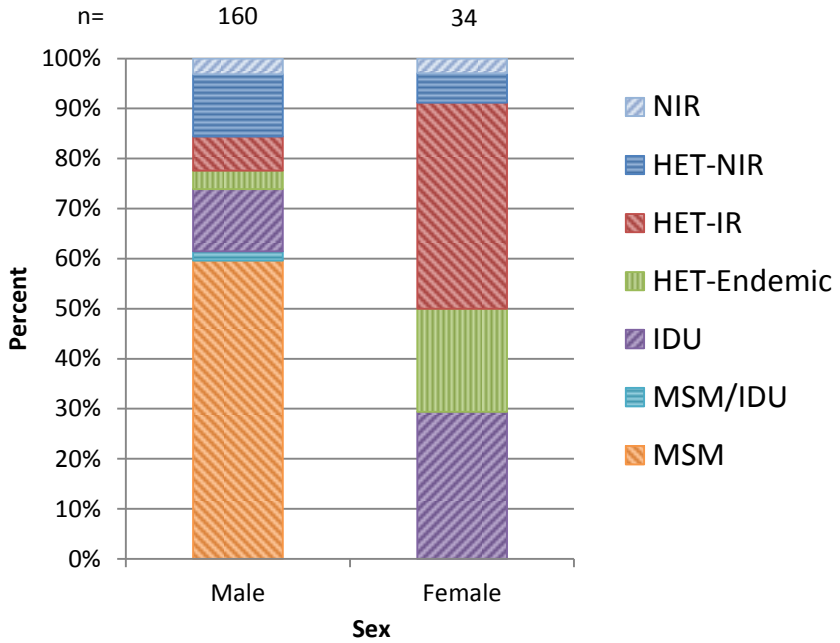
The number and proportion of cases among persons who reported injection drug use (IDU) and persons who reported heterosexual contact has increased over time (Table 1.1). Between 2002 and 2011, 17.0% of cases were among IDU (either IDU or MSM/IDU), others were among persons who reported heterosexual contact with a person at risk for infection (HET-IR; 12.9%), heterosexual contact with no identified risk (HET-NIR; 11.3%), birth in a country where HIV is endemic (HET-Endemic; 6.7%), and finally 3.1% had no identified risk factors for HIV infection (Figure 1.9). This overall distribution of exposure categories for Nova Scotia cases between 2002 and 2011 is similar to that of all Canadian cases reported in 2009 (8).

Cases in the HET-Endemic category may include immigrants to Nova Scotia who test positive for HIV on their immigration medical examination while they reside in Nova Scotia, as well as immigrants who acquired their infection after arriving in the province. As a result, trends in this exposure category may reflect changing immigration patterns, changes in HIV prevalence in immigrant countries of origin, changes in the frequency of immigrants completing their immigrant medical examination while in the province (versus testing completed out of country), or changes in the number of immigrants who were infected while in the province.

Among cases in the HET-IR category between 2002 and 2011, 48.0% reported having sex with a person with a confirmed or suspected HIV infection, 28.0% reported having sex with an IDU, and the same proportion reporting having sex with a person born in an HIV-endemic country (Figure 1.9). This differs from HET-IR cases reported between 1985 and 2001, where a lower proportion of cases reported having sex with an IDU or a person from an HIV-endemic country (15.7% and 9.8%, respectively), and a higher proportion reported having sex with a person with a confirmed or suspected HIV infection (72.5%).

Examining exposure categories by sex, male cases were predominantly in the MSM exposure category, which accounted for 59.4% of all male cases (Figure 1.10). Injection drug use and heterosexual contact with no identified risk were the next most common exposure categories among males, each accounting for 12.5% of cases. In females, the heterosexual contact with a person at risk for infection (41.2%), IDU (29.4%), and origin from an HIV-endemic country (20.6%) exposure categories accounted for nearly all female HIV cases.

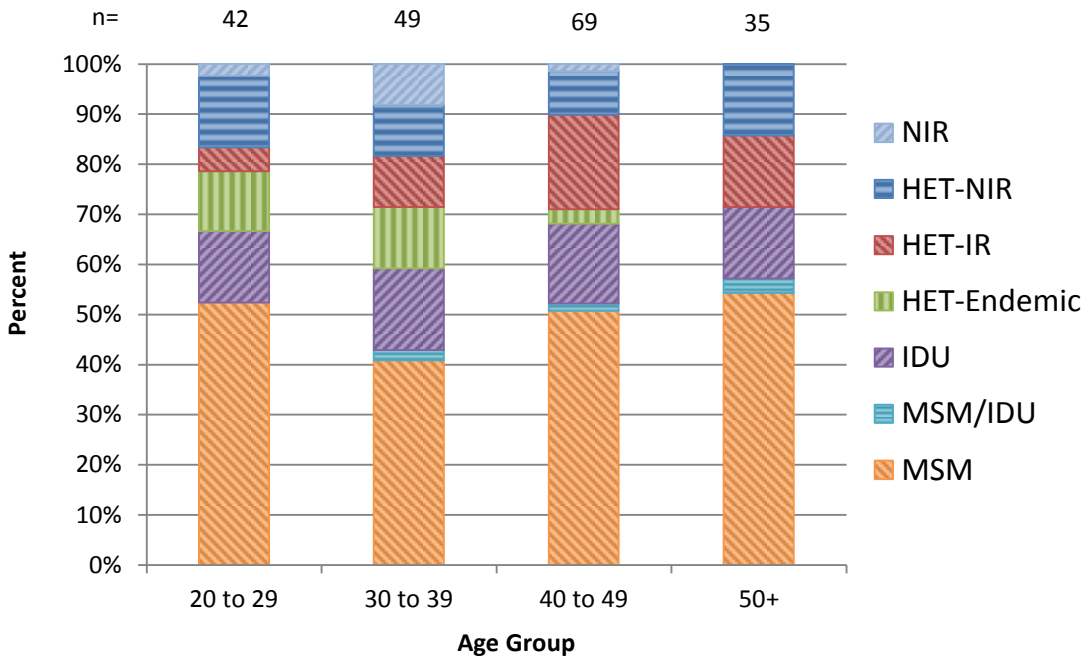
Figure 1.10: Percent distribution of reported HIV cases by exposure category and sex, Nova Scotia, 2002-2011.



Notes: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, NIR = No identified risk.

In all age groups, the MSM exposure category accounted for the highest proportion of cases, ranging from 40.8% in those 30 to 39 years of age to 52.9% of cases 50 years of age and over (Figure 1.11). Similar proportions of cases who reported IDU or heterosexual contact with no identified risk were noted for all groups.

Figure 1.11: Percent distribution of reported HIV cases by exposure category and age group, Nova Scotia, 2002-2011.



Notes: No cases under 20 years of age were reported during this time period. MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, NIR = No identified risk.

Origin from an HIV-endemic country was more common among cases in younger age groups, with 11.9% and 10.2% of those between 20 to 29 and 30 to 39 years of age assigned to this exposure category, respectively. Only 2.9% of cases between 40 and 49 years of age and no cases over 50 years were in this exposure category. In contrast, the proportion of cases who reported heterosexual contact with a person at risk for infection increased with increasing age, from 4.8% of cases 20 to 29 years of age to 18.8% of cases 40 to 49 years of age.

Reports by Race/Ethnicity

Surveillance information on HIV in Canada and worldwide often includes information on race/ethnicity because systemic and structural inequalities that increase vulnerability to HIV infection (such as poverty and lack of access to health services) may be more prevalent in certain ethnic groups (11). It is important to examine the race/ethnicity of reported HIV cases in Nova Scotia in order to understand whether such factors may be having an effect in

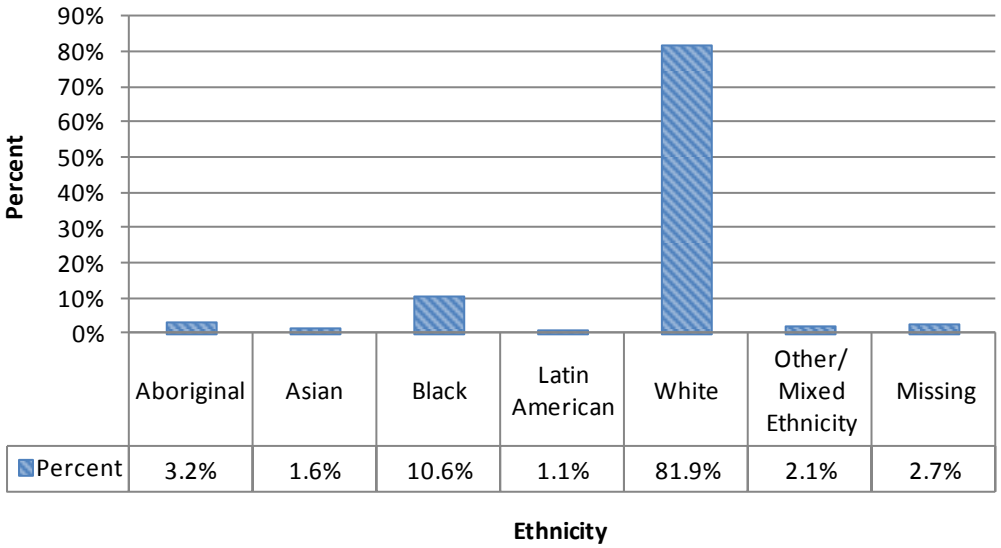
certain communities within the province. This information would help guide future research to understand populations at risk among these broadly categorized groups (which can be comprised of diverse populations), as well as to inform public health prevention and control strategies.

In the first years of the HIV epidemic in Nova Scotia, nearly all cases in Nova Scotia with reported race/ethnicity information were White. Since that time, the number and proportion of White cases has declined (Table 1.1). While the proportion of cases in non-White race/ethnicity groups has increased over time, the absolute number of these cases has remained relatively constant, with an average of 3 (range of 0 to 8) cases reported per year.

Between 2002 and 2011, 81.9% of reported HIV cases were White (Figure 1.12). Black cases accounted for the next largest race/ethnicity group, at 10.6% of all cases. Cases reporting an Aboriginal race/ethnicity accounted for 3.2% of all cases during this time period, and all other ethnicities each accounted for about 2% of the cases or less.

According to the Census visible minority and Aboriginal identity data, 2.0% of Nova Scotia residents self-identified as Black, 2.6% self-identified as Aboriginal, and 1.6% self-identified as Asian, Latin American or another visible minority. All of these populations appear to be slightly overrepresented in Nova Scotia HIV cases. The likelihood of identification by race/ethnicity may differ between the Census and through HIV case follow up, making the comparison between these two data sources difficult to interpret. Demographics and exposure categories for HIV cases can provide some insight into trends in reported cases by race/ethnicity and are discussed below.

Figure 1.12: Percent distribution of reported HIV cases by race/ethnicity, Nova Scotia, 2002-2011.



Nationally, among cases reported in 2009 with race/ethnicity information, there was a higher proportion of Aboriginal cases (33.3%) compared to the proportion observed in Nova Scotia (8). This is likely reflective of the fact that Aboriginal Canadians account for a larger proportion of the population in some areas and are overrepresented in HIV cases reported from other parts of Canada (12). Additionally, there was a higher proportion of White cases and lower proportions of cases for all other ethnicities reported in Nova Scotia compared to Canada as a whole, which is likely reflective of the different ethnic population distributions between Nova Scotia and the rest of Canada.

For Black cases, the age and geographic distributions were similar to the distributions for all HIV cases. However, 40.0% of the Black cases were female, which is higher than the overall percentage of female cases (17.5%). Of the Black cases, 70.0% were born outside of Canada, and the exposure category for the majority of the cases (60.0%) was origin from an HIV-endemic country. As previously noted, cases in to this exposure category may have acquired their infections outside of Nova Scotia, and so it is likely that some of the Black HIV cases included in provincial surveillance data are not reflective of disease acquisition within the province.

For Aboriginal cases, the age and sex distribution was similar to the overall distribution of all HIV cases described previously. There was a lower proportion of cases reported in Capital, and all cases were either assigned to the MSM or IDU exposure categories.

For the other reported non-White ethnicities, the exposure category and geographic distribution was similar to the overall distribution of all HIV cases described previously. All of the cases were female. Just over half (55.6%) were between 20 and 29 years of age, and the same proportion was born outside of Canada in a non-endemic country.

HIV-1 SUBTYPES

General Information

Like other viruses, Human Immunodeficiency Virus (HIV) can be categorized into various different groups and subtypes. These groups and subtypes have arisen in part due to HIV's high rates of genetic recombination and high error rate during the viral transcription process that causes point mutations in HIV's genes (13).

There are two main types of HIV: HIV-1, which is the predominant type worldwide, and HIV-2. Within HIV-1, Group M is the predominant group in humans worldwide, and it can be broken down into subtypes A to D, F to H, J, and K. Several of these subtypes can be further divided into sub-subtypes, and different circulating recombinant forms (CRFs) have arisen through recombination of these different subtypes. The prevalence of these subtypes and CRFs varies worldwide, with subtype B predominating in Canada. However, the prevalence of HIV-1 subtypes and CRFs in Canada may change over time due to travel and migration, or the emergence of new CRFs (14).

Surveillance of HIV-1 subtypes is useful to inform HIV-1 screening, diagnostic practices, and management. As well, this information may help to inform the development of HIV-1 vaccines, as vaccines could be subtype-specific.

The purpose of this section is:

- To describe the HIV-1 subtypes in newly diagnosed, treatment-naïve HIV-1 cases
- To describe the characteristics of cases with non-B HIV-1 subtypes

Data Sources, Definitions, and Technical Notes

General information

In partnership with the Public Health Agency of Canada (PHAC), Nova Scotia participates in the Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program). Since 1998, Nova Scotia has sent archived diagnostic sera samples from newly-diagnosed, treatment-naïve HIV cases to the National HIV and Retrovirology Laboratories for subtype analysis, transmitted drug resistance genotyping, and testing for recency of HIV infection using assays which distinguish recent from established HIV infection. Epidemiologic information for each sample is provided to PHAC for analysis and inclusion in national reports. Further information on the testing methods used to identify subtypes can be found in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).

This section includes data on subtypes among HIV cases diagnosed between January 2002 and August 2011.

Between January 2002 and August 2011, 156 samples were sent for SDR testing, which accounts for 82.1% of all Nova Scotia HIV cases reported during the same time period. Of these samples, viral RNA was successfully amplified in 152 (97.4%) samples. As a result, SDR information is available for 80.0% of all Nova Scotia HIV cases reported between January 2002 and August 2011.

Routine HIV surveillance data were used to produce information about the characteristics of cases with subtype information. Methods for

obtaining these data are described in the HIV Reports section of this report.

Statistical analysis

Comparisons were made between HIV-1 diagnoses with B subtype and those with non-B subtypes or circulating recombinant forms using the χ^2 test (or Fisher's exact test, where appropriate) for categorical variables, and the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05.

Data limitations

- Since this section uses information collected as part of routine HIV surveillance in Nova Scotia, all limitations noted in the HIV Reports section also apply to this section of the report.
- The information presented in this section does not reflect all HIV cases reported within the province. Of the 190 newly-diagnosed HIV cases reported between January 2002 and August 2011, only 152 (80.0%) were eligible for the SDR program, were sent for testing at the National HIV and Retrovirology Laboratories, and had viral RNA successfully amplified. However, after comparing characteristics of cases with and without subtype information, the only significant difference between these two groups was geographic region. About 85% of cases diagnosed in Capital region had subtype information versus 71.6% for cases from regions outside Capital, which means that a higher proportion of cases from Capital region are reflected in this analysis compared to cases from other regions of the province.
- Limitations associated with the laboratory testing methods used for subtype analyses are described in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).

Reports by HIV-1 Subtypes

Table 2.1 shows the distribution of subtypes detected among the newly diagnosed, treatment naïve HIV cases reported between January 2002 and August 2011 for which subtype information was available. Six different subtypes or circulating recombinant forms (CRFs) were detected, and the prevalence of non-B subtypes and CRFs was 14.5%. The reported prevalence of non-B subtypes and CRFs for SDR-tested specimens from five Canadian provinces (British Columbia, Alberta, Saskatchewan, Manitoba, and Nova Scotia) between 2002 and 2008 was similar, at 12.9% (14). The number and proportion of cases with non-B subtypes or CRFs remained fairly constant over time, with 3 or fewer cases reported each year (Table 2.2).

Table 2.1: Number and percentage of HIV-1 subtypes and circulating recombinant forms (CRFs) detected among newly diagnosed, treatment naïve HIV cases, Nova Scotia, January 2002 to June 2011 (n=152).

HIV-1 Subtype or CRF	Number	(%)
B	130	(85.5)
A1	9	(5.9)
C	7	(4.6)
D	3	(2.0)
CRF02_AG	2	(1.3)
CRF01_AE	1	(0.7)

Table 2.2 compares the characteristics of treatment naïve HIV-1 B subtype cases versus those with non-B subtypes or CRFs. There were significant differences between these groups for:

- Sex distribution: 7.3% of males had non-B subtypes or CRFs, versus 46.4% of females. This lower proportion of males is similar to what was observed nationally between 1984 and 2008, where the prevalence of non-B subtypes or CRFs was lower among HIV positive males versus females
- Exposure category distribution: None of the MSM, MSM/IDU, or IDU cases had non-B subtypes or CRFs. Higher proportions of non-B subtypes or CRFs were noted for cases with origin in a HIV-endemic country (90.0% of these cases) and heterosexual contact with a person at risk for HIV infection (47.4%). Nationally, there was also a higher proportion of cases with non-B subtypes or CRFs among persons from an HIV-endemic country or those who reported heterosexual contact with a person at risk for HIV infection. This finding is compatible with evidence that non-B subtypes and CRFs are more common in countries outside of North America or Europe, so new Nova Scotia diagnoses with these subtypes may have acquired their infection prior to arriving in Nova Scotia (13)
- Race/ethnicity distribution: Nearly 70% of Black cases and 57.1% of cases with other or mixed race/ethnicity had non-B subtypes or CRFs. In contrast, only 5.7% of White cases had non-B subtypes or CRFs. This difference in distribution was also seen at the national level, and may be explained by immigration from countries where non-B subtypes and CRFs are more prevalent

The presence of non-B subtypes or CRFs, as well as the differences between cases with B and non-B subtypes or CRFs, demonstrate the heterogeneity among cases of HIV reported in Nova Scotia with respect to likely place of acquisition. Cases of HIV diagnosed within the province may have acquired their infection within or outside the country, which should be considered when developing strategies for preventing and controlling HIV transmission within the province.

Table 2.2: Comparison of characteristics of treatment naïve HIV-1 B subtype cases versus those with non-B subtypes or circulating recombinant forms, Nova Scotia, January 2002 to June 2011.

	Subtype B	Non-B subtypes and CRFs		P value
	Number	Number	(%)	
Year of diagnosis				
2002-2003	23	5	(17.9)	0.91
2004-2005	41	5	(10.9)	
2006-2007	28	5	(15.2)	
2008-2009	22	4	(15.4)	
2010-2011 (June)	16	3	(15.8)	
Sex				
Male	115	9	(7.3)	**< 0.01**
Female	15	13	(46.4)	
Median age at diagnosis	42 years (IQR 33-48)	38 years	(IQR 33-42)	0.12
Geographic region				
Western	4	1	(20.0)	0.51
Northern	8	0	(0.0)	
Eastern	16	1	(5.9)	
Capital	101	20	(16.5)	
Unknown/Missing	1	0	(0.0)	
Exposure category				
MSM or MSM/IDU	79	0	(0.0)	**< 0.01**
IDU	26	0	(0.0)	
HET-Endemic	1	9	(90)	
HET-IR	10	9	(47.4)	
HET-NIR	11	3	(21.4)	
Other	0	0	(0.0)	
NIR	3	1	(25)	
Race/ethnicity				
Aboriginal	5	0	(0.0)	**< 0.01**
Black	5	11	(68.8)	
White	115	7	(5.7)	
Other/Mixed Race/ethnicity	3	4	(57.1)	
Unknown/Missing	2	0	(0.0)	
Recency of infection				
Recent Infection	31	4	(11.4)	0.57
Established Infection	77	14	(15.4)	
Unknown	22	4	(15.4)	
TOTAL	**130**	**22**		

Notes: A bold P value indicates statistical significance at the 0.05 level. CRF = circulating recombinant form. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Drug resistance mutation classes: MDR = Multidrug resistance, NNRTI = Non-nucleoside reverse transcriptase inhibitor, NRTI = Nucleoside reverse transcriptase inhibitor, WT = Wild type. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

HIV-1 TRANSMITTED DRUG RESISTANCE

General Information

Transmitted drug resistance refers to antiretroviral resistance observed in individuals newly diagnosed with HIV who have not yet started antiretroviral treatment. This type of resistance likely reflects transmission of drug resistant HIV from persons who are already diagnosed and receiving treatment. Transmitted drug resistance differs from secondary drug resistance, which develops in a person after they are infected and have started treatment.

Transmitted drug resistance is a concern because it may increase the likelihood of treatment failure, as effectiveness of antiretroviral therapy may be compromised among those infected with drug resistant HIV-1. As well, transmitted drug resistance may result in increased morbidity and mortality for those with drug-resistant HIV-1 compared to those infected with non-drug resistant strains (15).

Information from monitoring transmitted drug resistance can be used to inform treatment guidelines for HIV. Ongoing surveillance of transmitted drug resistance can also provide insight on trends in the transmission of drug resistant HIV, which can be used to inform prevention and control efforts.

The purpose of this section is:

- To describe the prevalence of HIV-1 transmitted drug resistance in newly diagnosed, treatment-naïve HIV cases
- To describe the characteristics of cases with HIV-1 transmitted drug resistance

Data Sources, Definitions, and Technical Notes

General information

Nova Scotia public health obtains surveillance data on HIV-1 transmitted drug resistance in newly-diagnosed, treatment-naïve HIV cases through the Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) described in the HIV-1 Subtypes section of this report. Further information on the testing methods used for drug resistance genotyping can be found in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).

Routine HIV surveillance data were used to produce information about the characteristics of cases with transmitted drug resistance mutations. Methods for obtaining these data are described in the HIV Reports section of this report.

In this section, cases diagnosed between January 2002 and August 2011 were examined since data on drug resistance mutations were only available up until this point.

Drug resistance mutation classification

HIV-1 drug resistance mutations are categorized based on which class of antiretroviral drug they confer resistance to:

- **NRTI** = Mutations associated with nucleoside reverse transcriptase inhibitors
- **NNRTI** = Mutations associated with non-nucleoside reverse transcriptase inhibitors
- **PI** = Mutations associated with protease inhibitors
- **MDR** = Multidrug resistance. Includes mutations associated with resistance to at least two of the three classes of antiretroviral drugs

HIV-1 drug resistance is defined based on the WHO 2009 consensus list of mutations of surveillance of transmitted drug resistant HIV strains, using the Stanford HIV Database Calibrated Population Resistance Tool (16).

Statistical analysis

Comparisons were made between treatment naïve HIV cases with transmitted drug resistance mutations versus cases with wild type virus using the χ^2 test (or Fisher's exact test, where appropriate) for categorical variables, and using the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05.

Data limitations

- Since this section uses information collected as part of routine HIV surveillance in Nova Scotia, all limitations noted in the HIV Reports section also apply to this section of the report.
- The information presented in this section does not include all HIV cases reported within the province. Of the 190 newly-diagnosed HIV cases reported between January 2002 and August 2011, only 152 (80.0%) were eligible for the SDR program, were sent for testing at the National HIV and Retrovirology Laboratories, and had viral RNA successfully amplified. However, after comparing characteristics of cases with and without transmitted drug resistance genotyping information, the only significant difference noted between these two groups was for geographic region. About 85% of cases diagnosed in Capital region had a result on HIV drug resistance, versus 71.6% for cases in regions outside Capital. As a result, cases with transmitted drug resistance genotyping information are likely more reflective of cases diagnosed in Capital region.
- Limitations associated with the laboratory testing methods used for transmitted drug resistance genotyping are described in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).

Reports by HIV-1 Transmitted Drug Resistance

Table 3.1 shows the distribution of transmitted drug resistance mutations detected among the newly diagnosed, treatment naïve HIV cases reported between January 2002 and August 2011 for which transmitted drug resistance mutation information was available.
The prevalence of transmitted drug resistance mutations was 9.2%. This is similar to the 10.3% prevalence of transmitted drug resistance mutations for SDR-tested specimens from five Canadian provinces (British Columbia, Alberta, Saskatchewan, Manitoba, and Nova Scotia) between 2002 and 2008 (14). Mutations associated with resistance to each of the three drug classes were reported. Mutations associated with resistance to nucleoside reverse transcriptase inhibitors (NRTIs) were most commonly reported (7.2% of cases).

The prevalence of multidrug resistance for the Nova Scotia cases was 1.3% (Table 3.1), which is similar to the 1.0% prevalence observed between 2002 and 2008 in the five Canadian provinces noted above. The number and prevalence of cases with transmitted drug resistance mutations remained generally low over time, ranging from 1 to 5 cases and 3.6% to 15.8% of cases reported in each two-year period (Table 3.2).

Table 3.1: Number and percentage of transmitted drug resistance mutations detected among newly diagnosed, treatment naïve HIV cases, Nova Scotia, January 2002 to June 2011 (n=152).

Drug class	Number	(%)
NRTI only	9	(5.9)
NNRTI only	3	(2.0)
NNRTI/NRTI (MDR)	1	(0.7)
PI/NNRTI/NRTI (MDR)	1	(0.7)
Total cases with drug resistance	**14**	**(9.2)**
Total cases with MDR	**2**	**(1.3)**

Notes: Percentages may not sum to totals due to rounding. NRTI = Nucleoside reverse transcriptase inhibitor, NNRTI = Non-nucleoside reverse transcriptase inhibitor, PI = Protease inhibitor, MDR = Multidrug resistance.

Table 3.2 compares the characteristics of cases with transmitted drug resistance mutations versus those without any mutations (i.e. wild type cases). There were no significant differences between these groups for all of the characteristics examined. This finding could result from the small number of cases included in this analysis. Some notable observations about the cases with transmitted drug resistance mutations are that all were male, nearly all were among men who have sex with men (MSM) or MSM and injection drug use (MSM/IDU) exposure categories, and all were White, born in Canada, and were infected with HIV-1 subtype B.

Table 3.2: Characteristics of treatment naïve HIV cases with transmitted drug resistance mutations versus cases with wild type virus, Nova Scotia, January 2002 to June 2011.

	Wild type		Transmitted drug resistance mutation(s)		P value
	Number		Number	(%)	
Year of diagnosis					
2002-2003	27		1	(3.6)	0.60
2004-2005	41		5	(10.9)	
2006-2007	31		2	(6.1)	
2008-2009	23		3	(11.5)	
2010-2011 (June)	16		3	(15.8)	
Sex					
Male	110		14	(11.3)	0.06
Female	28		0	(0.0)	
Median age at diagnosis	41 years	(IQR 33-47)	42 years	(IQR 34-50)	0.68
Geographic region					
Western	5		0	(0.0)	0.92
Northern	7		1	(12.5)	
Eastern	16		1	(5.9)	
Capital	109		12	(9.9)	
Unknown/Missing	1		0	(0.0)	
Exposure category					
MSM or MSM/IDU	68		11	(13.9)	0.42
IDU	25		1	(3.8)	
HET-Endemic	10		0	(0.0)	
HET-IR	17		2	(10.5)	
HET-NIR	14		0	(0.0)	
Other	0		0	(0.0)	
NIR	4		0	(0.0)	
Race/ethnicity					
Aboriginal	5		0	(0.0)	0.68
Black	16		0	(0.0)	
White	108		14	(11.5)	
Other/Mixed Race/ethnicity	7		0	(0.0)	
Unknown/Missing	2		0	(0.0)	
Recency of infection					
Recent Infection	33		2	(5.7)	0.73
Established Infection	83		8	(8.8)	
Unknown	22		4	(15.4)	
Strain type					
Subtype B	116		14	(10.8)	0.22
Non-B subtypes and CRFs	22		0	(0.0)	
TOTAL	**138**		**14**		

Notes: A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. CRF = circulating recombinant form. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

HIV DISEASE PROGRESSION AT DIAGNOSIS

General Information

Since people with HIV may be asymptomatic, they may not be aware that they are infected. Therefore, if they are not tested for HIV on a routine basis, they may not learn they are HIV positive until many years after they were infected. It is estimated that approximately 26% of people living with HIV in Canada are unaware that they are infected with the virus (17).

Those who are unaware of their HIV status and who are not diagnosed until later stages of infection (called late presenters) may have unknowingly transmitted HIV to others. As well, they miss the benefit of receiving HIV treatment earlier in the course of their infection, which would reduce their viral load and in turn reduce the risk of transmission. Additionally, late presenters may be at a greater risk for adverse outcomes such as death compared to those who are diagnosed earlier in the course of their infection (18).

It is important to characterize and monitor early and late presenters to diagnosis as this information can be used to inform whether initiatives to facilitate early diagnosis of HIV may be of benefit, and to determine whether these efforts could be targeted at particular groups.

The purpose of this section is:

- To describe the prevalence and characteristics of persons with recent infection among newly diagnosed, treatment-naïve HIV cases
- To provide information about HIV cases presenting late to diagnosis

Data Sources, Definitions, and Technical Notes

General information

Nova Scotia public health obtains surveillance data on recent HIV infections in newly-diagnosed, treatment-naïve HIV cases through the Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) described in the HIV-1 Subtypes section of this report. Recency of infection was determined using one of three modified enzyme immunoassay (EIA) tests (Abbot 3A11, bioMèrieux Vironostika HIV-1-LS and Calypte BED assay). Further information on the testing methods used to determine the recency of infection can be found in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).

In this section, cases from 2001 to 2010 were examined since data on recent infections were only available up until the end of 2010 (versus information available up to the end of 2011 for other sections of this report). As well, this time period allowed for adequate AIDS follow up to determine whether cases diagnosed with HIV up to the end of 2010 were late presenters to diagnosis (see definition below).

During this time period, 157 samples were sent for recency testing, which accounts for 80.9% of all Nova Scotia HIV cases reported during the same time period. Of these samples, 138 (87.9%) were successfully tested for recent HIV infection. As a result, information on recency of infection was available for 71.1% of all Nova Scotia HIV cases reported between 2001 and 2010.

Routine HIV/AIDS surveillance data were used to produce information about late presenters to HIV diagnosis. Methods for obtaining these data are described in the HIV and AIDS Reports sections of this report.

Recency of infection classification

Cases were classified by the recency of their HIV infection as follows:

- **Recent infection** = Infections occurring up to 170 days before HIV diagnostic sample collection
- **Established infection** = Infections occurring 170 days or more before sample collection

Late presentation classification

Various definitions of late presentation to HIV diagnosis (also called advanced HIV disease at diagnosis) are used in the literature (19). The following definition was chosen to facilitate comparison to other Canadian jurisdictions (20, 21).

Late presenters to HIV diagnosis were defined as:

- A case that was diagnosed with AIDS within one year after their first positive HIV test

  AND/OR

- A case with an initial CD4+ T-cell count less than 200 cells/µl within 6 months of HIV diagnosis

Because CD4 counts were not systematically captured by public health for HIV cases diagnosed prior to 2001, the section on prevalence of late presentation since 1985 uses only the AIDS diagnosis component of this definition.

Statistical analysis

Comparisons were made between recent and established HIV cases and between late presenters and non-late presenters using the $\chi 2$ test (or Fisher's exact test, where appropriate) for categorical variables, and using the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05. Trends over time were assessed using the Cochran-Armitage test for trend.

Bivariate and multivariate logistic regression analyses were used to examine factors associated with late presentation to HIV diagnosis. Factors in the model were selected based on a literature review and based on availability in the provincial surveillance dataset. The factors used were year of diagnosis (2001-2005 versus 2006-2010), sex, age at diagnosis, geographic region (Western, Northern, Eastern, Capital), exposure category (MSM or MSM/IDU, IDU, HET-IR, HET-NIR), and race/ethnicity (White versus non-White). Crude and adjusted odds ratios were calculated along with their 95% confidence intervals. Statistical significance for an odds ratio was achieved when the 95% confidence interval did not include 1.

Data limitations

- Since this section uses information collected as part of routine HIV and AIDS surveillance in Nova Scotia, all limitations noted in the HIV Reports and AIDS Reports sections also apply to this section of the report.
- The information presented on recency of infection does not include all HIV cases reported within the province. Of the 194 HIV cases diagnosed between 2001 and 2010, only 138 (71.1%) were eligible for the SDR program, were sent for testing at the National HIV and Retrovirology Laboratories, and had a successful result. However, after comparing characteristics of

cases with and without recency information, no significant differences were noted between these groups (data not shown).

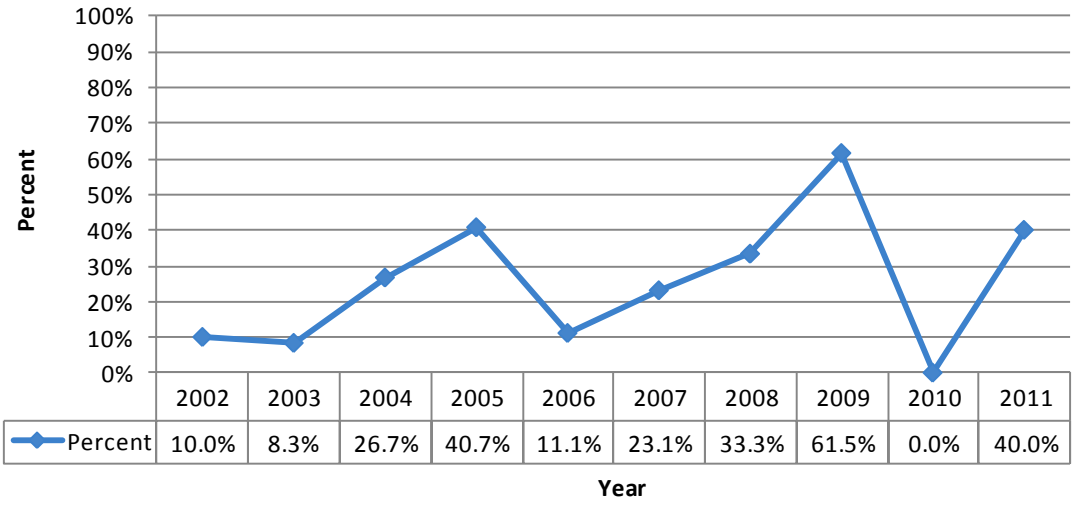
- Limitations associated with the laboratory testing methods used to determine recency of infection are described in the PHAC HIV-1 Strain and Transmitted Drug Resistance in Canada surveillance report (14).
- The definition for late presentation to HIV diagnosis used in this report may have resulted in misclassification of cases:
    - There are many definitions used to define late presentation to HIV diagnosis (19). It is not known how well the definition used in this report captures late presenters to HIV diagnosis, and so it is possible that cases attributed to late presentation may not truly fall into this category (for example, cases with other concurrent conditions that accelerate disease progression), or that true late presenters were not classified as such (see the following two bullets for examples). A data quality analysis found that eight cases who were classified as a late presenters for this report were also classified as having a recent infection. This contradictory finding may result from misclassification of these cases as either recent infections or late presenters.
    - The definition uses CD4 counts as a method to classify cases. Between 2001 and 2010, 20 (10.3%) HIV cases were missing this information. It is possible that these cases with missing CD4 counts may have been misclassified as non-late presenters if their missing CD4 counts would have resulted in the case meeting the definition for late presentation.
    - The definition also uses information on AIDS diagnoses to classify cases. Underreporting of AIDS cases may result in cases being misclassified as non-late presenters if information on their missing AIDS diagnosis would have resulted in the case meeting the definition for late presentation.
    - Because the definition for late presentation includes components based on AIDS diagnoses or CD4 counts to classify cases, cases with missing information for one component may still be correctly classified if information is present for the other component. As a result, the extent of misclassification due to missing information is likely lower than if only one measure was used.

Reports by Recency of Infection

Between 2001 and 2010, 27.5% of HIV cases diagnosed in Nova Scotia were recently infected (within 170 days before sample collection). This proportion is similar to the proportion of recently infected cases (31.5%) reported for four Canadian provinces (British Columbia, Alberta, Saskatchewan, and Manitoba) between 2000 and 2008 (22).

Figure 4.1 shows the prevalence of recent infections over time. The prevalence ranged quite widely over time, from 0.0% in 2010 to 61.5% in 2009, however these changes did not reflect a significant increasing trend over time (p=0.10).

Figure 4.1: Percent of reported HIV cases with a recent infection by year of diagnosis, Nova Scotia, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Percent	10.0%	8.3%	26.7%	40.7%	11.1%	23.1%	33.3%	61.5%	0.0%	40.0%

Table 4.1 compares the characteristics of cases with a recent infection versus those with established infections. The only significant difference between these two groups was for year of diagnosis. The variability in the proportion of recent infections by year is illustrated in Figure 4.1. However, when comparing cases from Capital to cases from other regions of the province combined, there was a significantly lower proportion of cases with recent infections from Capital (23.1%) compared to cases from outside Capital (43.3%, p=0.03). It is possible that those in regions outside Capital may have been more likely to seek testing closer to the time of their infection, which could be due to increased awareness about HIV transmission and symptoms or to differences in testing practices.

Compared to the cases studied in the four Canadian provinces noted above, there appeared to be a slightly lower proportion of recently infected females (25% in Nova Scotia versus 36.2% in the other provinces), IDU (26.1% versus 38.0%), and Aboriginal cases (25.0% versus 40.4%) in Nova Scotia, and slightly higher proportions of recently infected cases originating from countries where HIV is endemic (18.2% versus 8.7%) and Black cases (16.7% versus 9.5%). Differences in these proportions between Nova Scotia cases and cases from the other provinces may result from differences in testing practices or to increased awareness about HIV transmission and symptoms, particularly in provinces experiencing HIV outbreaks within certain demographic and risk groups.

Table 4.1: Comparison of characteristics for treatment naïve HIV-1 cases with a recent infection versus those with established infections, Nova Scotia, 2001 to 2010.

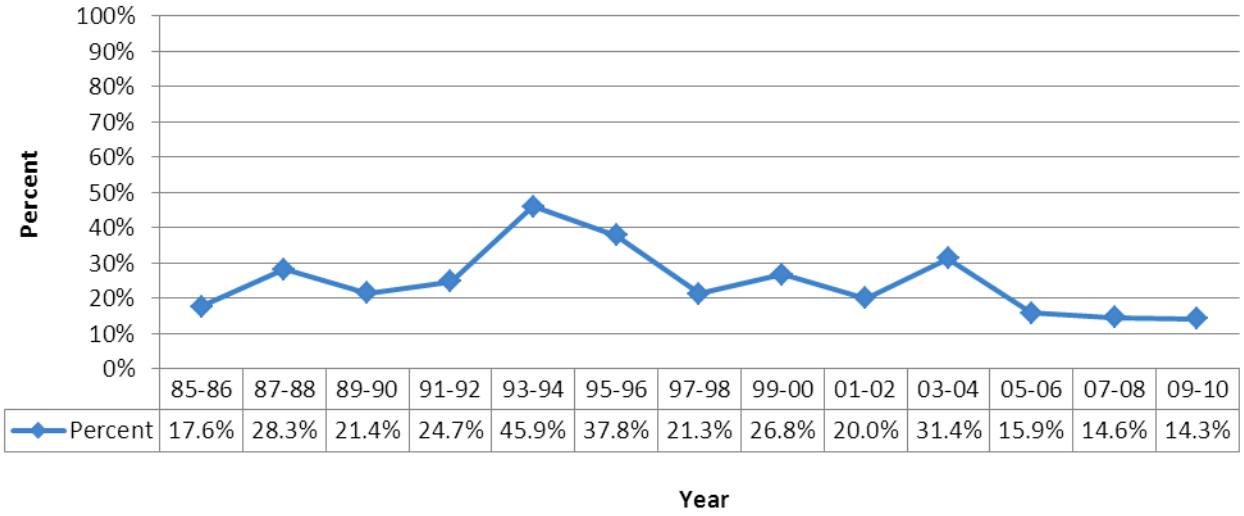
	Recent Infection	Established Infection		P value
	Number	Number	(%)	
Year of diagnosis				
2001-2002	2	20	(90.9)	**0.01**
2003-2004	15	27	(64.3)	
2005-2006	5	26	(83.9)	
2007-2008	12	13	(52.0)	
2009-2010	4	14	(77.8)	
Sex				
Male	31	79	(71.8)	0.74
Female	7	21	(75.0)	
Median age at diagnosis	41 years (IQR 31-49)	38 years	(IQR 29-46)	0.43
Geographic region				
Western	3	1	(25.0)	0.06
Northern	3	4	(57.1)	
Eastern	7	11	(61.1)	
Capital	25	83	(76.9)	
Unknown/Missing	0	1	(100)	
Exposure category				
MSM or MSM/IDU	21	47	(69.1)	0.87
IDU	6	17	(73.9)	
HET-Endemic	2	9	(81.8)	
HET-IR	5	12	(70.6)	
HET-NIR	4	11	(73.3)	
Other	0	0	(0.0)	
NIR	0	4	(100)	
Race/ethnicity				
Aboriginal	1	3	(75.0)	0.81
Black	3	15	(83.3)	
White	33	76	(69.7)	
Other/Mixed Race/ethnicity	1	4	(80.0)	
Unknown/Missing	0	2	(100)	
Strain type				
Subtype B	31	79	(71.8)	0.75
Non-B subtypes and CRFs	4	15	(78.9)	
Missing	3	6	(66.7)	
Drug resistance mutation class				
MDR	0	2	(100)	0.55
NNRTI only	1	0	(0.0)	
NRTI only	1	6	(85.7)	
WT	34	86	(71.7)	
Missing	2	6	(75.0)	
TOTAL	**38**	**100**		

Notes: A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. CRF= circulating recombinant form. Drug resistance mutation classes: MDR = Multidrug resistance, NNRTI = Non-nucleoside reverse transcriptase inhibitor, NRTI = Nucleoside reverse transcriptase inhibitor, WT = Wild type. See Table 3.2 for notes on the eexposure category abbreviations.

Reports by Late Presentation

The proportion of HIV cases with an AIDS diagnosis within one year of their first positive HIV test has varied over time (Figure 4.2). The proportion reached a peak in 1993-1994 at 45.9% of cases and has gradually declined since that time to 14.3% of cases in 2009-2010.

Figure 4.2: Percent of reported HIV cases with an AIDS diagnosis within one year after their first positive HIV test, Nova Scotia, 1985 to 2010.



	85-86	87-88	89-90	91-92	93-94	95-96	97-98	99-00	01-02	03-04	05-06	07-08	09-10
Percent	17.6%	28.3%	21.4%	24.7%	45.9%	37.8%	21.3%	26.8%	20.0%	31.4%	15.9%	14.6%	14.3%

Table 4.2 shows the prevalence of late presentation in Nova Scotia between 2001 and 2010 based on various definitions of late presentation. These estimates were generally similar to what has been observed in other jurisdictions:

- Approximately 20% of cases had an AIDS diagnosis within one year of their first positive HIV test. A study examining newly diagnosed HIV cases in British Columbia between 2001 and 2008 found that 9.5% of cases met this definition (referred to as advanced HIV disease in that report) (21).
- Approximately 25% of cases had a reported CD4 count less than 200 cells/µl within 6 months of HIV diagnosis. A study on new laboratory-diagnosed cases from Northern Alberta found that 28.2% of cases diagnosed between May 1998 and December 2003 had a CD4 count less than 200 cells/µl (20). A study examining cases first presenting to HIV care providers across the United Kingdom and Ireland found that 33.4% of cases had CD4 counts less than 200 cells/µl (23).
- 31.4% of cases met the definition for late presentation that is used in the remainder of this report (AIDS diagnosis within one year or initial CD4 count less than 200 cells/µl within 6 months). The British Columbia study noted above found that 17% of cases diagnosed in that province between 2004 and 2008 met this definition (21). An Italian study of newly-diagnosed cases presenting to HIV care providers in the late 1990's found 28.9% of cases had either an AIDS diagnosis or CD4 count less than 200 cells/µl within 6 months of HIV diagnosis (24).

Table 4.2: Number and percent of cases meeting various definitions for late presentation to HIV diagnosis, Nova Scotia, 2001 to 2010.

Late presentation definition	Number	(%)
AIDS diagnosis within one year of first positive HIV test	39	(20.1)
Initial CD4 count less than 200 cells/µl within 6 months of HIV diagnosis	48	(24.7)
AIDS diagnosis within one year of first positive HIV test AND/OR Initial CD4 count less than 200 cells/µl within 6 months of HIV diagnosis (*definition of late presentation used for the remainder of this report*)	61	(31.4)

Possible explanations for the higher proportion of Nova Scotia cases meeting a late presentation definition compared to other jurisdictions include a greater likelihood of testing for CD4 counts within 6 months of HIV diagnosis for late-stage patients in Nova Scotia compared to other jurisdictions, or that the prevalence of cases presenting late to diagnosis is truly higher.

Table 4.3 compares the characteristics of late presenters to HIV diagnosis with non-late presenters among cases diagnosed between 2001 and 2010. The distribution of the characteristics was very similar between these two groups. Comparing the risk factor distribution of Nova Scotia late presenters with those diagnosed in British Columbia between 2004 and 2008, there were similar proportions of late presenters in the MSM and MSM/IDU (44.3% in Nova Scotia versus 40.1% in British Columbia) and IDU (18.0% versus 20.5%) exposure categories (23).

Bivariate and multivariate logistic regression analyses found that only older age was significantly associated with late presentation to HIV diagnosis for Nova Scotia cases diagnosed between 2001 and 2010 (adjusted odds ratio for 1 year age increase: 1.04, 95% confidence interval 1.01-1.08). This finding has been noted in similar studies (21, 24, 25). One possible explanation for this finding is if those who present later to diagnosis are a similar age at the time of infection compared to those who are non-late presenters. The time elapsed between infection and diagnosis would be longer for those who are late presenters, resulting in the higher age at diagnosis. Alternatively, those who present late might be older than non-late presenters at the time of infection. Those infected at an older age are more likely to progress faster to advanced stages of HIV disease compared to those infected at a younger age (26). Finally, it is possible that late presenters may have been previously diagnosed elsewhere but were reported to public health in Nova Scotia as new infections.

However, these other studies also noted significant associations between late presentation and being male, living in smaller cities or rural areas, reporting only heterosexual contact, testing positive through nominal testing, and not having a previous HIV test. The studies suggest that those who present late to diagnosis might believe they are at a lower risk for HIV infection and thus be less likely to seek testing. Another explanation is that late presenters might be reluctant to be tested for fear of testing positive (27). From these findings, targeted strategies for HIV screening or initiatives to encourage earlier testing could be developed.

Table 4.3: Comparison of characteristics for HIV cases with late presentation to HIV diagnosis versus those with non-late presentation, Nova Scotia, 2001 to 2010.

	Non-Late Presenter	Late Presenter		P value
	Number	Number	(%)	
Year of diagnosis				
2001-2002	23	7	(23.3)	0.59
2003-2004	32	19	(37.3)	
2005-2006	28	16	(36.4)	
2007-2008	29	12	(29.3)	
2009-2010	21	7	(25.0)	
Sex				
Male	109	51	(31.9)	0.78
Female	24	10	(29.4)	
Median age at diagnosis	38 years (IQR 29-46)	45 years	(IQR 38-49)	**< 0.01**
Geographic region				
Western	5	1	(16.7)	0.70
Northern	9	2	(18.2)	
Eastern	19	11	(36.7)	
Capital	98	47	(32.4)	
Unknown/Missing	2	0	(0.0)	
Exposure category				
MSM or MSM/IDU	70	27	(27.8)	0.69
IDU	21	11	(34.4)	
HET-Endemic	8	6	(42.9)	
HET-IR	15	8	(34.8)	
HET-NIR	14	8	(36.4)	
Other	0	0	(0.0)	
NIR	5	1	(16.7)	
Race/ethnicity				
Aboriginal	5	1	(16.7)	0.58
Black	14	7	(33.3)	
White	107	50	(31.8)	
Other/Mixed Race/ethnicity	3	3	(50.0)	
Unknown/Missing	4	0	(0)	
TOTAL	**133**	**61**		

Notes: Late presentation is defined as an AIDS diagnosis within one year of first positive HIV test and/or an initial CD4 count less than 200 cells/µl within 6 months of first positive HIV test. A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

This analysis of cases newly-diagnosed with HIV in Nova Scotia between 2001 and 2010 found that 27.5% of cases were recently infected with HIV, which means that a substantial proportion of cases are seeking testing and being diagnosed within 6 months of infection. This is an encouraging finding, since early education and treatment can be provided to these cases to reduce further transmission, slow disease progression, and ensure a better prognosis.

However, 31.4% of cases presented late for HIV diagnosis, resulting in missed opportunities for preventing transmission and providing treatment and care earlier in the course of illness. Aside from those who were older at the time of diagnosis, this analysis did not identify any specific populations at higher risk of presenting late to HIV diagnosis. Further studies analyzing other variables not routinely collected by public health and not examined in this analysis (e.g. socioeconomic status) may reveal groups in Nova Scotia who are at a higher risk for late presentation. Any decisions to implement screening programs or strategies to encourage earlier testing based on this analysis would have to consider the feasibility of doing so, particularly since the findings do not provide the evidence required to target programs or campaigns to specific populations. As well, methodological issues with classifying cases as having a recent infection or presenting late to diagnosis may have influenced these findings and further validation of these measures may be warranted

AIDS REPORTS

General Information

Acquired Immune Deficiency Syndrome (AIDS) develops over time in HIV infected persons who are severely immunocompromised, and is characterized by the development of one or more indicator diseases (8). To help prevent progression from HIV to AIDS, Highly Active Antiretroviral Therapy (HAART) was developed in the late 1990's as a treatment for those with HIV. By using HAART, HIV infected persons are able to maintain adequate immune responses and in turn prevent progression to AIDS. As a result of the introduction of HAART, AIDS-related deaths in Canada have declined and those with HIV are living longer and with fewer disease complications (28).

AIDS surveillance data can be used to understand the characteristics of cases who progress to this advanced disease state, which could result from lack of (or delayed) access to testing or from treatment compliance issues. As well, this information can be used to assess disease burden and can be used in mathematical models that estimate how many people are unaware of their HIV-positive status (17). Finally, AIDS surveillance data can be used to understand the characteristics of cases who present late for HIV diagnosis, which was explored in the HIV Disease Progression at Diagnosis section of this report.

The purpose of this section is:

- To examine trends in Nova Scotia AIDS diagnoses over time
- To describe the characteristics of AIDS cases first diagnosed within Nova Scotia, with a particular focus on cases reported in the last ten years (2002 to 2011)

Data Sources, Definitions, and Technical Notes

General information

In Nova Scotia, AIDS diagnoses must be reported to public health, as required by the Health Protection Act (3). AIDS has been reportable in the province since 1983.

As part of public health AIDS case follow-up, public health staff complete a case report form that captures demographic, risk factor, and clinical information about the case. This information is reported to the Nova Scotia Department of Health and Wellness (DHW) for provincial surveillance purposes. Provincial surveillance data for AIDS capture Nova Scotia residents with a first-time AIDS diagnosis.

Further information on AIDS surveillance case definitions, reporting procedures, and forms can be found in the Nova Scotia Surveillance Guidelines for Notifiable Diseases and Conditions (4).

All population counts used in this section were obtained from Statistics Canada, and are estimates based on the 2006 Census. All national AIDS surveillance information presented in this section was obtained from the Public Health Agency of Canada (PHAC) HIV/AIDS Surveillance Report (8). Age-standardized rates for Nova Scotia and national data were calculated using the 1991 population of Canada as the standard population. All other data used in this section are cited where appropriate.

Statistical analysis

Comparisons were made between cases diagnosed in 1983-2001 and 2002-2011 using the χ^2 test (or Fisher's exact test, where appropriate) for categorical variables, and using the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05, or by non-overlapping 95% confidence intervals (for data shown in figures).

Data limitations

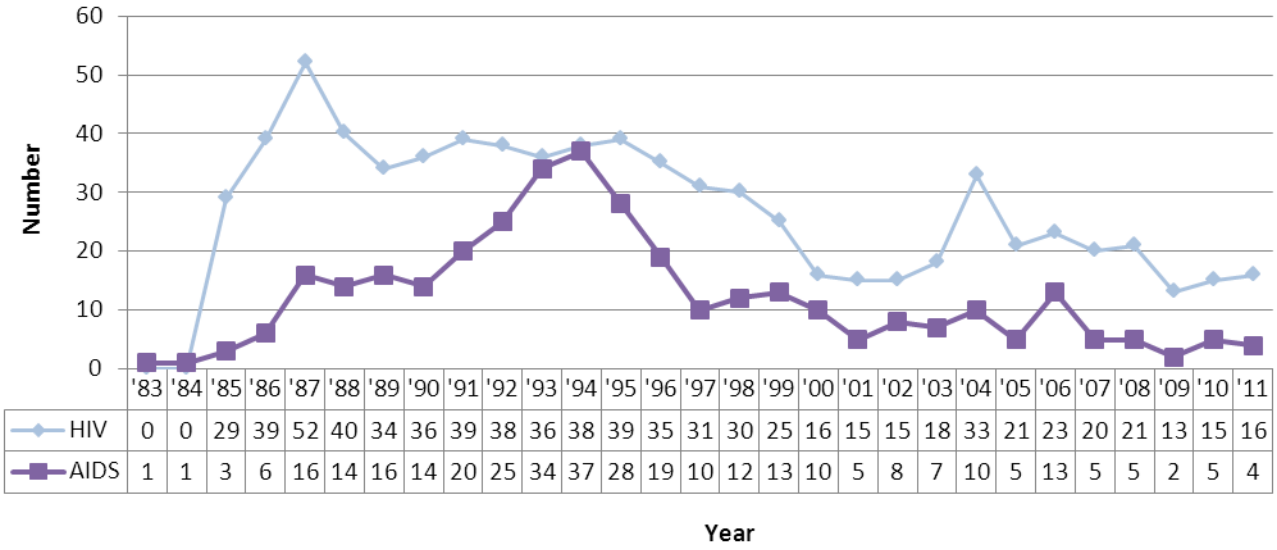
The number of AIDS cases presented in this report may be an underestimate of the true number of AIDS diagnoses made in the province if healthcare providers do not complete and submit AIDS case report forms to public health. In the case of HIV, positive lab results must be reported to public health by the testing laboratory, and so any missing HIV case report forms identified from the laboratory reports can be investigated by public health. Because AIDS is a clinical diagnosis and does not require laboratory testing, public health cannot follow up on unreported cases. The extent of underreporting of AIDS cases is not known.

Reports by Year

Since the first reported AIDS diagnosis in 1983, there have been 348 newly-diagnosed cases of AIDS reported to public health in Nova Scotia. As shown in Figure 5.1, the increase in reported HIV cases in the mid 1980's was followed by a gradual increase in AIDS cases in the late 1980's and into the 1990's. This difference in the rate of increase of reports for these two conditions reflects the variable stages of disease progression in HIV cases at diagnosis and the length of time between infection and the development of AIDS, which was estimated to be about 11 years in the pre-HAART era (29).

The peak number and rate of reported AIDS diagnoses in Nova Scotia was in 1994. There were 37 reported cases, corresponding to a rate of 4.0 cases per 100,000 population (Figure 5.1). Since that year, AIDS case reports have decreased over time, to a low of 2 cases in 2009. This decline is likely a result of the availability of Highly Active Antiretroviral Therapy (HAART) in the late 1990's, which can prevent the onset of AIDS in HIV-infected persons.

Figure 5.1: Number of reported HIV and AIDS cases by year of diagnosis, Nova Scotia, 1983 to 2010.



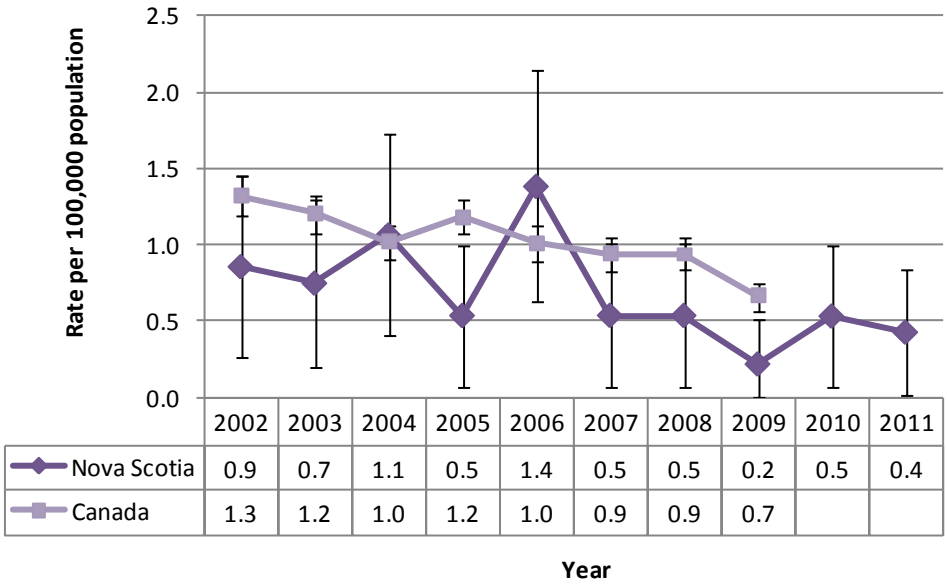
	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
HIV	0	0	29	39	52	40	34	36	39	38	36	38	39	35	31	30	25	16	15	15	18	33	21	23	20	21	13	15	16
AIDS	1	1	3	6	16	14	16	14	20	25	34	37	28	19	10	12	13	10	5	8	7	10	5	13	5	5	2	5	4

Overall, there have been fewer AIDS reports than HIV reports in Nova Scotia, which could be due to a number of factors:

- Increased effectiveness of HIV treatment, resulting in the prevention of AIDS or prolonging the time between infection and AIDS
- Death prior to a case being diagnosed with AIDS
- HIV cases moving outside of Nova Scotia prior to their AIDS diagnosis
- Delayed reporting of AIDS cases
- Under-reporting of AIDS cases

As shown in Figure 5.2, the age-standardized rate of AIDS cases reported in the last ten years in Nova Scotia is similar compared to Canada as a whole. However, the Canadian rates exclude Quebec data from July 2003 onwards, so the Canadian rate is likely higher than reported for these years. Rates over this ten-year period were consistently below 1.5 cases per 100,000 population for both Nova Scotia and Canada as a whole. The rate in Nova Scotia in 2011 was 0.4 cases per 100,000 population.

Figure 5.2: Age-standardized rate (per 100,000 population) of reported AIDS cases by year of diagnosis, Nova Scotia and Canada, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nova Scotia	0.9	0.7	1.1	0.5	1.4	0.5	0.5	0.2	0.5	0.4
Canada	1.3	1.2	1.0	1.2	1.0	0.9	0.9	0.7		

Note: Vertical bars denote the 95% confidence interval on the rate. The Canadian rates exclude Quebec cases from July 2003 onwards; as a result the Canadian rate is likely higher than reported for these years. 2010-2011 data for Canada not available at time of report.

Reports by Select Characteristics

Table 5.1 summarizes the characteristics of AIDS cases reported between 2002 and 2011. Similar to HIV cases reported during this period and to AIDS cases reported for Canada as a whole, nearly all cases (85.9%) were male, and the median age was 42 years (interquartile range 37-49 years). Most cases (71.9 %) were reported in Capital region, which had an average annual rate of 1.0 cases per 100,000 population (95% confidence interval 0.7 - 1.3). This is reflective of the proportion of HIV cases reported in the Capital region during this time period (75.3%).

Table 5.1: Comparison of characteristics for AIDS cases diagnosed between 1983-2001 and 2002-2011, Nova Scotia.

	Year of Diagnosis				P value
	1983 to 2001		2002 to 2011		
	Number	(% within time period)	Number	(% within time period)	
Sex					
Male	263	(92.6)	55	(85.9)	0.09
Female	21	(7.4)	9	(14.1)	
Median age at diagnosis	36 years	(IQR 31-44)	42 years	(IQR 37-49)	**< 0.01**
Geographic region					
Western	27	(9.5)	0	(0.0)	**0.03**
Northern	16	(5.6)	5	(7.8)	
Eastern	21	(7.4)	10	(15.6)	
Capital	204	(71.8)	46	(71.9)	
Unknown/Missing	16	(5.6)	3	(4.7)	
Exposure category					
MSM or MSM/IDU	215	(75.7)	34	(53.1)	**< 0.01**
IDU	16	(5.6)	6	(9.4)	
HET-Endemic	9	(3.2)	2	(3.1)	
HET-IR	22	(7.7)	9	(14.1)	
HET-NIR	5	(1.8)	11	(17.2)	
Other	17	(6.0)	1	(1.6)	
NIR	0	(0.0)	1	(1.6)	
Race/ethnicity					
Aboriginal	3	(1.1)	2	(3.1)	0.15
Black	19	(6.7)	5	(7.8)	
White	250	(88)	55	(85.9)	
Other/Mixed Race/ethnicity	0	(0.0)	1	(1.6)	
Unknown/Missing	12	(4.2)	1	(1.6)	
Number of years after HIV diagnosis					
Within one year	163	(57.4)	38	(59.4)	**< 0.01**
One to four years after	75	(26.4)	5	(7.8)	
Five to nine years after	38	(13.4)	10	(15.6)	
Ten or more years after	8	(2.8)	10	(15.6)	
Missing	0	(0.0)	1	(1.6)	
TOTAL	**284**		**64**		

Notes: A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

Also similar to the HIV cases, about half (53.1%) of the AIDS cases were among MSM or MSM/IDU exposure categories, followed by heterosexual contact with no identified risk (HET-NIR, 17.2%), heterosexual contact with a person at risk (HET-IR, 14.1%), and IDU (9.4%). Nearly all cases were White (85.9%), and nearly all were born in Canada (87.5 %).

Compared to cases reported between 1983-2001, the latest ten year period had significantly different distributions for age, geographic region, and exposure category (Table 5.1). Because these trends in AIDS reports reflect the changing distribution of HIV cases reported in Nova Scotia (as described in the HIV Reports section), it is unlikely that differences between these time periods reflect a change in the risk of developing AIDS within each group.

There was also a significantly different distribution for the number of years between HIV and AIDS diagnoses between these two time periods (Table 5.1). A higher proportion of cases diagnosed with AIDS between 2002 and 2011 developed AIDS five or more years after their HIV diagnosis compared to AIDS cases diagnosed between 1983 and 2001. This increase can likely be attributed to the increased effectiveness of HIV treatment in delaying disease progression and the onset of AIDS. The effect of HIV treatment on AIDS diagnoses in the province is also reflected in the lower number of AIDS diagnoses being reported over time (Figure 5.1).

Of note, more than half (59.4%) of all AIDS cases reported between 2002 and 2011 were diagnosed with HIV in the previous year. This proportion is nearly unchanged from what was observed between 1983 and 2001 (57.4%). However, this observation may relate more to the prevalence of late presentation to HIV diagnosis than to the effect of HIV treatment on progression to AIDS. An analysis of late presentation to HIV diagnosis in the HIV Disease Progression at Diagnosis section of this report found that the proportion of late presenters has declined over time, but about 20% of HIV cases from the most recent ten year period still had an AIDS diagnosis within one year of their HIV diagnosis. This observation, along with the declining number of AIDS diagnoses, likely explains the unchanged proportion of AIDS cases with an HIV diagnosis in the previous year.

HIV/AIDS MORTALITY

General Information

Mortality due to HIV/AIDS is a disease outcome that is becoming less commonly reported in Canada due to the effectiveness of Highly Active Antiretroviral Therapy (HAART) in preventing disease progression in those living with HIV/AIDS (28). Examining deaths among those with HIV/AIDS can provide insight on the impact of treatment on these cases.

The purpose of this section is:

- To examine trends in deaths over time in HIV/AIDS cases first diagnosed in Nova Scotia
- To describe the characteristics of deceased HIV/AIDS cases first diagnosed in Nova Scotia, with a particular focus on cases reported in the last ten years (2002 to 2011)

Data Sources, Definitions, and Technical Notes

General information

As per the Health Protection Act (3), death registrations with HIV or AIDS listed as a cause of death or as a significant condition contributing to death must be reported to public health by the Vital Statistics Division of Service Nova Scotia and Municipal Relations. Additionally, public health receives information about deaths for HIV/AIDS cases if the death occurs while public health follow-up is still being completed, or if the case's health care provider sends an updated case report form noting the date of death for the case. This section includes only deaths in cases first diagnosed with HIV and/or AIDS in Nova Scotia.

All population counts used in this section were obtained from Statistics Canada, and are estimates based on the 2006 Census. All national HIV/AIDS mortality information presented in this section was obtained from the Public Health Agency of Canada (PHAC) HIV/AIDS Surveillance Report (8). All other data used in this section are cited where appropriate.

Statistical analysis

Comparisons were made between deaths occurring in 1985-2001 and 2002-2011 using the χ^2 test (or Fisher's exact test, where appropriate) for categorical variables, and using the Mann-Whitney U test for continuous variables. Statistical significance was defined as a p value less than 0.05, or by non-overlapping 95% confidence intervals (for data shown in figures).

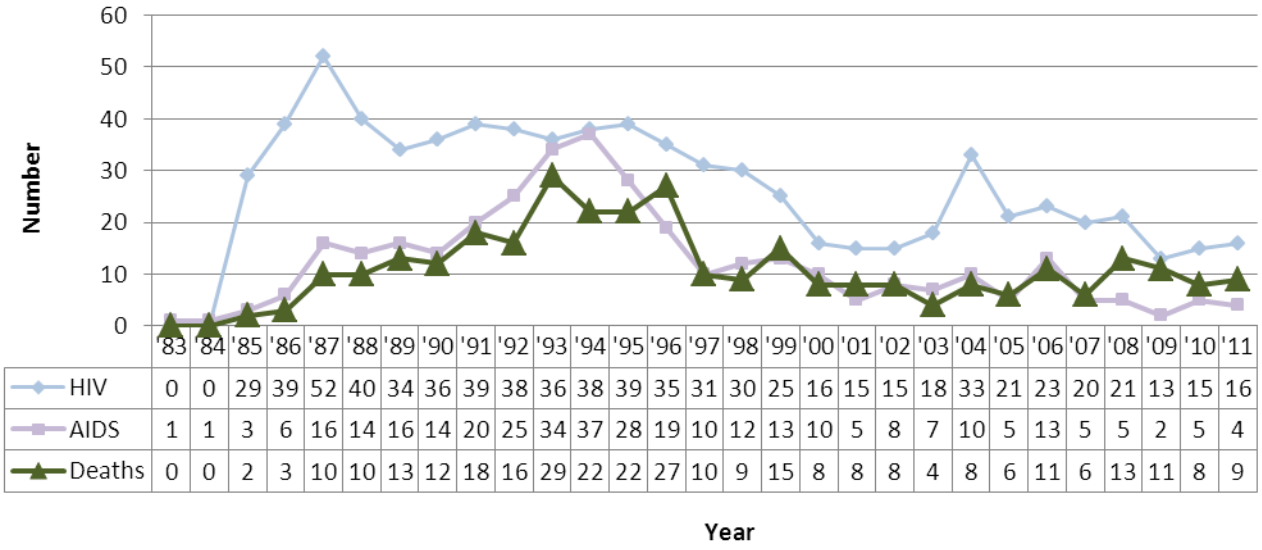
Data limitations

- Surveillance data on deaths in HIV/AIDS cases first diagnosed in Nova Scotia can reflect both deaths resulting from HIV/AIDS (as reported by Vital Statistics), as well as deaths unrelated to HIV/AIDS (as reported during case follow up, e.g. death due to car accident). Because the source of report and information about the death is not captured in the provincial surveillance database, it is not possible to determine whether deaths presented in this report can be attributed to HIV/AIDS or not.
- The surveillance data may not capture all deaths for cases first diagnosed with HIV/AIDS in Nova Scotia. This can result if the case does not reside in the province at the time of their death, or if the death is not deemed related to HIV/AIDS (resulting in no report from Vital Statistics) or is not reported by those completing case follow up.

Reports by Year

Since the first reported death in 1985, there have been 318 deaths in HIV/AIDS cases reported to public health in Nova Scotia. As to be expected, increases in reported deaths in HIV/AIDS cases have trailed increases in reported HIV and AIDS cases (Figure 6.1). The number of reported deaths reached a plateau between 1993 and 1996 (ranging from 22 to 29 deaths reported per year), and have declined since that time. This decline is likely a result of the availability of HAART in the late 1990's, which delays disease progression and in turn deaths in HIV-infected persons. National modeling studies of HIV prevalence in Canada note that the prevalence of persons living with HIV in the country has increased over time, which is partly a result of declining mortality due to HIV/AIDS (17).

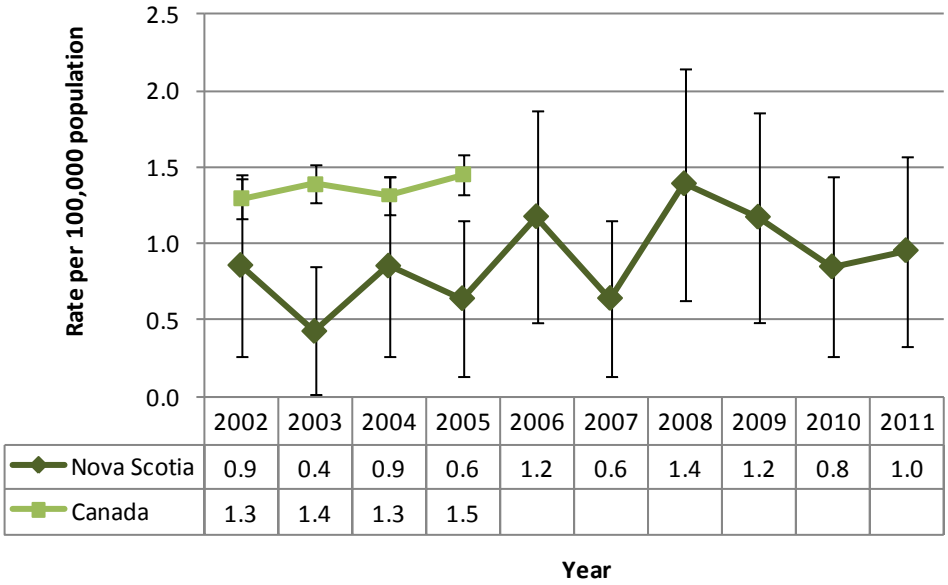
Figure 6.1: Number of deaths among reported HIV and AIDS cases by year of death, Nova Scotia, 1983 to 2011.



	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
HIV	0	0	29	39	52	40	34	36	39	38	36	38	39	35	31	30	25	16	15	15	18	33	21	23	20	21	13	15	16
AIDS	1	1	3	6	16	14	16	14	20	25	34	37	28	19	10	12	13	10	5	8	7	10	5	13	5	5	2	5	4
Deaths	0	0	2	3	10	10	13	12	18	16	29	22	22	27	10	9	15	8	8	8	4	8	6	11	6	13	11	8	9

As shown in Figure 6.2, the crude rate of deaths in reported HIV/AIDS cases over the last ten years has ranged between 0.4 deaths per 100,000 population in 2003 to 1.4 deaths per 100,000 population in 2008. For the years where national data were available (2001-2005), the Nova Scotia rate was significantly lower than the national rate in 2003 and 2005.

Figure 6.2: Crude rate (per 100,000 population) of deaths among reported HIV and AIDS cases by year of death, Nova Scotia and Canada, 2002 to 2011.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nova Scotia	0.9	0.4	0.9	0.6	1.2	0.6	1.4	1.2	0.8	1.0
Canada	1.3	1.4	1.3	1.5						

Note: Vertical bars denote the 95% confidence interval on the rate. 2006-2011 data for Canada not available at time of report.

Reports by Selected Characteristics

Table 6.1 summarizes the characteristics of HIV/AIDS cases with a reported death between 2002 and 2011. Similar to HIV and AIDS cases reported during this period, nearly all deaths (88.1%) were in males. The median age at death was 47 years (interquartile range 42-55 years), which is higher than the median age of HIV and AIDS cases at diagnosis during this time period. This difference may have occurred because deaths reported during this period were reflective of diagnoses made prior to 2001, as 47.6% of the deaths between 2002 and 2011 occurred more than ten years after HIV diagnosis (Table 6.1).

The majority of deaths (65.5%) were reported in Capital region, which is where most HIV and AIDS reports originate. The proportion of deaths for persons in the IDU exposure category (22.6%) appeared to be slightly higher than this proportion for HIV and AIDS cases reported during this time period (15.5% and 9.4%, respectively), as well as for cases reported before 2001. This higher proportion of deaths among the IDU or MSM/IDU exposure categories could result from risk factors associated with intravenous drug use that may result in premature death, confections with other blood-borne pathogens that accelerate disease progression and increase the risk of complications and death, delayed access to treatment, or reduced adherence to treatment (30, 31, 32). Most deaths were in White cases (82.1%), and most were born in Canada (79.8%).

Table 6.1: Comparison of characteristics for HIV/AIDS cases with a reported death between 1985-2001 and 2002-2011, Nova Scotia.

	Year of Death				P value
	1985 to 2001		2002 to 2011		
	Number	(% within time period)	Number	(% within time period)	
Sex					
Male	216	(92.3)	74	(88.1)	0.24
Female	18	(7.7)	10	(11.9)	
Median age at diagnosis	39 years	(IQR 33-46)	47 years	(IQR 42-55)	**< 0.01**
Geographic region					
Western	18	(7.7)	3	(3.6)	**0.03**
Northern	17	(7.3)	6	(7.1)	
Eastern	27	(11.5)	8	(9.5)	
Capital	162	(69.2)	55	(65.5)	
Unknown/Missing	10	(4.3)	12	(14.3)	
Exposure category					
MSM or MSM/IDU	181	(77.4)	45	(53.6)	**< 0.01**
IDU	13	(5.6)	19	(22.6)	
HET-Endemic	5	(2.1)	3	(3.6)	
HET-IR	12	(5.1)	5	(6.0)	
HET-NIR	2	(0.9)	6	(7.1)	
Other	19	(8.1)	4	(4.8)	
NIR	2	(0.9)	2	(2.4)	
Race/ethnicity					
Aboriginal	3	(1.3)	3	(3.6)	**0.02**
Black	12	(5.1)	7	(8.3)	
White	195	(83.3)	69	(82.1)	
Other/Mixed Race/ethnicity	0	(0.0)	2	(2.4)	
Unknown/Missing	24	(10.3)	3	(3.6)	
Number of years after HIV diagnosis					
Within one year	43	(18.4)	12	(14.3)	**< 0.01**
One to ten years after	180	(76.9)	31	(36.9)	
Ten or more years after	11	(4.7)	40	(47.6)	
Missing	0	(0.0)	1	(1.2)	
AIDS diagnosis at or before death					
Yes	213	(91.0)	43	(51.2)	**< 0.01**
No	21	(9.0)	41	(48.8)	
TOTAL	**234**		**84**		

Notes: A bold P value indicates statistical significance at the 0.05 level. IQR = Interquartile Range. Exposure categories: MSM = Men who have sex with men, IDU = Injection drug use, HET-Endemic = Heterosexual contact and origin from an HIV-Endemic country, HET-IR = Heterosexual contact with a person at risk for infection (e.g. HIV positive partner), HET-NIR = No risks other than heterosexual contact, Other = cases in which the mode of HIV transmission is known but is not captured in the major exposure categories (e.g. perinatal, blood transmission), NIR = No identified risk. Note that the Other category used in this report includes more exposure categories than the Other category used in the national HIV/AIDS surveillance reports (8).

Compared to deaths reported between 1985-2001, the latest ten year period had significantly different distributions for all characteristics except for sex (Table 6.1),. Because these trends in reported deaths reflect the changing distribution of HIV/AIDS cases reported in Nova Scotia (as described in the HIV and AIDS Reports sections), it is unlikely that differences between these time periods reflect a change in the risk of death within each group.

Between 2002 and 2011, nearly half of all deaths occurred ten or more years after HIV diagnosis. In contrast, only 4.7% of deaths between 1985 and 2001 fell into this category. Similarly, the proportion of deaths where the case had an AIDS diagnosis declined from 91.0% to 51.2% between these two periods. These differences reflect the effect of HAART in preventing the development of AIDS and extending the lives of those with HIV/AIDS. The decline in the proportion of deaths with an AIDS diagnosis may result because as cases live longer, they in turn have a greater chance of dying due to other causes. This is more likely as HIV cases age, since ongoing antiretroviral treatment and the immunologic effects of HIV in the body over time can cause increased morbidity and mortality that is unrelated to AIDS (33).

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