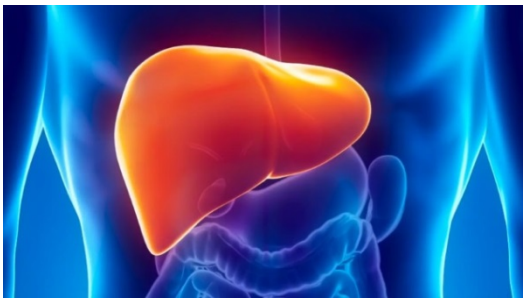
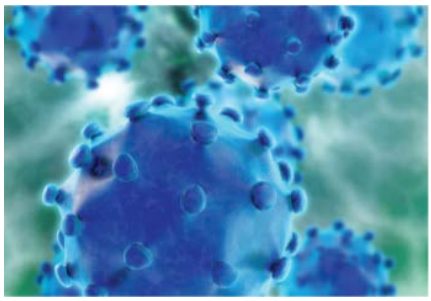
REPORT ON HEPATITIS B AND C IN CANADA: 2014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REPORT ON HEPATITIS B AND C IN CANADA: 2014

Foreward

The Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada (PHAC), is pleased to present the *Report on Hepatitis B and C in Canada: 2014*. This report is intended to provide information on trends in cases and rates of hepatitis B virus (HBV) and hepatitis C virus (HCV) infection to those who require surveillance data including program managers, policy makers, researchers, and others.

Viral hepatitis is an inflammation of the liver caused by one of the five hepatitis viruses; hepatitis B and C are the most common bloodborne hepatitis viruses and are the focus of this report. Although distinct from one another, infection with HBV and HCV can both cause either non-symptomatic or symptomatic acute infection. Infection with either virus may progress to chronic infection, and can result in severe illness and premature death (1).

Both HBV and HCV infections are notifiable in Canada. The *Report on Hepatitis B and C in Canada: 2014* is based on surveillance data reported to the Canadian Notifiable Disease Surveillance System (CNDSS) by provincial and territorial health authorities.

Any comments and suggestions that would improve the usefulness of future publications are appreciated and should be sent to the attention of the staff of the Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada at *ccdic-clmti@phac-aspc.gc.ca*.

Acknowledgements

The publication of this report would not have been possible without the collaboration of epidemiological units in all provinces and territories, whose continuous contribution to national HBV infection and HCV infection surveillance is gratefully appreciated.

This report was prepared by the Centre for Communicable Diseases and Infection Control, Infectious Disease Prevention and Control Branch, Public Health Agency of Canada.

Executive Summary

This report summarizes surveillance data on cases and rates of hepatitis B virus (HBV) and hepatitis C virus (HCV) infection in Canada, reported from 2005 to 2014. Cases are reported to the Canadian Notifiable Disease Surveillance System (CNDSS) by provincial and territorial health authorities. While data for HBV are summarized separately for acute and chronic infection where possible, it is not presently feasible to present HCV cases into acute and chronic cases for all provinces and territories due to differential reporting patterns among them. Information about acute HBV offers valuable insight into current transmission trends and patterns, while cases of chronic HBV infection represent the potential burden of disease in Canada. Appendices B and C summarize the differential reporting patterns on hepatitis B and C by different provinces and territories between 2005 and 2014.

Hepatitis B

In 2014, a total of 178 cases of acute hepatitis B were reported in Canada. Analysis of acute HBV data reported through the CNDSS demonstrates that acute HBV rates decreased from 1.0 to 0.5 per 100,000 between 2005 and 2014. In 2014, the highest rate of reported cases of acute HBV infection was observed among males in the 30-59 age group (1.0 per 100,000 population), followed by males 60+ years of age (0.76 per 100,000). In males above 30 years of age, the rates were nearly double the rates among females, while in younger age groups, the rates were similar among males and females. Over this ten-year timeframe, acute HBV rates decreased among males of all age groups, where the most prominent decrease was observed in age groups 30-39 years and 20-24 years. Similar results were seen among females, where rates of reported acute HBV infection showed a decline in all age groups except 60+ years, with the most prominent decline observed in the 20-24 year age group. In 2014, rates of reported cases above the national rate of 0.5 per 100,000 were observed in Saskatchewan, Ontario, New Brunswick, Nova Scotia, and the Northwest Territories.

For chronic hepatitis B, reporting from different provinces has evolved over a period of time with different provinces starting to report chronic cases in different years and sometimes combined with unspecified cases. Accordingly, the trends in rates need to be interpreted with caution especially during early years and shorter term trends between 2009 and 2014. The trends between 2009 and 2014 are generally stable. In 2014, 4,058 cases of chronic HBV were reported, resulting in a rate of 12.0 per 100,000. The rates of reported cases of chronic HBV have fluctuated between 10.9 (2008) and 13.6 (2012) per 100,000 with no definite trend emerging except for a marginal decline in rates between 2012 and 2014. Between 2005 and 2014, chronic HBV rates were consistently higher among males than among females, with the exception of 2007.

In 2014, rates of chronic HBV were higher in males than in females of 30 years of age and above, while rates among females below 30 years of age were higher or equal to that of males. In 2014, females in the 25-29 age group posted the highest rate of chronic HBV (25.7 per 100,000), followed by males in the 30-39 age group (24.5 per 100,000). British Columbia, Alberta, Ontario, and Yukon reported rates (20.8, 13.3, 13.6, and 16.2, respectively) higher than the national average of 12.0 per 100,000.

Various potential factors may explain the trends described in this report. For example, Canada's universal immunization program targeted at newborns and/or school-age children and, in some jurisdictions, high-risk populations, has likely contributed to declining rates of acute HBV. Other public health and infection control interventions aimed at preventing the transmission of sexually transmitted and bloodborne infections may have also affected observed trends.

It is worth noting that the national HBV rates are heavily influenced by variations in temporal and geographical reporting practices and should therefore be interpreted with caution. Provinces and territories differ in their capacity to distinguish HBV cases by infection status (acute vs. chronic); as a result, HBV reporting is not uniform across the country and many hepatitis B cases are reported as unspecified, i.e. unknown infection status. Moreover, the rates presented in this report likely underestimate the true burden of infection in Canada as HBV infection is asymptomatic in most individuals, who therefore may not present to a healthcare practitioner for testing.

Hepatitis C

Similar to the surveillance of hepatitis B in Canada, the surveillance of hepatitis C is still evolving; most provinces and territories do not report HCV infection differentiated into acute and chronic status. Only three jurisdictions started reporting separately either acute and chronic cases (Alberta and Yukon since 2013) or acute and unspecified cases (Quebec since 2012). Therefore, for the purpose of this report, such differentiation is not highlighted and all the cases are reported as HCV infection and include acute, chronic, and unspecified cases. Note that chronic HCV infection probably makes up the majority of cases reported to the CNDSS as acute infection is usually asymptomatic and less likely to be diagnosed.

Between 2005 and 2014, the rate of reported cases of hepatitis C decreased steadily from 40.2 per 100,000 to 29.3 per 100,000 and appears to be reaching a plateau in recent years. Rates declined among both males and females in all age groups, except a small increase in males aged 20 to 24 years, and 60 years and older, and females aged 25 to 29 years. Over the ten year time frame, rates of reported cases of HCV were consistently higher in males than in females in age 25 years and above. In 2014, the highest rate was observed among males in the 40-59 (58.2 per 100,000) and 25-29 (55 per 100,000) age groups.British Columbia, Alberta, Saskatchewan, Ontario, Nova Scotia, Prince Edward Island, Yukon, and the Northwest Territories all posted rates significantly higher than the national average of 29.3 per 100,000.

Advances in blood donation screening, infection control practices in healthcare settings and medical and public health interventions have likely contributed to the observed reductions in rates of reported HCV cases in Canada. It is also possible that public health interventions that seek to prevent transmission of infection among people who inject drugs have had an impact on these trends.

The difficulties in ascertaining acute or chronic HCV infection status and reporting patterns render it challenging to draw inferences about trends in either acute HCV transmission or the chronic burden of infection. Likewise, the lack of risk factor data on reported HCV cases limits the interpretation of the findings presented in this report.

National statistics and trends of HBV and HCV are used to inform public health programs, guidelines, and recommendations. Despite the limitations of the data collected by the CNDSS, the observed HBV and HCV rates and trends from 2005 to 2014 substantiate the need for continued prevention and management efforts in Canada. As the reporting of acute and chronic HBV and HCV becomes more harmonized across the country over time, available data will be more representative of the true burden of viral hepatitis in Canada.

Abbreviations

CBS	Canadian Blood Services
CCDIC	Centre for Communicable Diseases and Infection Control
CDC	US Centers for Disease Control and Prevention
CHMS	The Canadian Health Measures Survey
CNDSS	Canadian Notifiable Disease Surveillance System
CORR	Canadian Organ Replacement Register
DNA	Deoxyribonucleic acid
EIA	Enzyme immunoassay
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
PHAC	Public Health Agency of Canada
RNA	Ribonucleic acid
US	United States

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1.0 Methods

1.1 Case Definitions

Case definitions for hepatitis B and hepatitis C used in Canada for surveillance purposes are available in Appendix A. HBV infection has been notifiable in Canada since 1969 and the current national case definition (1) defines acute, chronic and unspecified infection status. HCV infection has been nationally notifiable since 1991. Surveillance of hepatitis C cases was phased in over time by provinces and territories, with all jurisdictions reporting cases by 1999. The current HCV infection case definition used for national surveillance (2) defines both acute and unspecified (including chronic, resolved and indeterminate) infection status.

1.2 Data Collection

In Canada, the surveillance of nationally notifiable infectious diseases is conducted by the Public Health Agency of Canada (PHAC) in coordination with provincial and territorial governments, which voluntarily provide non-nominal data to PHAC. Responsibility for primary data collection of notifiable disease data falls to local public health authorities according to provincial/territorial legislation (3).

PHAC collects and manages data received from the provinces and territories via the Canadian Notifiable Disease Surveillance System (CNDSS). CNDSS staff validate reported data with the submitting province or territory during data processing to resolve data errors or inconsistencies and maximize accuracy. Variables submitted by all reporting jurisdictions include: age at diagnosis, year of diagnosis, province/territory of diagnosis, and sex. As such, national reporting is limited to analyses of these variables. Extracts from the CNDSS are used as the basis of national surveillance reports. The current report is based on data extracted in August 2016.

1.3 Data analysis

Until recently, surveillance data reported to the CNDSS by most provinces and territories did not distinguish between acute and chronic HBV infection. A number of provinces and territories began reporting acute HBV infection cases in 2005; however, chronic HBV infection reporting only became more consistent in 2009. In order to examine trends over time, only those provinces and territories that consistently reported acute or chronic HBV infection over the timeframe considered were included in annual rates. Population estimates from jurisdictions not included in a particular analysis (acute or chronic) were removed from the overall denominator used to calculate corresponding national rates. Consequently, annual rates of acute HBV infection reported from 2005-2014 included data from British Columbia, Alberta, Saskatchewan, Ontario, Quebec,

New Brunswick, the Northwest Territories, and selected years for other provinces and territories such as Yukon (2008-2014), Manitoba (2009-2014), and Nova Scotia (2009-2014). Annual rates of chronic HBV infection reported from 2005-2014 include data from Alberta, Quebec, New Brunswick, and selected years for other provinces and territories such as Saskatchewan (2005-2013), Yukon (2008-2014), the Northwest Territories (2008-2014), British Columbia (2009-2014), Nova Scotia (2009-2014), Ontario (2012-2014), and Manitoba (2009, 2010, 2012-2014). Appendix B provides information on the years in which the provinces/territories started to report cases differentiated into acute and chronic HBV infection.

Most provinces and territories diagnose HCV cases using antibody testing which does not distinguish between acute and chronic HCV infection, or between current and resolved infection; such cases are reported as unspecified HCV infection (Appendix C). As such, HCV data presented in this report are unspecified infections, and include acute, chronic, resolved and indeterminate HCV infections.

Descriptive analysis of HBV and HCV infection by year, age group and sex was conducted using data reported to the CNDSS. Demographic patterns in age and sex were examined in HBV and HCV cases reported in 2014 to provide a more detailed snapshot of the most recent available data. Rates (given per 100,000 population), percentages, and percent change in rates were calculated using unrounded numbers, thus rounded numbers presented may differ from calculations based on rounded numbers and may not sum to the total. The population data were October 2016 obtained from Statistics Canada (Demography Division, Demographic Estimates Section) estimates. Rates calculated with these updated estimates may differ from those reported in previous reports.

1.4 Data limitations

Observed trends over time must be interpreted with caution as rates based on small numbers are more prone to fluctuation over time. Improved diagnostic capabilities and data cleaning/validation (i.e. duplicate removal), shortened reporting delay and changes in reporting practices at the jurisdictional level can contribute to changes in observed trends.

Once the data for this report has been validated, adjustments made to P/T data post-validation may not be reflected in that year's national data, but will be updated in subsequent reports. Therefore, small discrepancies between PHAC and provincial or territorial numbers are expected as a result of comparing dynamic databases. Larger discrepancies may be noted where P/Ts employ an analytic strategy that is different from what is used in this report. For instance, some jurisdictions choose to report chronic and unspecified HBV infections together as one category, while unspecified infections are excluded from analysis at the national level.

2. Hepatitis B

2.1 Introduction

HBV is a DNA virus of the *Hepadnaviridae* family that mainly infects liver cells but has also been found in a variety of tissues and organs, including the kidneys, pancreas and mononuclear cells (4,5). After acquisition of HBV infection, less than 10% of children, and 30-50% of adults, will manifest symptoms which may include jaundice, fatigue, loss of appetite, nausea, and joint or abdominal pain (6). Age at infection is a significant determinant of the likelihood of developing chronic infection, which occurs in approximately 90% of infants infected at birth and decreases with increasing age to less than 5% of adults (6). Chronic HBV infection may, over time, result in liver cirrhosis, hepatocellular carcinoma, decompensated liver disease and premature death (6).

Transmission of HBV occurs through contact with infected blood and body fluids, most commonly through sexual or close personal contact with an infected person, use of contaminated drug injection equipment, and vertical (mother-to-child) transmission during pregnancy or birth (6). The patterns of HBV transmission are somewhat different in developing and developed countries, with vertical transmission and exposure through close family contacts being of significant importance in developing countries, while sexual transmission and injection drug use are the predominant patterns in developed countries such as Canada (7,8). HBV can survive outside the body for up to seven days and has been implicated in both nosocomial transmission (via contaminated medical or dental equipment) and occupational exposure among healthcare workers (9).

Diagnosis of HBV infection requires laboratory confirmation via a blood sample to differentiate HBV infection from other types of hepatitis. Infection markers present in the blood can also be used to distinguish between acute and chronic HBV infection. Acute HBV infection is characterized by the presence of the hepatitis B surface antigen (HBsAg) and immunoglobulin M antibodies to the hepatitis B core antigen (anti-HBc IgM) (6). Chronic infection is characterized by the presence of antibodies to the hepatitis B core antigen (anti-HBc other than IgM) and HBsAg for over six months (6). The presence of HBeAg, an antigen characteristic of the initial phase of acute infection and which may be present during chronic infection, indicates that the infected individual is highly contagious (10,11). In contrast, anti-HBe appears during recovery from acute infection and its presence during chronic infection generally indicates reduced viral replication and low infectivity (11).

A vaccine against hepatitis B has been available globally since 1982 (9). In Canada, all provinces and territories have had a universal newborn and/or childhood HBV vaccination program since the 1990s, although programs vary by jurisdiction with respect to the recommended dosages and schedules, as well as the age groups targeted (11,12). In addition, some jurisdictions offer HBV vaccine to individuals who are at increased risk of infection (e.g., people who inject drugs or who engage in high-risk sexual practices) (13). The National Advisory Committee on Immunization recommends

routine testing for HBsAg during pregnancy or at the time of delivery. Infants born to infected mothers are put on an immediate immunization schedule in an effort to reduce the risk of HBV infection (14).

There is no treatment for acute HBV infection; care is focused on alleviating symptoms, preventing hepatic complications and reducing the spread of infection through counseling (9,11). Among persons with chronic HBV infection, interferon injections and antiviral medications are the approved treatments to prevent the development of cirrhosis, liver failure and liver cancer. However, only some individuals with chronic HBV are eligible for treatment, determined by the age of the individual, the concentrations of serum aminotransferase and DNA HBV, and the severity of liver disease among other factors (11).

2.2 National trends

2.2.1 Acute Hepatitis B

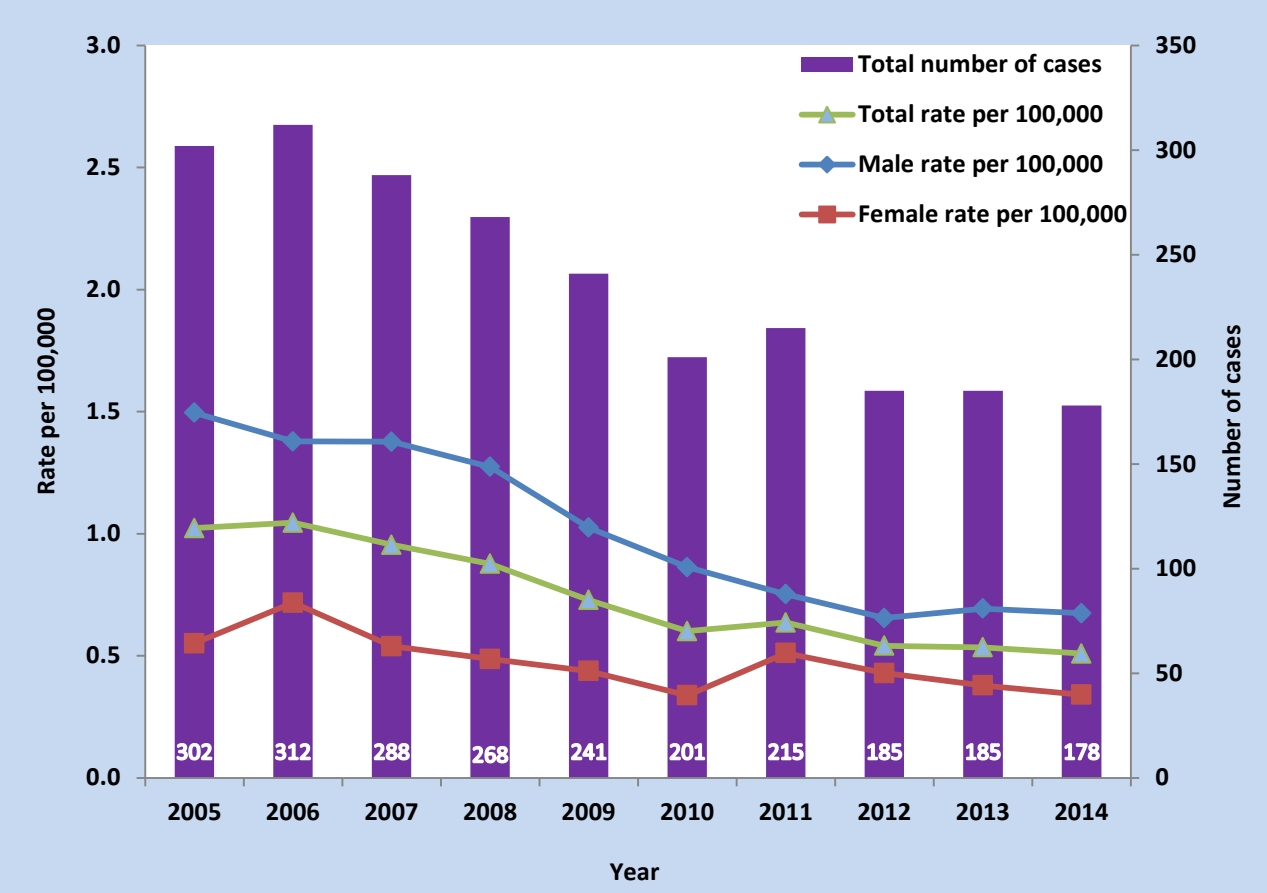
This section of the report presents the rates and trends of acute HBV infection in Canada between 2005 and 2014. In order to provide consistent time trends, only those provinces and territories that provided data on acute HBV infection during this timeframe are included in national acute HBV infection rates, with denominators adjusted accordingly.

2.2.1.1 Trends over time

The overall rate of reported cases of acute HBV infection reduced steadily between 2005 and 2014. In 2005, a total of 302 cases of acute HBV infection were reported, corresponding to an overall rate of 1.0 per 100,000, compared to 178 cases reported in 2014, which represented a rate of 0.5 per 100,000 (Figure 1).

Between 2005 and 2014, rates of reported cases of acute HBV were consistently higher among males than females, although the gap between sexes narrowed over time, with males experiencing a greater decrease in rates than females (54.9% versus 38.2% respectively) (Figure 1).

Figure 1. Reported number of cases and rates of acute HBV infection in Canada[1] by sex, CNDSS, 2005-2014

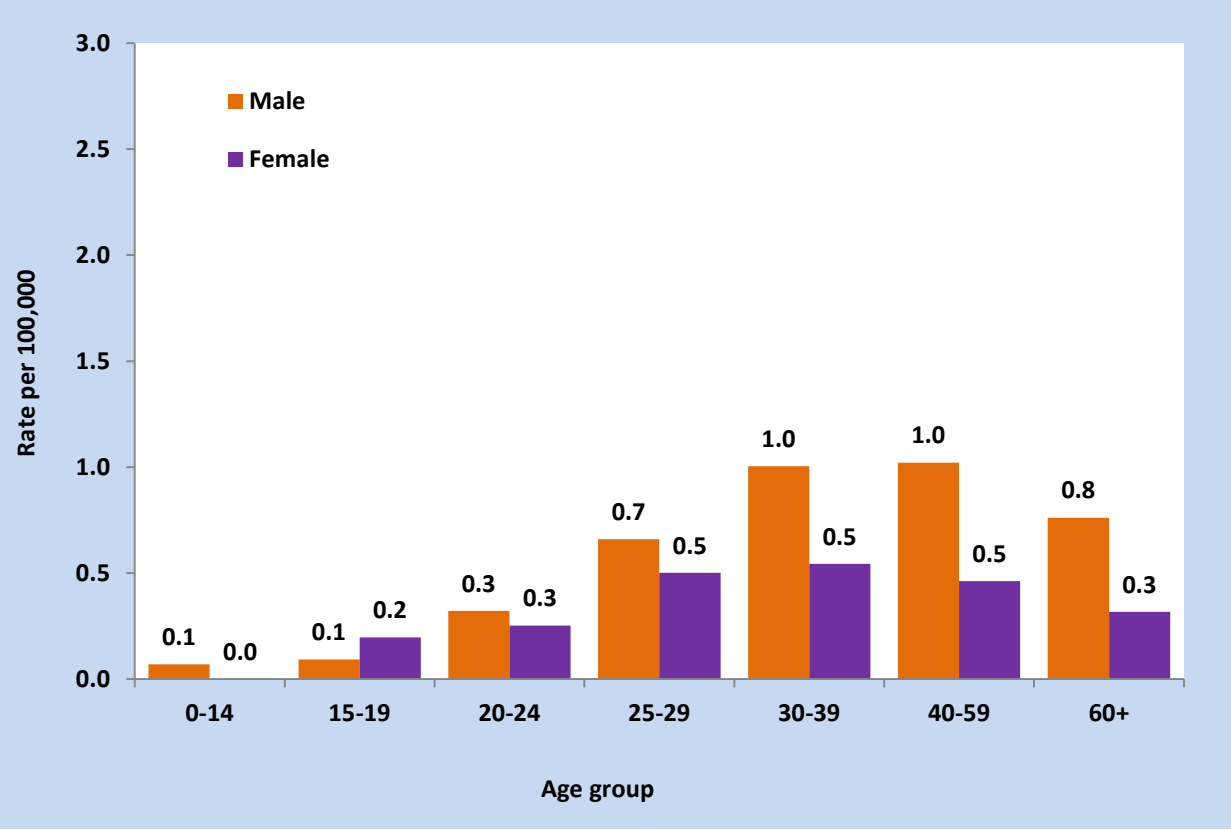


[1] Includes data from BC, AB, SK, ON, QC, NB, NT (Data from 2005 to 2014); YT (Data from 2008 to 2014); MB and NS (Data from 2009 to 2014)

2.2.1.2 Trends by age group and sex

In 2014, the highest rate of reported cases of acute HBV infection was observed among males in the 30-59 age group (1.0 per 100,000), followed by males 60+ years of age (0.76 per 100,000). In males above 30 years of age, the rates were nearly double than that among females, while in younger age groups, the rates were similar among males and females (Figure 2).

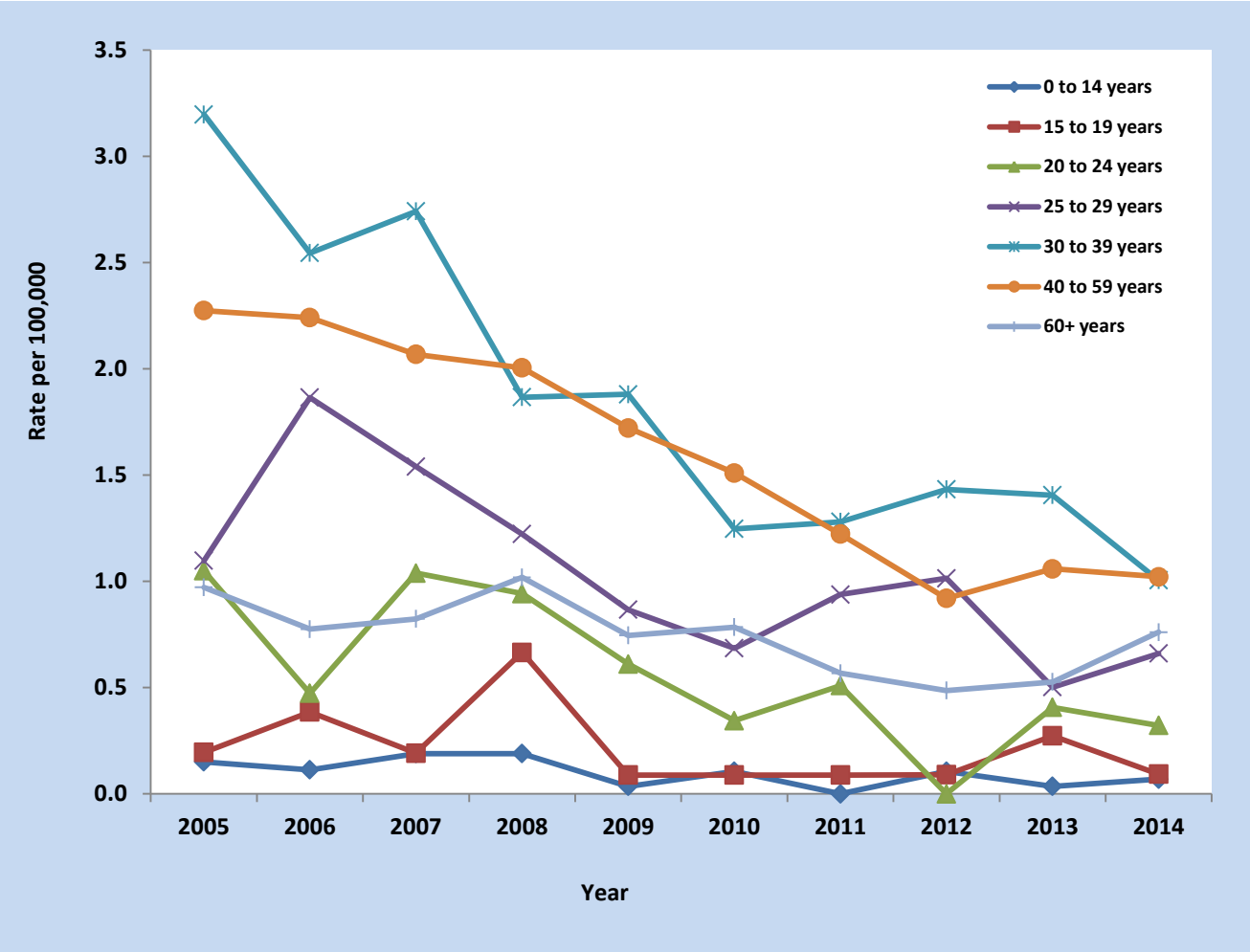
Figure 2. Rates of reported cases of acute HBV in Canada[1] by age group and sex, CNDSS, 2014



[1] Includes data from BC, AB, SK, ON, QC, NB, NT, YT, MB, and NS

Among males, the rates of reported cases of acute HBV between 2005 and 2014 decreased across most age groups with the most significant (69% reduction; $p<0.05$) was in the 30-39 years old age group and the least significant (22% reduction; $p<0.05$) was in the 60+ years old (Figure 3).

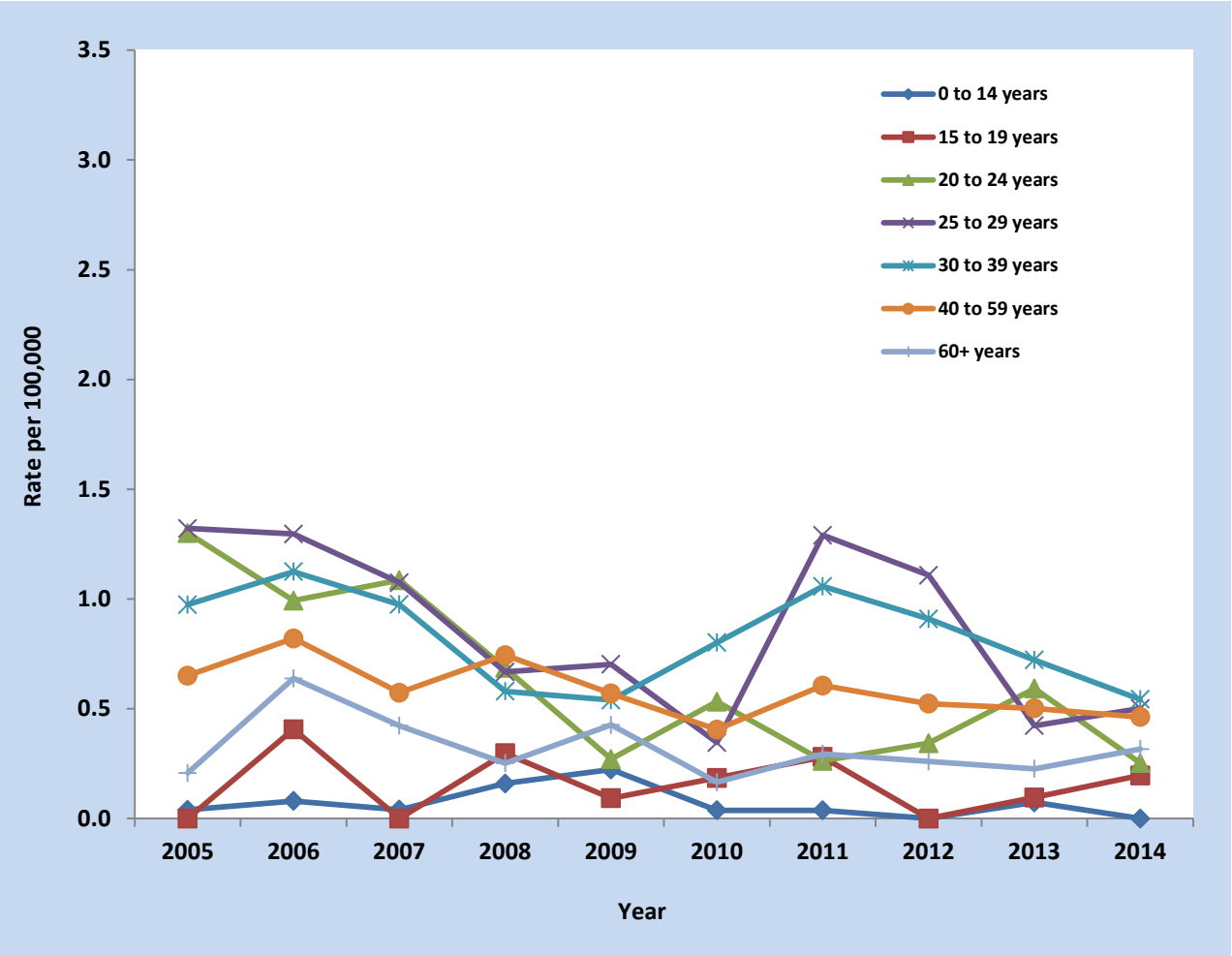
Figure 3. Rates of reported cases of acute HBV in Canadian[1] males by age group and year, CNDSS, 2005-2014



[1] Includes data from BC, AB, SK, ON, QC, NB, NT (Data from 2005 to 2014); YT (Data from 2008 to 2014); MB and NS (Data from 2009 to 2014)

Among females, the significant ($p<0.05$) decreasing trend of the rates of acute HBV infection is noted (Figure 4) in the 20-24 years old (from 1.3 to 0.3 per 100,000; 80% reduction), 25-29 years old age (from 1.3 to 0.5 per 100,000), 30-39 years old (from 1.0 to 0.5 per 100,000), and 40-59 years old (from 0.7 to 0.5 per 100,000). In other age groups, there was either no change (0-14 years old) or slight increase (15-19 years old) and nearly 50% increase in females (60 years and above) as depicted in Figure 4.

Figure 4. Rates of reported cases of acute HBV in Canadian[1] females by age group and year, CNDSS, 2005-2014



[1] Includes data from BC, AB, SK, ON, QC, NB, NT (Data from 2005 to 2014); YT (Data from 2008 to 2014); MB and NS (Data from 2009 to 2014)

2.2.1.3 Rates by province/territory

In 2014, the rates of reported cases of acute HBV were low in all participating jurisdictions, however, Saskatchewan, Ontario, New Brunswick, Nova Scotia, and the Northwest Territories reported acute HBV rates above the national average of 0.5 per 100,000 (0.8, 0.8, 1.2, 0.7 and 2.3 per 100,000, respectively). Rates among males were consistently higher than those in females across all provinces and territories, except in Manitoba where the number of reported cases was too low to make a valid comparison (Table 1).

Table 1. Reported number of cases and rates[1] of acute HBV infection by sex and province/territory in Canada, CNDSS, 2014

Jurisdiction	Male		Female		Total	
	Number of cases	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*
Canada	117	0.7	60	0.3	178	0.5
BC	9	0.4	5	0.2	14	0.3
AB	9	0.4	1	0.0	10	0.2
SK	7	1.2	2	0.4	9	0.8
MB	0	0.0	4	0.6	4	0.3
ON	60	0.9	43	0.6	104	0.8
QC	17	0.4	3	0.1	20	0.2
NB	8	2.1	1	0.3	9	1.2
NS	6	1.3	1	0.2	7	0.7
PE	N/A	N/A	N/A	N/A	N/A	N/A
NL	N/A	N/A	N/A	N/A	N/A	N/A
YT	0	0.0	0	0.0	0	0.0
NT	1	4.4	0	0.0	1	2.3
NU	N/A	N/A	N/A	N/A	N/A	N/A

[1] Includes data from BC, AB, SK, ON, QC, NB, NT, YT, MB, and NS

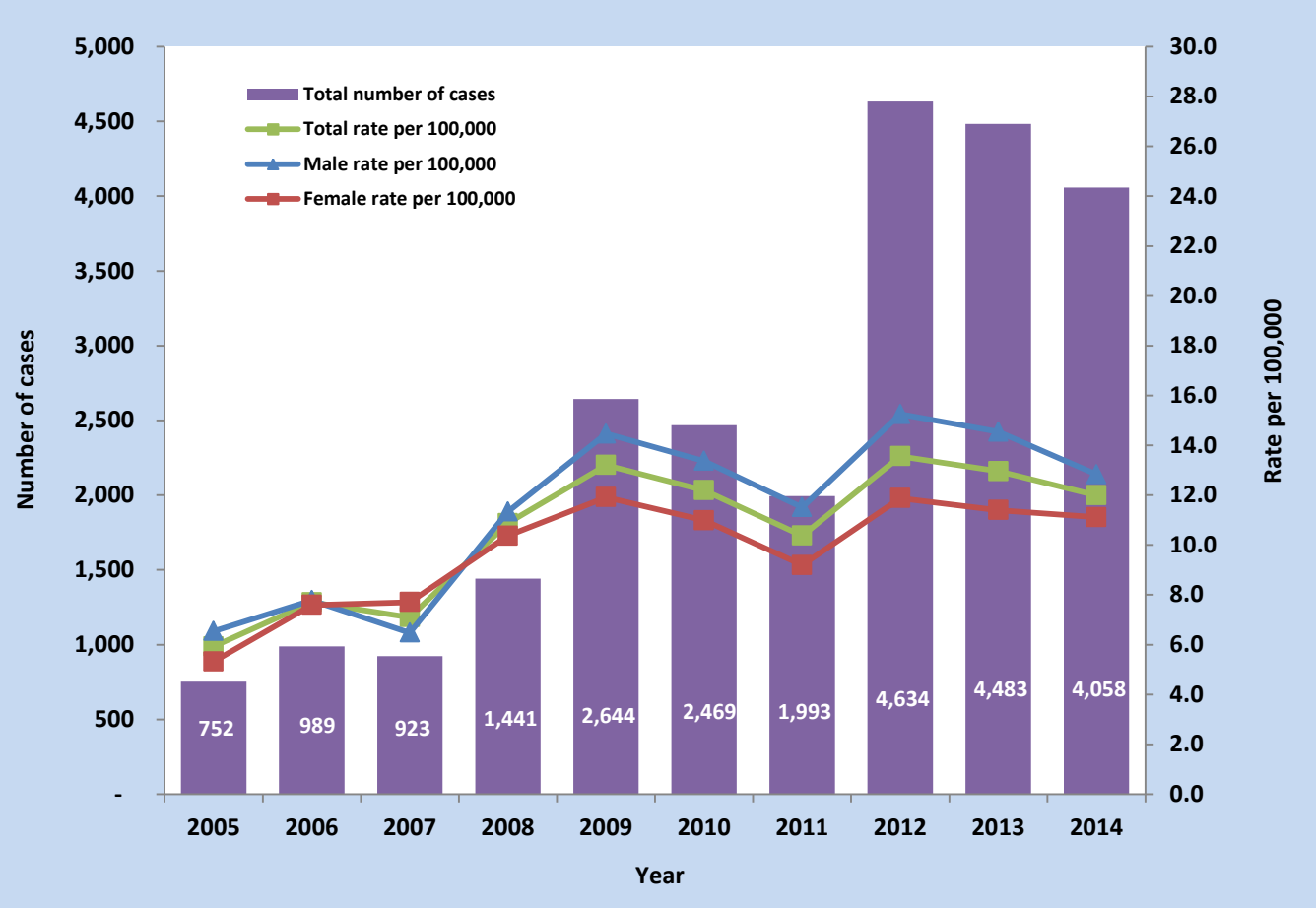
2.2.2 Chronic Hepatitis B

Provinces and territories started reporting chronic cases of HBV infection in different years. Chronic HBV infection statistics presented in the current report were adjusted to account for differences related to the variation in the year when each jurisdiction started the reporting. As a consequence, interpretation of these statistics should be done with caution since data from different time periods may represent different provincial/territorial groupings.

2.2.2.1 Trends over time

There has been a variable but overall increasing trend in the rate of reported cases of chronic HBV infection between 2005 and 2014. It may partially be related to provinces with different rates joining the surveillance systems in different years. Although there is an overall increasing pattern in the rate of chronic HBV over the years, it is worth noting that since 2012, it has declined slightly from 13.6 per 100,000 to 12.0 in 2014 (Figure 5). The decrease occurred among both males and females, but was more prominent among males (15.8% reduction) than females (6.5% reduction), as indicated in Figure 5.

Figure 5. Reported number of cases and rates of chronic HBV infection in Canada[1] by sex, CNDSS, 2009-2014

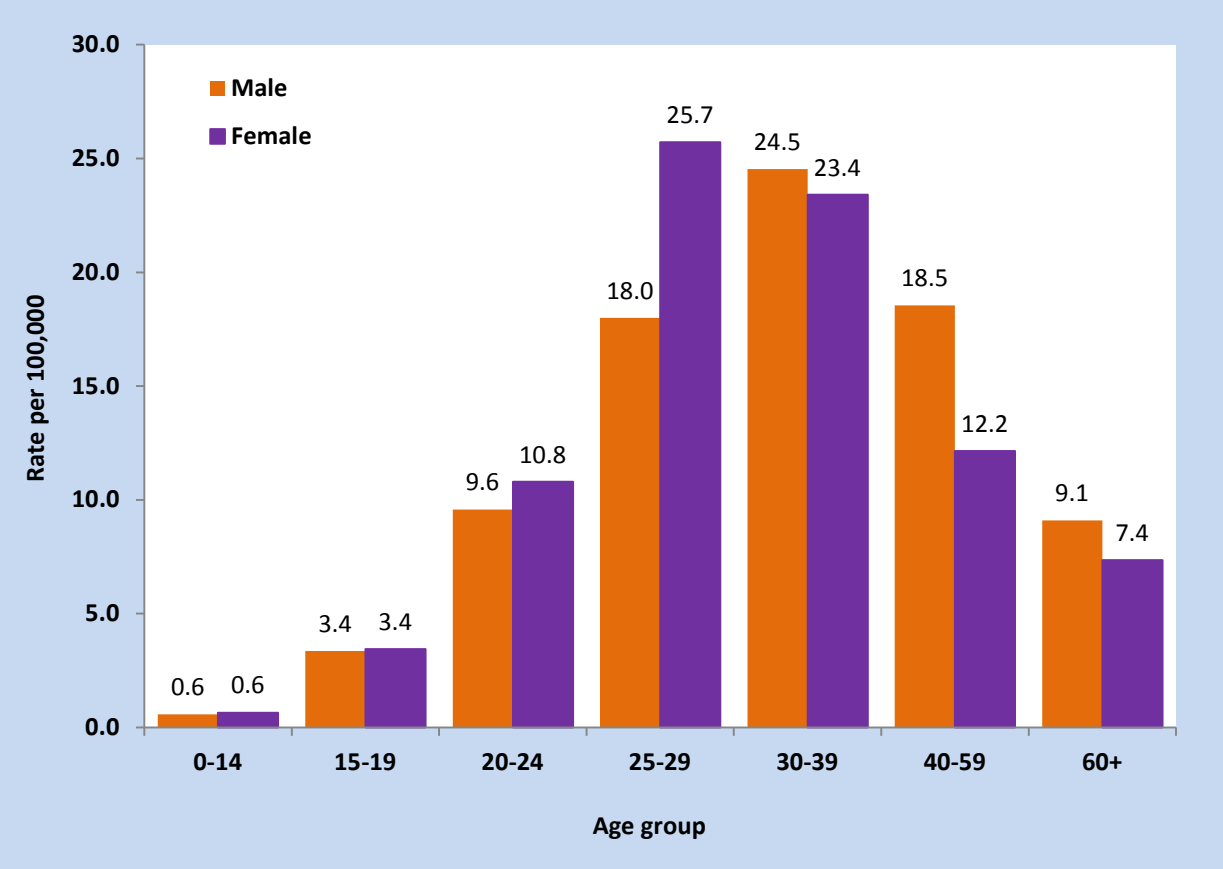


[1] Includes data from AB, QC, NB (Data from 2005 to 2014); SK (Data from 2005 to 2013); YT, NT (Data from 2008 to 2014); BC, NS (Data from 2009 to 2014) MB (Data from years 2009, 2010, and from 2012 to 2014) ON (Data from 2012-2014);

2.2.2.2 Trends by age group and sex

In 2014, rates of chronic HBV were higher in males than in females aged 30 years and over, while rates among females were higher or equal to those among males for younger age groups (Figure 6). Overall, the highest rates of reported cases of chronic HBV in 2014 among females was observed in the 25-29 age group (25.7 per 100,000), and among males in the 30-39 years age group (24.5 per 100,000).

Figure 6. Rates of reported cases of chronic HBV in Canada[1] by age group and sex, CNDSS, 2014



[1] Includes data from BC, AB, ON, QC, NB, NT, YT, MB, and NS

2.2.2.3 Trends by province/territory

The reported number of chronic HBV cases and rates by sex and province/territory for 2014 are presented in Table 2. In 2014, Ontario reported the highest number of cases, 1,873, corresponding to a rate of 13.6 per 100,000, followed by British Columbia with 971 cases corresponding to a rate of 20.8 per 100,000. The provinces of Ontario, British Columbia, Alberta, and Yukon reported rates of chronic HBV above the national average of 11.4 per 100,000 (13.6, 20.8, 13.3, and 16.2 per 100,000, respectively). Except for Yukon and British Columbia, the rates were higher among males than females.

Table 2. Reported number of cases and rates[1] of chronic HBV infection by sex and province/territory in Canada, CNDSS, 2014

Jurisdiction	Male		Female		Total	
	Number of cases	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*
Canada	2,154	12.8	1,896	11.1	4,058	12.0
BC	475	20.5	494	21.0	971	20.8
AB	301	14.3	249	12.3	550	13.3
SK	N/A	N/A	N/A	N/A	N/A	N/A
MB	36	5.6	33	5.1	69	5.4
ON	992	14.7	875	12.5	1,873	13.6
QC	319	7.8	223	5.4	542	6.6
NB	18	4.8	12	3.1	30	4.0
NS	11	2.4	6	1.2	17	1.8
PE	N/A	N/A	N/A	N/A	N/A	N/A
NL	N/A	N/A	N/A	N/A	N/A	N/A
YT	2	10.6	4	22.0	6	16.2
NT	0	0.0	0	0.0	0	0.0
NU	N/A	N/A	N/A	N/A	N/A	N/A

[1] Includes data from BC, AB, ON, QC, NB, NT, YT, MB, and NS

2.3 Discussion

Overall, although the rate of reported cases of HBV infection in Canada is relatively low, it remains an important and preventable cause of illness and death. In 2013 (the most recent year for which mortality data were available), acute HBV infection was documented as the leading cause of 18 deaths in Canada, and a further 50 deaths were attributed to chronic HBV (15). Initial observations on mortality statistics point towards the possibility of a rising number of deaths attributable to chronic HBV infection between 2011 and 2013. In addition, the true magnitude of HBV-related deaths is likely higher and is underestimated due to potential misclassification on death certificates (16).

Acute HBV cases offer valuable insight into current transmission trends and patterns, as cases diagnosed and reported as acute infection approximate incident cases (i.e., those that have been recently acquired). Data from the CNDSS indicate a decrease in the rates of reported cases of acute HBV infection between 2005 and 2014 in Canada, among both males and females, although rates were consistently higher among males than females over this timeframe. In 2014, the rates of reported cases of acute HBV were observed to be the highest in males in the 40-59 age group, followed by males in the 30-39 age group and males in the 60+ age group.

These decreasing rates of acute HBV infection in Canada may be attributable to the implementation of routine immunization programs in all provinces and territories, starting in the early 1990s. These programs are offered to infants and/or school-aged children and, in some jurisdictions, high-risk populations (13). Those who received HBV vaccine are considered to be protected from acute and chronic HBV infection. As an increasing proportion of the Canadian population is covered by HBV immunization, it is reasonable to expect continued decreases in acute HBV rates. In 2009, HBV immunization coverage by the second birthday was estimated to be 69% in provinces and territories with a three-dose infant program (20). Coverage with at least two doses of the HBV vaccine by the 17th birthday was 74.8% in 2011 (21). In 2012, national HBV immunization coverage was estimated at only 39.7% in the non-institutionalized adult population; however, approximately 64.9% of healthcare workers in close contact with patients had received the HBV vaccine (21).

Refinement in blood screening and improved infection prevention and control practices in healthcare settings have also likely contributed to Canada's decreasing rates of acute HBV infection. Surveillance of blood donations received by the Canadian Blood Services (CBS) in 2015 indicates that HBV was detected in 42.6 per 100,000 first-time donations (which comprise less than 10% of the total overall donations), and only 2.0 per 100,000 repeat donations (i.e. donations among those who have donated previously). All donations that test positive for a transmissible disease are discarded (22). Under the Blood Safety Contribution Program (BSCP) of PHAC through its surveillance systems (Transfusion Transmitted Injury Surveillance System [TTISS], Transfusion Error Surveillance System [TESS]) no case of HBV infection related to blood transfusion has been reported.

Comparisons in acute HBV rates between Canada and other countries are limited due to differences in case definitions, reporting sources, and screening programs. However, declining rates have been similarly observed in countries with comparable population structures, health status and public health infrastructure. For example, data from routine and/or enhanced surveillance in England and the United States indicate that the annual rates of acute HBV in these countries have been decreasing over time (17-19). According to the most recent report by the US Centers for Disease Control and Prevention (CDC) in 2014, acute HBV rates of infection have been decreasing in the US since 2010. In 2010, 3,350 acute HBV cases were reported while in 2014, the number of reported cases fell to 2,953 (17). Like the US, England has also been experiencing a decrease in the number of acute HBV reported cases according to Public Health England's most recent acute Hepatitis B report from 2015. From 2014 to 2015, the annual incidence of reported acute HBV cases went down from 0.91 per 100 000 population to 0.83 per 100 000 population (18).

Understanding the magnitude of chronic HBV infection in Canada is important, as it represents the potential burden of disease in Canada resulting from the prolonged inability to clear the infection. Chronic HBV infection can lead to long-term conditions such as cirrhosis and liver cancer (6). Data from the Canadian Organ Replacement Register (CORR) indicate that HBV was the primary diagnosis for 4.2% of liver transplant recipients in Canada from 2005 to 2014 (23). In comparison to acute HBV,

individuals with chronic HBV are more likely to transmit the virus to others, as the period of communicability is relatively brief during acute infection (24).

As a result of variable reporting of chronic HBV cases by provinces and territories between 2005 and 2014, the analysis of chronic HBV infection trends over time must be interpreted with caution. CNDSS data indicate that rates of reported chronic HBV cases decreased slightly between 2012 and 2014. In 2014, the highest rates were observed among females in the 25-29 age group, and males in the 30-39 age group.

The rates of reported chronic HBV infection are higher than those of acute HBV for a variety of reasons, including the probable under-diagnosis of acute cases due to their largely asymptomatic nature. Chronic HBV is more likely to be diagnosed among those who were not immunized as children, as evidenced by higher rates of reported cases among those 30 years old and over, who would have been older than the recommended recipients of vaccine at the time of the implementation of universal immunization programs.

There is evidence that immigration from countries where HBV is endemic also likely contributes to an increase in the number of HBV cases throughout Canada (25). According to one study conducted in 2011, approximately 3% of immigrants to Canada during the early 2000s were estimated to be infected with HBV while only 0.5% of Canadian-born people were infected during the same period (26). However, the percentage of chronic HBV infected individuals amongst immigrants to Canada could actually be higher than 3% as found in a 2012 study from McGill University in which 6.7% of immigrants had chronic HBV (27). In a study in British Columbia, the majority of the chronic HBV infections identified in recent years was among persons who have emigrated from a country where HBV is endemic (26).

Population seroprevalence studies can help provide additional information on the burden of HBV infection in Canada. The Canadian Health Measures Survey (CHMS) (29,30) found the seroprevalence of current HBV infection, inclusive of both acute and chronic infection, to be 0.4% over a period of data collection spanning from 2007 to 2011. Serological evidence of a previous HBV infection was identified among 4.2% of participants. Of those previously infected with HBV, 79% demonstrated complete resolution and protective immunity (31). Such surveys provide useful information and complement the surveillance system to better characterize disease burden due to HBV infection.

Though HBV infection rates are generally low among the general population in Canada, past research has demonstrated that certain factors are strongly associated with the risk of infection, these include high-risk sexual activity, injection drug use, household contact with an HBsAg carrier, a history of blood transfusion, and body piercing and tattooing (32,33). Due to such risk factors, some vulnerable populations experience higher than average rates of HBV infection, such as people who inject drugs and street-involved youth who may not have benefitted from provincial/territorial immunization programs despite being eligible for them (34,35).

2.4 Limitations

There are notable limitations to the findings presented in this report. Reporting practices did not remain consistent over the timeframe included in this report and, as a result, certain provinces and territories were excluded from acute and/or chronic HBV infection data analyses. Unlike the reporting of acute HBV which was more consistent over the 2005 to 2014 timeframe, reporting of chronic HBV across jurisdictions over this same period was more variable. For example, Prince Edward Island, and Newfoundland and Labrador did not specify infection status for the HBV cases reported to CNDSS and have always reported hepatitis B cases as unspecified. Among those provinces that reported acute and chronic cases, some of the cases were also reported as unclassified. In 2014 alone, 712 cases of HBV infections were reported as unspecified and therefore are not presented in this report.

The data are limited to analysis by age, sex, and infection status. At this time, there are no additional data elements in the CNDSS to help explain observed trends. Consequently, it is not clear what proportion of reported HBV infections are due to cases imported from endemic countries, injection drug use, or high risk sexual practices.

Observed trends over time may also be reflective of changes in screening practices or improved diagnostic capability, resulting in increased detection of persons with HBV infection, many of whom likely acquired the infection well before the time of diagnosis. Additionally, these trends may be attributable to the heightened ability to distinguish acute from chronic infection; and improved surveillance and reporting.

Also, rates based on small numbers of cases are more prone to fluctuations over time, such as with acute HBV, and should be interpreted with caution. For example, the large increase in the acute HBV rate observed among females in the 25 - 29 age group between 2010 and 2011, and a subsequent decrease in following years can be largely explained by the small number of cases reported in this group and the consequent potential for fluctuation in rates.

Finally, the HBV rates presented in this report are likely an underestimation of the true burden of infection in Canada. As acute HBV infection is asymptomatic in over 90% of children and 50-70% of adults, the majority of individuals recently infected will not present to a healthcare practitioner for testing and therefore will not be reported to the CNDSS as an acute case of HBV. Results from the 2007 to 2009 and 2009 to 2011 CHMS suggest that more than half of the survey participants with laboratory-confirmed HBV were unaware of their infections (31). The burden of chronic HBV infection in Canada is underestimated in this report due to the unavailability of chronic HBV infection data from different provinces for the time frame presented. Additionally, HBV infection often occurs in hard-to-reach populations who may not have access to a healthcare provider or who may exhibit low health care seeking behaviour. Finally, though in some instances a reported acute case may become a carrier at a later time, this was not assessed in the present report and data provided to PHAC by provinces and territories were considered final for the respective reporting year.

2.5 Conclusion

Although there are limitations to available data, the findings presented in this report help address a significant knowledge gap and are useful for detecting major trends in acute and chronic HBV infection in Canada. Canada continues to have a downward trend in HBV rates, most notably in acute HBV cases, and a continued downward trend in chronic HBV cases will eventually result from the vaccination strategies, especially those targeting high-risk populations.

Given the potential for HBV infection to progress to more serious conditions, such as cirrhosis, hepatocellular carcinoma and liver decompensation, and the consequent potential for putting a strain on Canada's health care system, continued monitoring of HBV infection is essential. Surveillance data are used to inform the development of public health programs, guidelines, and recommendations. PHAC released a primary care reference guide for the management of hepatitis B in 2013 (11), and provides recommendations on the use of HBV vaccine in the Canadian Immunization Guide (13). In the future, increasing national capacity to differentiate between acute and chronic HBV cases and standardized reporting will generate more robust data which will facilitate a more thorough understanding of trends in transmission and of the burden of HBV infection in Canada, and further contribute to public health actions.

3.0 Hepatitis C

3.1 Introduction

Hepatitis C virus (HCV) is an enveloped, single-stranded linear RNA virus belonging to the *Flaviviridae* family. It is estimated that there are approximately 250,000 people living with HCV infection in Canada (36). Six genotypes of hepatitis C virus have been identified, and genotype 1 is the predominant strain in Canada and throughout North America (36)(37). Individuals with acute HCV infection are commonly asymptomatic, which poses a challenge for identifying new cases. Approximately 15% to 50% of individuals will spontaneously clear and recover from their infection (6). Spontaneous clearance has been found to occur more often among those who experience symptomatic HCV infection, which is thought to signal a more robust immune response (38). Approximately 50% to 85% of those with acute HCV infection will progress to chronic infection but will remain asymptomatic for decades (39).

HCV is highly transmissible, and is spread through contact with infected blood. The majority of HCV infections in Canada occur through the sharing of needles and other drug injection materials (e.g., cooker, water, filter, etc.) (40). In the 2011 surveillance report on HCV in Canada, it was estimated that 54% to 70% of hepatitis C infections between 2005 and 2010 were a result of injection drug use (40). In a study conducted by PHAC in 2009, 61% of newly diagnosed HCV cases were associated with injection drug use (41).

Today, the risk of being infected with HCV from blood transfusions in Canada is extremely low since all donated blood is tested for the virus before use (42). In its 2015 surveillance report, the Canadian Blood Services stated that the estimated residual risk of transmitting HCV in Canada through blood transfusion is 1 in 12.6 million donations (22). Other less common routes of HCV transmission include spread through the sharing of sharp instruments and personal hygiene equipment with an infected person (e.g., razors, toothbrushes, scissors and nail clippers), as well as equipment for snorting or smoking drugs (e.g., straws, pipes, etc.).

Sexual transmission is thought to be rare in general, although HIV-positive men who have sex with men appear to be at elevated risk of contracting HCV through sexual transmission (43). Additionally, couples who have unprotected sex during a woman's menstrual cycle could risk sexual transmission of HCV (42). Vertical transmission from mother to child has also been documented (44,45).

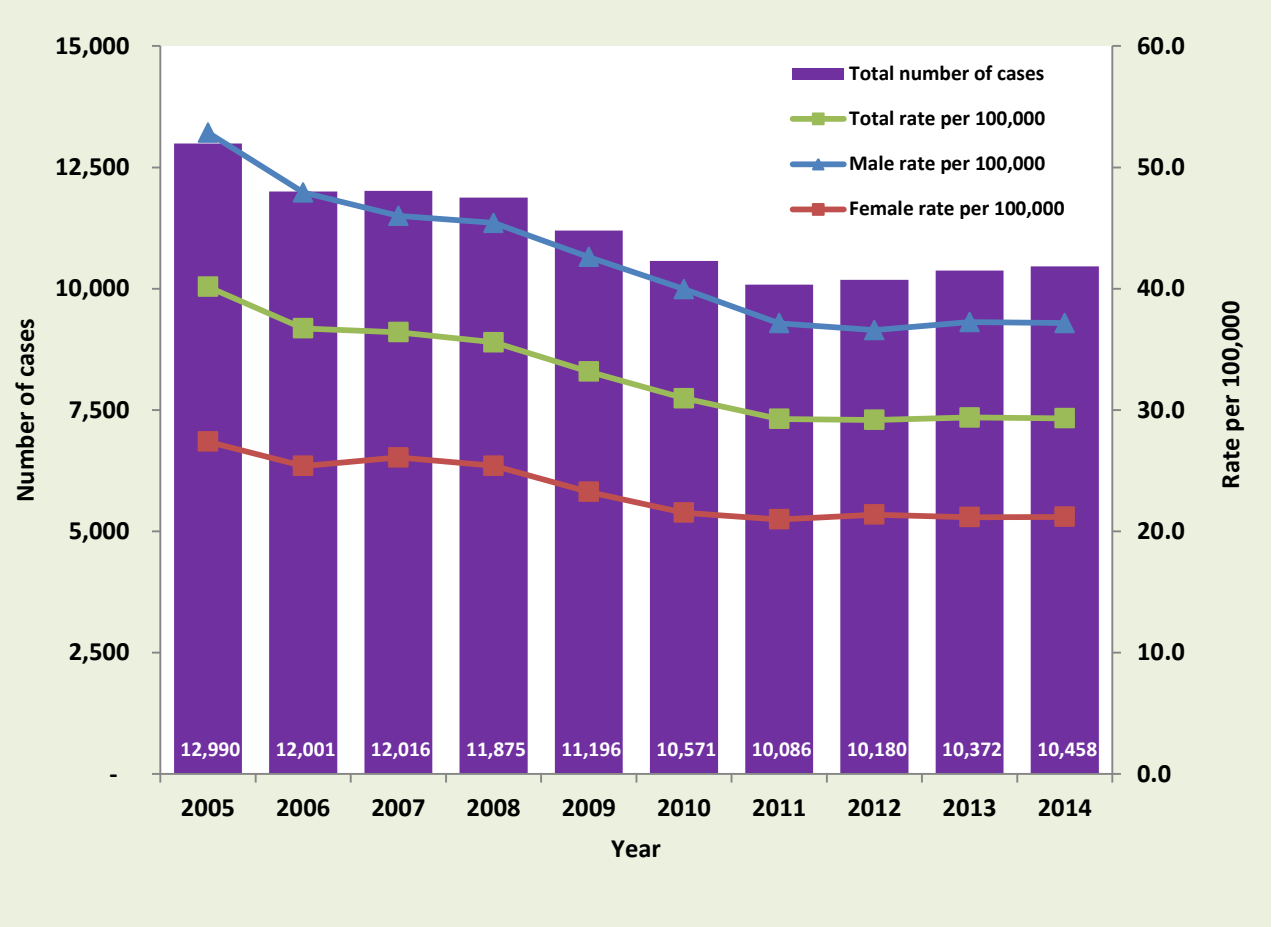
3.2 National Trends

3.2.1 Trends over time

Between 2005 and 2014, the rates of reported cases of HCV infection decreased steadily among both males and females, and appear to have stabilized in recent years (Figure 7). In 2005, a total of 12,990 cases were reported, corresponding to a rate of 40.2 per 100,000, compared to 2014, when a total of 10,458 cases were reported, corresponding to a rate of 29.3 per 100,000, a 27% decrease from 2005.

Over this timeframe, HCV infection rates of reported cases were consistently higher among males than females. Among males, from 2005 to 2014, the HCV infection rate decreased by 29.7% (from 52.9 to 37.2 per 100,000), whereas among females, during the same period, it decreased by 22.6% (from 27.4 to 21.2 per 100,000) (Figure 7).

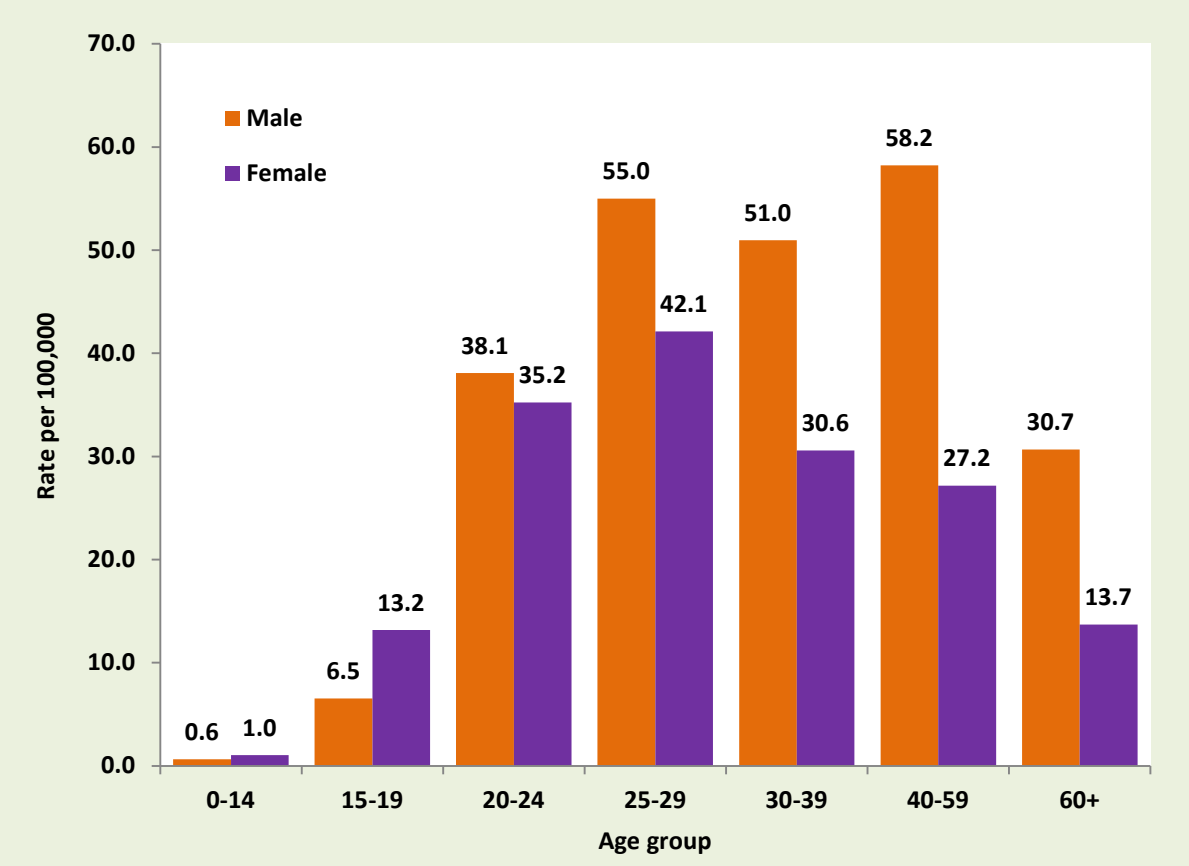
Figure 7. Reported number of cases and rates of HCV infection in Canada, by sex, CNDSS, 2005 - 2014



3.2.2 Trends by age group and sex

The highest rates of HCV infection were observed among individuals age 20 to 59 years old and ranged from 38.1 to 58.2 per 100,000 in males, compared to 27.2 to 42.1 per 100,000 in females (Figure 8). Youths, age 0 to 19 years old, posted the lowest rates: between 0.6 and 6.5 per 100,000 for males and 1.0 to 13.2 per 100,000 for females (Figure 8).

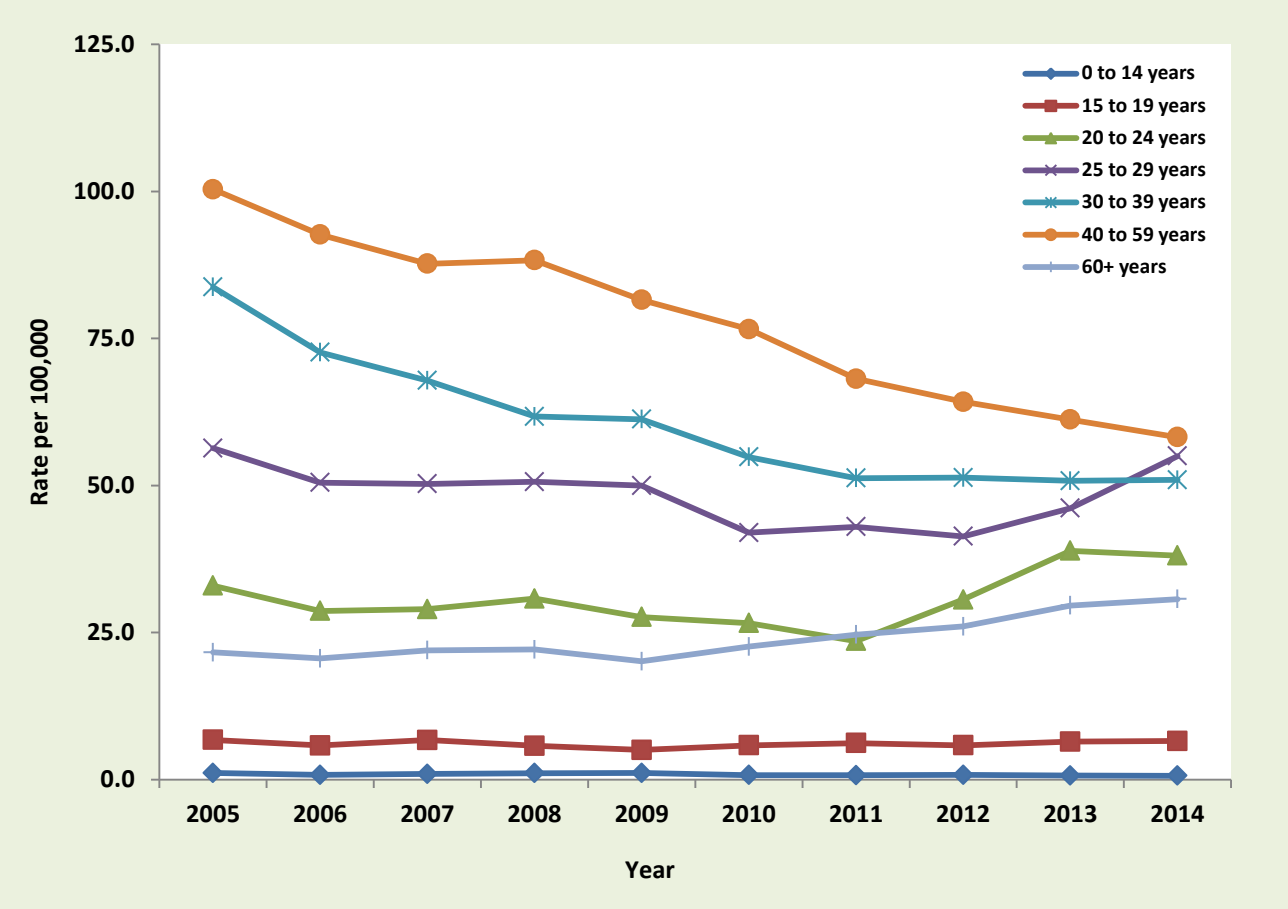
Figure 8. Rates of reported cases of HCV in Canada by age group and sex, CNDSS, 2014



Between 2005 and 2014, males of all age groups showed a decrease in the rate of reported HCV infection, with the exception of those 60 years of age and over and those aged 20-24 years, both of which experienced a rate increase from 21.6 per 100,000 to 30.7 per 100,000, and from 33.0 per 100,000 to 38.1 per 100,000, respectively (Figure 9). Among males in the age group of 25-29 years age group, the rates of reported HCV infection between 2005 and 2014 has remained stable. Males aged 40-59 years consistently had higher reported rates as compared to other age groups. In 2005, males aged 40-59 years had the highest rate of reported HCV infection at 100.4 per 100,000. By 2014, this rate had decreased to 58.2 per 100,000 (a 42% decrease between 2005 and 2014). A large rate decrease was also observed among males aged 30-39 years; from 2005 to 2014 rates of HCV infection decreased from 83.7 per 100,000 to 51.0 per

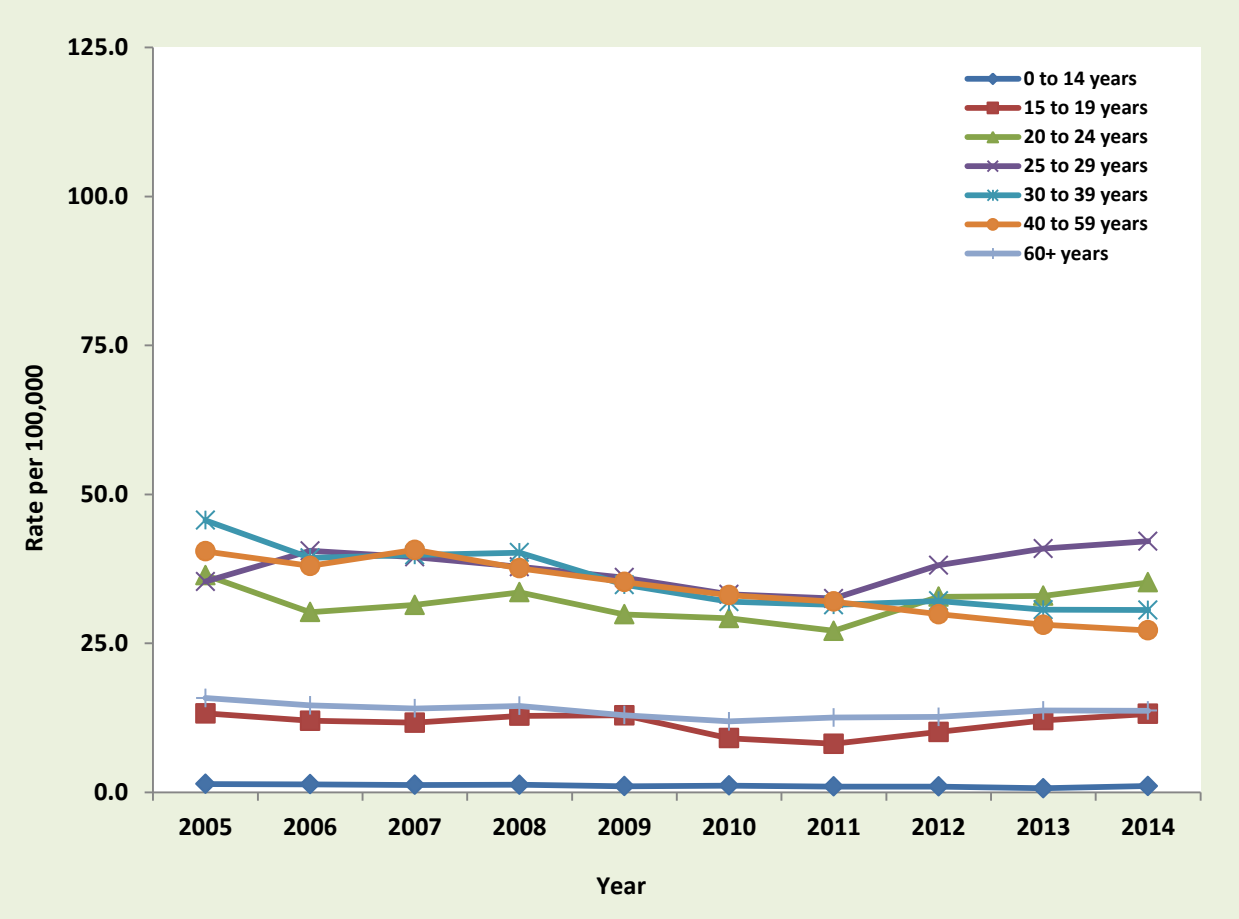
100,000 (Figure 9). Although difficult to predict at this stage, the rates of HCV infection among males aged 20-30 years point towards a rising trend since 2012. Over the 2005-2014 period, a noticeable decrease in rate of reported HCV infection was observed only in two male age groups: 30-39 year olds, in which the rate decreased from 83.7 to 51.0 per 100,000 (Figure 9), and 40-59 year olds, in which the rate decreased from 100.4 to 58.2 per 100,000, corresponding to a 39.1% and a 42.0% decrease, respectively. Among all other male age groups, the rates were relatively stable over the specified period (Figure 9).

Figure 9. Rates of reported cases of HCV in Canadian males by age group and year, CNDSS, 2005 – 2014



A pattern of decreasing HCV infection rate was also observed among females age 30 to 59 years old, but of lesser magnitude than among males (Figure 10). In the 20-29 year age group, the rates decreased steadily from 2005 to 2011 and then increased to either reach or surpass 2005 levels by 2014. The rate among those aged 60 years and over has essentially been stable recently while the rate among those aged 15-19 years increased slightly since 2011 (Figure 10).

Figure 10. Rates of reported cases of HCV in Canadian females by age group and year, CNDSS, 2005 – 2014



3.2.3 Trends by province/territory

In 2014, the highest rates of reported cases of hepatitis C were observed in Saskatchewan (54.4 per 100,000) and Yukon (54.0 per 100,000), followed by Prince Edward Island (49.9 per 100,000), British Columbia (42.5 per 100,000), Northwest Territories (40.9 per 100,000), Alberta (34.4 per 100,000), Nova Scotia (33.9 per 100,000) and Ontario (30.7 per 100,000), whose rates were all above the national average of 29.3 per 100,000 (Table 3). Rates among males were consistently higher compared to females across all provinces and territories, except in Nunavut. The reverse seen in Nunavut should be interpreted with caution, given the low number of reported cases.

Table 3. Reported number of cases and rates of HCV infection by sex and province/territory in Canada, CNDSS, 2014

Jurisdiction	Male		Female		Total[1]	
	Number of cases	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*	*Number of cases*	*Rate per 100,000*
Canada	6,579	37.2	3,811	21.2	10,458	29.3
BC	1,290	55.6	693	29.5	1,985	42.5
AB	890	42.3	531	26.1	1,423	34.4
SK	362	63.8	249	44.7	612	54.4
MB	207	32.4	145	22.4	352	27.4
ON	2,623	38.9	1,579	22.6	4,214	30.7
QC	724	17.7	352	8.5	1,127	13.7
NB	123	33.0	57	14.9	180	23.8
NS	205	44.3	115	23.9	320	33.9
PE	46	64.5	27	36.0	73	49.9
NL	78	29.9	50	18.7	128	24.2
YT	13	69.1	7	38.5	20	54.0
NT	17	75.6	1	4.6	18	40.9
NU	1	5.3	5	28.6	6	16.6

[1] Total includes cases of unspecified sex.

3.3 Discussion

HCV infection is a significant public health issue affecting certain segments of the Canadian population and it has numerous treatment and care implications (23). In 2013, no deaths were reported in Canada due to acute HCV infection (as compared to 33 in 2012); however, 465 deaths were attributed to chronic HCV infection (15). As with HBV, there is likely considerable underestimation of the number of HCV-related deaths due to potential misclassification on death certificates (46).

According to a 2010 study, HCV infection in Ontario was estimated to have the highest-ranked infectious disease burden in terms of years of life lost due to premature mortality, year-equivalents of reduced functioning, and health-adjusted life years, underscoring the impact of this infection on the health of Canadians (47). In a 2014 study, it was estimated that by 2035, 23% of chronic hepatitis C patients will experience severe complications. Between 2013 and 2035, compensated cirrhosis is expected to increase by 89%, decompensated cirrhosis by 80%, hepatocellular carcinoma by 205%, and liver-related deaths by 160% (48). Another study published in 2016 indicated that between 1990 and 2013, disability adjusted life years (DALY) in high income North American countries have increased from 89.2 per 100,000 to 177.2 per 100,000 for HCV infection that is attributable to injection drug use (49).

Between 2005 and 2014, the rates of reported cases of HCV have declined by 27%. Although males have consistently represented a larger proportion of reported HCV cases, particularly among those 30 years and over, differences in male and female rates have narrowed since 2005 because of a larger decrease in the number of reported HCV infections in males (30%) versus in females (23%).

The most important mode of transmission of HCV in Canada is the sharing of contaminated drug injection equipment. Among newly acquired HCV cases in the early 2000s with known risk factor information, 61% had reported a history of injection drug use (50). I-Track, the national behavioural and biological surveillance system that monitors HIV and hepatitis C and associated risk behaviours among people who inject drugs in Canada, found the lifetime exposure to hepatitis C (as measured by the presence of HCV antibody in a dried blood spot specimen) was 68% in Phase 3 of data collection conducted from 2010 to 2012 (41). The majority of I-Track participants (and the majority of injection drug users in general) are male which may partly explain why rates of reported HCV cases are higher among men. Differences between rates of reported infections and undiagnosed infections among males and females may also be a reflection of different testing behaviours as females are more likely to seek health care and testing (51).

Trends in HCV rates may be affected by observed changes in drug use practices. For example, studies have shown that use of smoked or snorted drugs such as crack cocaine in place of those administered primarily by injection can lessen the risk of HCV and other bloodborne infection transmission (52). Public health interventions aimed at preventing adverse consequences of drug use may also have a significant effect on these trends by affecting transmission rates (53).

As with HBV infection, changes in blood donation and infection control practices may have contributed to Canada’s decreasing rates of HCV. Canadian Blood Services data from 2013 indicate that HCV was detected in 56 per 100,000 first-time donors, and 0.5 per 100,000 repeat donors (22). Blood donation screening and disposal of positive donations are important safeguards for the prevention of transmission of bloodborne infections such as HCV (22). Under the Blood Safety Contribution Program (BSCP) of the PHAC through its surveillance systems (TTISS,TESS) no case of HCV infection related to blood transfusion has been reported.

The CHMS estimated the seroprevalence of the HCV antibody (anti-HCV), a marker of lifetime exposure to the virus, to be 0.5% of the household-dwelling population in Canada over a period of data collection spanning 2007 to 2011 (31). However, modelled prevalence estimates, taking into account vulnerable populations not surveyed by the CHMS (such as the homeless, prison inmates, and foreign-born populations who do not speak English or French) indicate that the rate of anti-HCV in the Canadian population may be closer to 1% (plausibility range, 0.6-1.3%), with approximately 42% to 45% of those being unaware of their status. The prevalence of chronic HCV infection was estimated to be at 0.6% (54).

An additional source of HCV cases may be immigration to Canada from countries where the virus is endemic, particularly from those regions where infection control measures to prevent the transmission of bloodborne infections in healthcare settings are not routinely implemented. In 2002, it was estimated that immigrants accounted for 20% of hepatitis C cases throughout Canada (55).

3.4 Limitations

The findings of this report should be interpreted in light of several limitations of the data. First, the HCV case definition used for national surveillance and the reporting protocols used by provinces and territories have evolved over time, which may have affected case reporting. The case definition has consistently allowed confirmatory testing to be conducted using a second manufacturer's enzyme immunoassay (EIA). The lower sensitivity and specificity of first and second generations of these HCV assays may have affected the accuracy of resulting HCV surveillance data (56).

Second, it is uncertain to what extent these data reflect true HCV incidence. Those with acute HCV infection are commonly asymptomatic, and thus may not have been tested or diagnosed; as a result, CNDSS data may reflect primarily chronic cases. According to results from the CHMS, only 30% of Canadian respondents who tested positive for a current HCV infection reported having been diagnosed with HCV (29). In addition, due to the long duration of infection and re-infection, it is possible that an individual may be tested and diagnosed in more than one province or territory over time, and consequently counted more than once in the CNDSS dataset.

Third, the data available from CNDSS are limited to analysis by age, sex, and province/territory. At this time, there are no additional data elements in the CNDSS that could explain observed trends. Consequently, it is not clear what proportion of reported HCV infections is due to transmission through injection drug use or other risky behaviours, or whether the virus is disproportionality affecting other groups or populations. The surveillance data need to be interpreted in light of other available information to derive the epidemiology of HCV infection in Canada.

Finally, information on whether reported HCV cases were acute or chronic was not available from most provinces and territories, thus the findings cannot interpret potential current trends in the transmission or potential burden of HCV infection in Canada. Similarly, misclassification of acute cases into chronic or unspecified cases cannot be ruled out.

3.5 Conclusion

The rates of new diagnoses of HCV infection appear to be on the decline in Canada. Given the potential for HCV infection to progress to more serious conditions and the consequent potential burden on Canada's health care system, continued monitoring of HCV is essential.

To improve the ability of surveillance data to assess progress towards prevention and control of HCV infection, additional efforts are being made to harmonize the reporting of hepatitis C cases by stage of infection and to improve the quality of HCV data collected through routine surveillance.

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Appendix A: Case Definitions

Table 4. Hepatitis B case definitions used under the CNDSS

Infection status	Case definition (3)
Acute HBV infection	HBsAg and anti-HBcIgM positive in the context of a compatible clinical history or probable exposure OR clearance of HBsAg in a person who was documented to be HBsAg positive within the last six months in the context of a compatible clinical history or probable exposure
Confirmed chronic HBV infection	a person being HBsAg positive for more than 6 months OR detection of HBsAg in the documented absence of anti-HBcIgM OR detection of HBV DNA for more than 6 months.
Unspecified HBV infection[1]	serological profile not in line with either acute or chronic case definition and HBsAg positive OR detection of HBV DNA

[1] For purposes of this report, cases reported as unspecified could also include cases not differentiated as acute or chronic by the reporting province or territory.

Table 5. Hepatitis C case definitions used under the CNDSS - updated 2011

Infection status	Case definition (4)
Confirmed case - Acute or recent infection	Detection of hepatitis C virus antibodies (anti-HCV) or hepatitis C virus RNA (HCV RNA) in a person with discrete onset of any symptom or sign of acute viral hepatitis within 6 months preceding the first positive HCV test AND negative anti-HAV IgM, and negative anti-HBc IgM or HBsAg tests AND serum alanine aminotransferase (ALT) greater than 2.5 times the upper normal limit OR Detection of hepatitis C virus antibodies (anti-HCV) in a person with a documented anti-HCV negative test within the preceding 12 months OR Detection of hepatitis C virus RNA (HCV RNA) in a person with a documented HCV RNA negative test within the preceding 12 months
Confirmed case – Unspecified (including chronic and resolved infections[1]	Detection of hepatitis C virus antibodies (anti-HCV) OR Detection of hepatitis C virus RNA (HCV RNA)
NOTE: If diagnosis is based on anti-HCV alone, it should be confirmed by HCV RNA, immunoblot, a second manufacturer's EIA, or based on an EIA signal to cut-off ratio predictive of a positive immunoblot. If HCV-RNA is used solely to confirm active infection, a repeat test is recommended. The HCV seroconversion window period is approximately 5-10 weeks. It is estimated that 30% of acute infections may be missed if anti-HCV is the only marker of infection used during this period. HCV-RNA is detectable within two to three weeks of infection and, in the context of clinical illness, can identify acute HCV infection even in the absence of anti-HCV.	

[1] For purposes of this report cases reported as unspecified could also include cases not differentiated as acute or chronic by the reporting province or territory.
Anti-HBc IgM:
IgM antibody against hepatitis B core antigen.
HBsAg:
Hepatitis B surface antigen.
EIA: enzyme immunoassay

Appendix B: Reported rates of acute and chronic HBV infections in Canada 2005-2014

	Rates per 100,000: Reported cases of Acute HBV									
P/T	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
BC	1.38	0.99	0.95	0.66	0.59	0.25	0.33	0.28	0.24	0.30
AB	0.78	0.87	0.51	0.91	0.70	0.61	0.58	0.61	0.65	0.24
SK	1.11	1.31	0.69	1.37	0.77	1.04	1.21	0.82	0.63	0.80
MB	NR	NR	NR	NR	0.33	0.16	0.48	0.16	0.39	0.31
ON	1.23	1.44	1.32	1.11	1.00	0.96	0.92	0.76	0.80	0.76
QC	0.61	0.52	0.58	0.57	0.43	0.28	0.30	0.37	0.22	0.24
NB	0.80	0.54	1.07	0.53	1.07	0.53	1.06	0.40	0.13	1.19
NS	NR	NR	NR	NR	0.32	0.11	0.53	0.21	0.74	0.74
PE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NL	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
YT	NR	NR	NR	0.00	0.00	2.87	0.00	0.00	0.00	0.00
NT	0.00	0.00	0.00	0.00	3.05	0.00	0.00	0.00	2.81	2.76
NU	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Rates per 100,000: Reported cases of Chronic HBV									
P/T	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
BC	NR	NR	NR	NR	26.54	25.74	22.68	21.12	23.24	20.79
AB	0.03	4.31	5.83	19.70	16.57	15.32	12.84	16.96	15.16	13.31
SK	8.05	6.85	0.00	0.00	7.79	8.14	6.82	12.45	9.10	NA
MB	NR	NR	NR	NR	8.42	10.70	NA	4.14	4.65	5.37
ON	NR	NR	NR	NR	NR	NR	NR	17.05	14.95	13.64
QC	8.63	9.72	8.93	9.02	8.11	6.06	4.64	5.85	6.61	6.58
NB	2.01	3.76	3.75	3.48	3.99	4.24	3.18	5.15	5.69	3.97
NS	NR	NR	NR	NR	0.53	0.64	0.42	0.85	0.53	1.80
PE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NL	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
YT	NR	NR	NR	0.00	0.00	11.50	14.07	8.28	16.56	16.21
NT	NR	NR	NR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NU	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	NR: The P/Ts did not report the cases classified into acute and chronic HBV infections									
	NA: Data for that particular year were not available.									

Appendix C: HCV Infection Reporting in Canada: CNDSS 2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
BC	Reported as unspecified HCV Infection									
AB	Reported as unspecified HCV Infection							Reported HCV Infection classified into Acute, Chronic, and Unspecified categories		
SK	Reported as unspecified HCV Infection									
MB	Reported as unspecified HCV Infection									
ON	Reported as unspecified HCV Infection									
QC	Reported as unspecified HCV Infection							Reported HCV Infection classified into Acute, and Unspecified categories		
NB	Reported as unspecified HCV Infection									
NS	Reported as unspecified HCV Infection									
PE	Reported as unspecified HCV Infection									
NL	Reported as unspecified HCV Infection									
YT	Reported as unspecified HCV Infection								Reported HCV Infection classified into Acute, Chronic, and Unspecified categories	
NT	Reported as unspecified HCV Infection									
NU	Reported as unspecified HCV Infection									