

Epi-Update

Brief Report: Hepatitis B Infection in Canada

At a Glance

- ▶ The absolute numbers and corresponding rates of reported cases of hepatitis B virus (HBV) infection reported to the Public Health Agency of Canada through the Canadian Notifiable Disease Surveillance System (CNDSS) are decreasing, particularly among age groups for whom recommendations for routine HBV immunization have applied.
- ▶ The reported incidence rate of acute hepatitis B appears to be decreasing as indicated by the Enhanced Hepatitis Strain Surveillance System (EHSSS).
- ▶ Over the last 4 years, the declining trend seems to have been halted among people aged 0 to 24 years, although 68% of these acute hepatitis B cases reported during this period corresponded to non-Canadian-born people.
- ▶ Between 1999 and 2008, reported rates of acute hepatitis B were three times higher for Aboriginal peoples compared to non-Aboriginal peoples.
- ▶ Sexual transmission appears to be the most common route of HBV infection, although injection drug use (IDU) and drug snorting also contribute substantially to infection rates.

Introduction

Hepatitis B virus (HBV) infects the liver. HBV can result in subclinical or asymptomatic infection, acute hepatitis or fulminant hepatitis requiring liver transplantation. HBV is a DNA virus, with a core antigen (HBcAg) surrounded by a coat containing surface antigen (HBsAg). This virus is about 100 times more infectious than HIV.

Chronic hepatitis B remains a serious public health concern worldwide. Globally, it is estimated that two billion people worldwide have serologic evidence of past or present HBV infection, and 360 million are chronically infected and at risk for HBV-related liver disease. Approximately one third of all cases of liver cirrhosis and half of all cases of hepatocellular carcinoma (HCC) can be attributed to chronic HBV infection. HBV is estimated to be responsible for 500,000 to 700,000 deaths annually [1].

Acute HBV infection is usually asymptomatic among infants and young children. Over 95% of infants and 90% of children between one and five years of age do not develop symptoms. However, approximately 30% to 50% of adolescents and adults develop clinical symptoms such as jaundice. Age at infection is one of the most important factors influencing the probability of developing chronic HBV infection. The risk of subsequent chronic hepatitis B is about 90% for infants, 25% to 50% for children aged one to five years, 5% to 10% for adolescents, and 1% to 5% for adults. After several decades, 20% to 25% of HBsAg-positive carriers will develop cirrhosis and about 5% to 6% will develop HCC [2].

HBV is transmitted through percutaneous or mucosal contact with infectious biological fluids. Therefore, most infections can happen when body fluids including blood, blood products of an infected person enter the body of a person who is not protected against the virus. HBV has also been found in semen. Infection routes include sexual contact with an infected person and exposure to needle sticks and other 'sharps' which have been contaminated with HBV (this includes people who use injection drugs). It can also be passed from mother to newborn infant at the time of birth (vertical transmission).



Prevention of HBV Infection in Canada

Prevention of vertically transmitted HBV

All pregnant women in Canada are required to test for HBsAg during prenatal visits or at the time of delivery [7]. All infants born to infected mothers must be given the initial dose of HBV vaccine within 12 hours of birth [7]. The second and third doses of the vaccine series should be administered 1 month and 6 months after the first dose [7]. However, these strategies may fail to prevent vertical transmission in some cases [8]. These include the 2% to 10% of infected infants who acquired HBV infection in utero; those with a high maternal HBV-DNA level; or those with HBsAg-mutant infection which may not be prevented by HBV vaccination [8].

HBV Immunization

The Canadian Hepatitis B Working Group recommended a universal HBV vaccination program for preadolescents [7]. Since the early 1990s, all provinces and territories (P/T) have implemented a universal school-based HBV vaccination program aimed at preadolescents aged nine to 13 years [9]. High completion rates (78% to 97%) have been reported [10, 11]. These programs could prevent 63% of acute HBV infection and 47% of the chronic HBV infection in Canada [12].

In Canada, HBV vaccination is recommended for all individuals who are at increased risk of HBV infection (i.e. IDU, persons with high-risk sexual behaviour). This strategy has several limitations. Risk factors cannot be identified for about 25% of acute HBV infections [13] and there is poor compliance to the HBV vaccine schedule in risk groups [14].

Despite the vast population of infected individuals, efforts to prevent and control HBV have met with increasing levels of success and hold promise for large reduction in disease burden in the future.

Prevalence of HBV Infection in Canada

The prevalence of HBV infection may vary among population subgroups in Canada. In previous studies of selected populations in Canada, HBsAg seroprevalence rates were estimated to be between 0.24% to 0.47% in people aged 14 to 30 years from a Northern Ontario town [3]. These rates were estimated to be 5% to 15% in adults from Southeast Asia [4], and 0.1% to 0.5% in Canadian first-time blood donors [5]. In a 1995 survey of 1200 school children aged 8 to 10 years in Québec, none were found to be positive for HBsAg, or antibody to the HBV core antigen [6].

Routine Minimum HBV Surveillance In Canada

HBV infection has been reportable through the Canadian Notifiable Disease Surveillance System (CNDSS) since 1969. Physicians are required to report clinically diagnosed HBV infection cases (with or without laboratory confirmation) to their local health authority. Cases that meet the HBV infection surveillance case definition are officially reported to P/T public health authorities [15]. Local laboratories are also required to report laboratory-confirmed HBV infection cases to provincial laboratories, which in turn report the cases to both local and P/T public health authorities. Aggregate data on HBV infection from all P/Ts are sent to the Public Health Agency of Canada (PHAC) on a regular basis. However, reporting practices across P/Ts remain inconsistent because some jurisdictions report only acute HBV infection cases, while others report acute and indeterminate HBV infection cases together. Since 2004, chronic HBV infection cases are also being reported by some P/Ts. Efforts to investigate and remove duplicate HBV infection cases vary across jurisdictions. In addition, risk factor information is not collected, and the case-by-case reporting utilized by some P/Ts does not contain standardized data elements.

The rate of reported acute and indeterminate HBV infection cases decreased in all age groups, particularly among age groups for whom recommendations for routine vaccination have applied.

- ▶ Overall, the rates of reported acute and indeterminate HBV infection cases declined significantly from 10.8 per 100,000 inhabitants in 1990, to 1.7 per 100,000 inhabitants in 2008 (Table 1 and Figure 1).
- ▶ The average rate of reported acute and indeterminate HBV infection cases per 100,000 inhabitants among males was 5.0 (range 2.2-13.8), compared with 2.5 (range 1.2-7.5) among females (Figure 2).
- ▶ During the period 1990-2008, the reported rate of acute and indeterminate HBV infection cases among children aged 10 to 19 years declined 90%, from 5.8 cases per 100,000 inhabitants in 1990 to 0.6 cases per 100,000 inhabitants in 2008 (Figure 3). **The greatest decrease occurred among the cohort of children to whom the recommendations for routine vaccination have applied.**
- ▶ Although the rate of reported infections also has declined among persons aged 20 to 39 years, rates in this age group still remained substantially higher than in any other age groups (Figure 3).
- ▶ Since 2004, some jurisdictions also report chronic/ carrier HBV infection cases to the CNDSS. These cases do not represent new infections and therefore have not been used to calculate yearly rates (shown in Table 1, Figures 1, 2 & 3) in this update.

Table 1: Number and rates of reported acute, indeterminate and chronic/carrier HBV infection cases in Canada, CNDSS, 1990-2008*

Year	Number of Reported Cases		Rate per 100,000 (based on Acute and Indeterminate cases only)
	Acute, Indeterminate	Chronic/Carrier	
1990	3001	N/A	10.8
1991	2622	N/A	9.4
1992	1949	N/A	6.9
1993	1734	N/A	6.1
1994	1675	N/A	5.8
1995	1398	N/A	4.8
1996	1227	N/A	4.1
1997	1017	N/A	3.4
1998	940	N/A	3.1
1999	795	N/A	2.6
2000	742	N/A	2.4
2001	596	N/A	1.9
2002	579	N/A	1.9
2003	588	N/A	1.8
2004	863	64	2.7
2005	712	740	2.2
2006	591	966	1.8
2007	602	907	1.8
2008	582	1429	1.7

N/A: Not Available

* Data as of April, 2011

Figure 1: Reported rates of acute and indeterminate HBV infection cases by year in Canada, CNDSS, 1990-2008

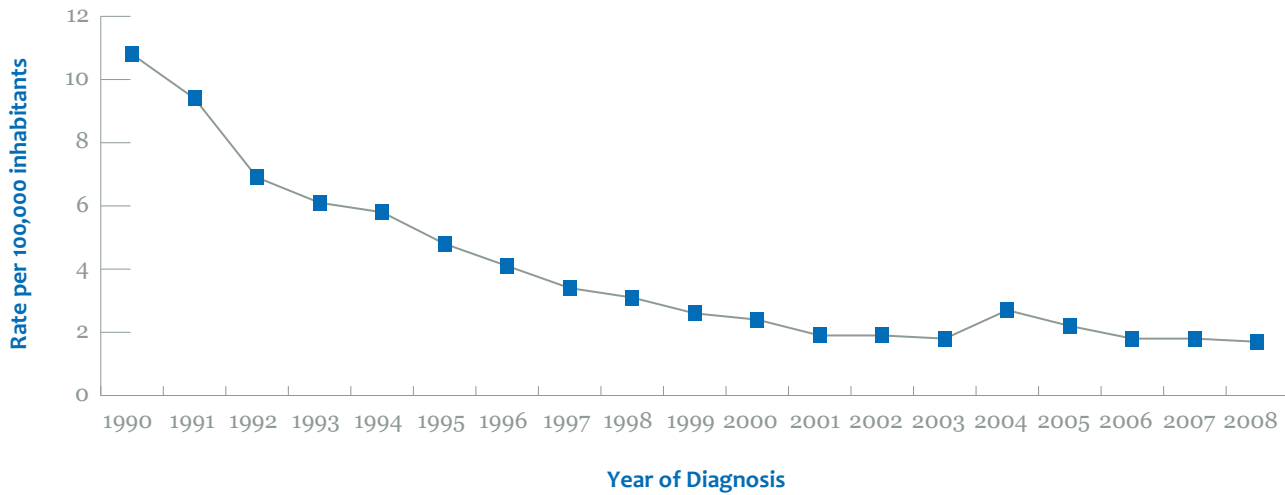


Figure 2: Reported rates of acute and indeterminate HBV infection cases by gender and year, CNDSS 1990-2008

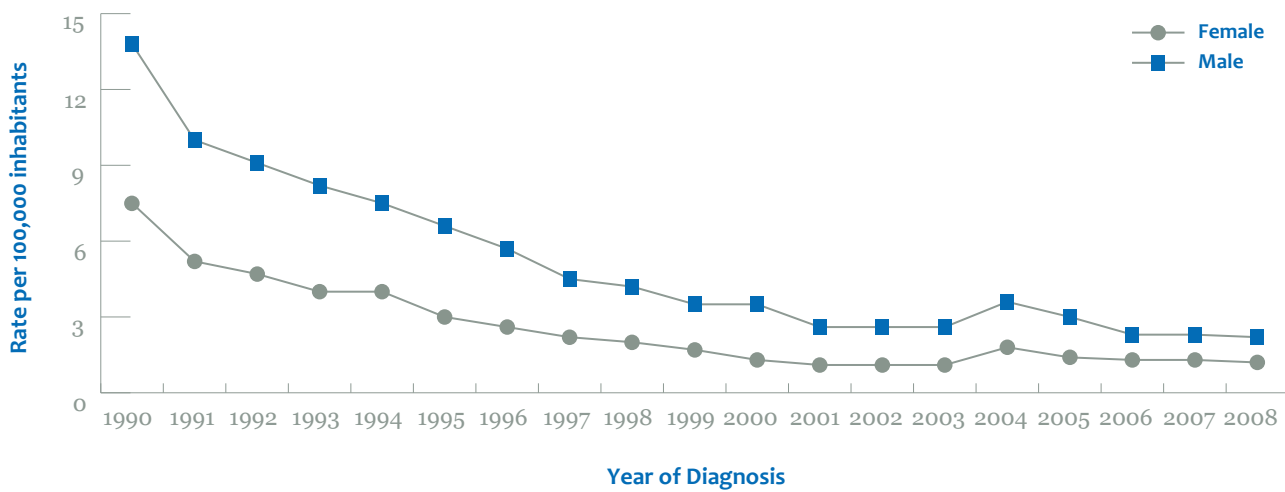
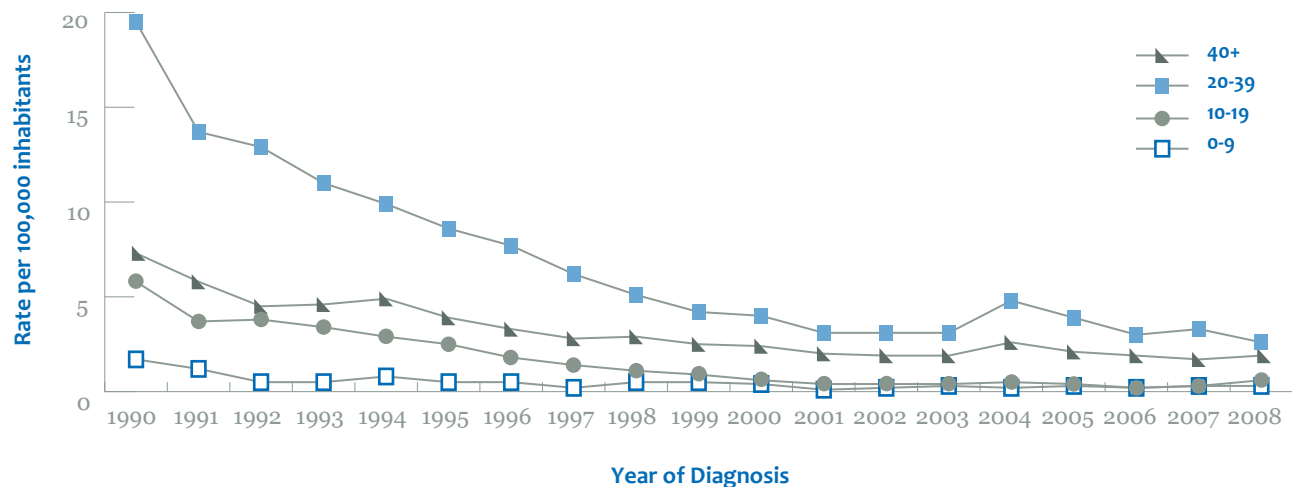


Figure 3: Reported rates of acute and indeterminate HBV infection cases by age group and year, CNDSS, 1990-2008



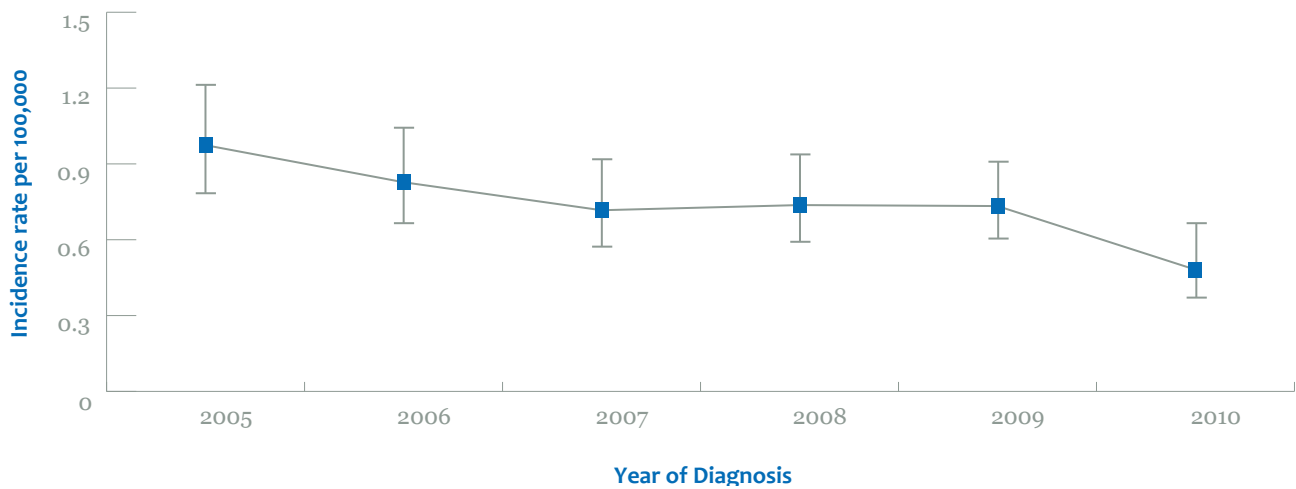
Comprehensive HBV surveillance

To overcome some of the reporting limitations associated with the CNDSS, the Enhanced Hepatitis Strain Surveillance System (EHSSS) was established by PHAC's Blood Safety Surveillance and Health Care-Associated Infections Division, in 1998. As of April 2011, 11 sites across Canada were participating in the EHSSS. These national sites span Western Canada, the Northwest Territories, Ontario and Québec, involving English- and French-speaking populations and diverse ethnic groups. These regions cover approximately 41% of the Canadian population. Based on the 2006 Canadian census, the proportions of non-Canadian-born people and Aboriginal people in the 11 sites were 29.3% and 3.1%, respectively. Data presented here were collected by the EHSSS from January 1, 2005 through September 30, 2010. Risk factor information is available for 64.7% of the 405 cases of acute HBV infection reported to the EHSSS during this time period.

The reported rate of acute HBV infection appears to be decreasing.

- ▶ The incidence rate of reported acute HBV infection declined from 0.97 per 100,000 inhabitants in 2005 to 0.49 per 100,000 inhabitants in 2010 (Figure 4).
- ▶ Overall, incidence rates per 100,000 inhabitants were 2.8 times higher among males (range 0.79-1.51) than among females (range 0.19-0.53), and gender-specific trends in incidence paralleled the overall trends (Figure 5).
- ▶ There was a significant difference in terms of the age-specific patterns of acute HBV infection between males and females. Among males, the highest cumulative incidence rate of acute HBV infection was observed in people aged 35 to 44 years. However, among females, the highest rate was observed in people aged 25 to 34 years (Figure 6).
- ▶ During the period 2005-2010, incidence rates of the disease per 100,000 inhabitants among age groups 0 to 14 and 15 to 24 years were less than 0.4, and a decline in the incidence was observed in age groups 20 to 29 and 30 to 39 years (Figure 7). Over the last 4 years, the declining trend observed among age groups 0 to 14 and 15 to 24 years during the first 10 years of the program seems to have been halted, although 13 of these 19 cases reported corresponded to non-Canadian born people (Table 2 and Figure 7).
- ▶ The majority of reported acute HBV infection occurred in individuals aged 25 to 54 years. Between January 2005 and September 2010, 77.5% of identified acute HBV infections were diagnosed in people aged between 25 and 54 years (Figure 8).

Figure 4: Incidence rates¹ of reported acute HBV infection by year, EHSSS, 2005-2010^{2,3}

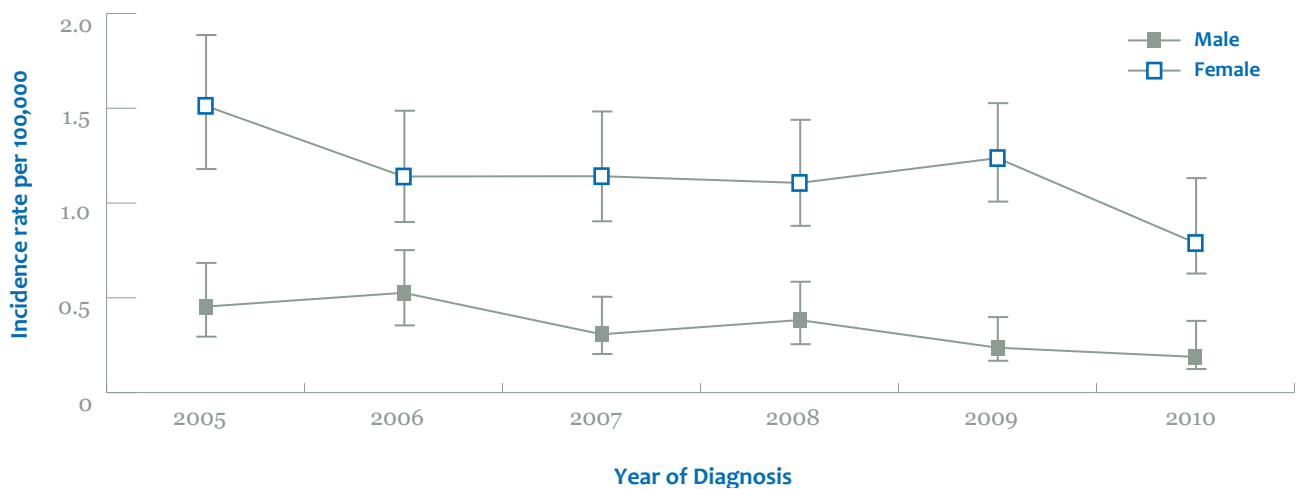


¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 2001 and 2006 census data and intercensal population estimates

²From January 1, 2005 through September 30, 2010

³Bars indicate 95% confidence interval

Figure 5: Incidence rates¹ of reported acute HBV infection by year and gender, EHSSS, 2005-2010^{2,3}

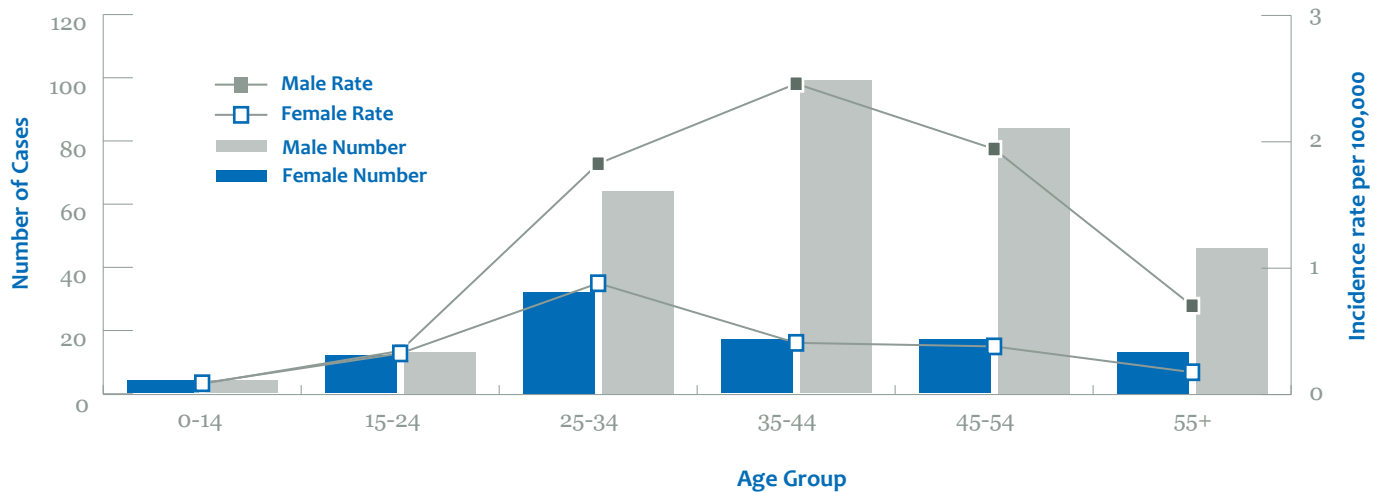


¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 2001 and 2006 census data and intercensal population estimates

²From January 1, 2005 through September 30, 2010

³Bars indicate 95% confidence interval

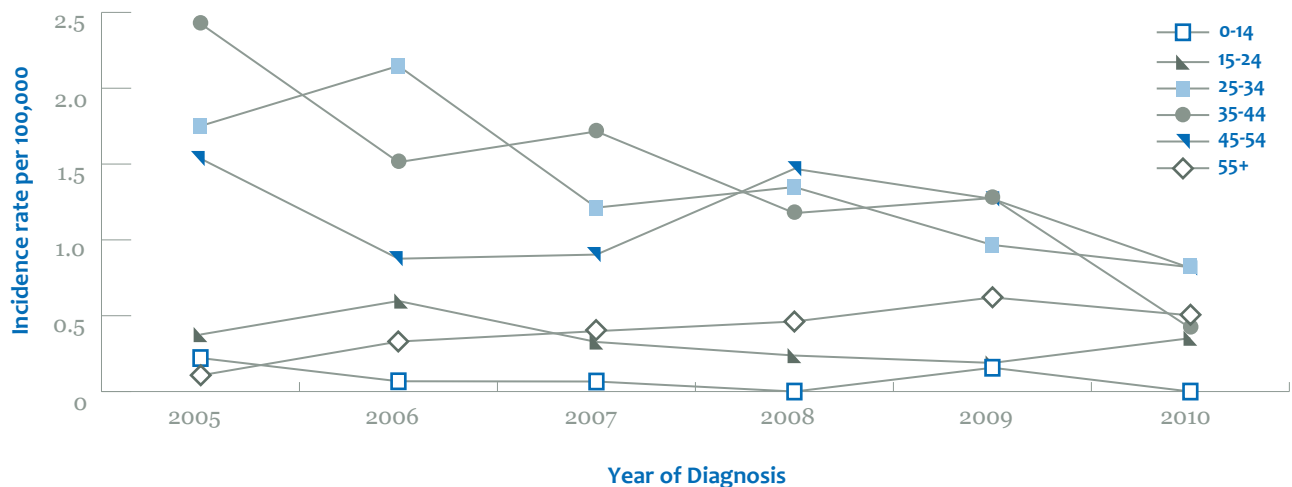
Figure 6: Cumulative number and incidence rates¹ of reported acute HBV infection by age group and gender, EHSSS, 2005-2010²



¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 2001 and 2006 census data and intercensal population estimates

²From January 1, 2005 through September 30, 2010

Figure 7: Reported incidence rates¹ of acute HBV infection by year and age group, EHSSS, 2005-2010²



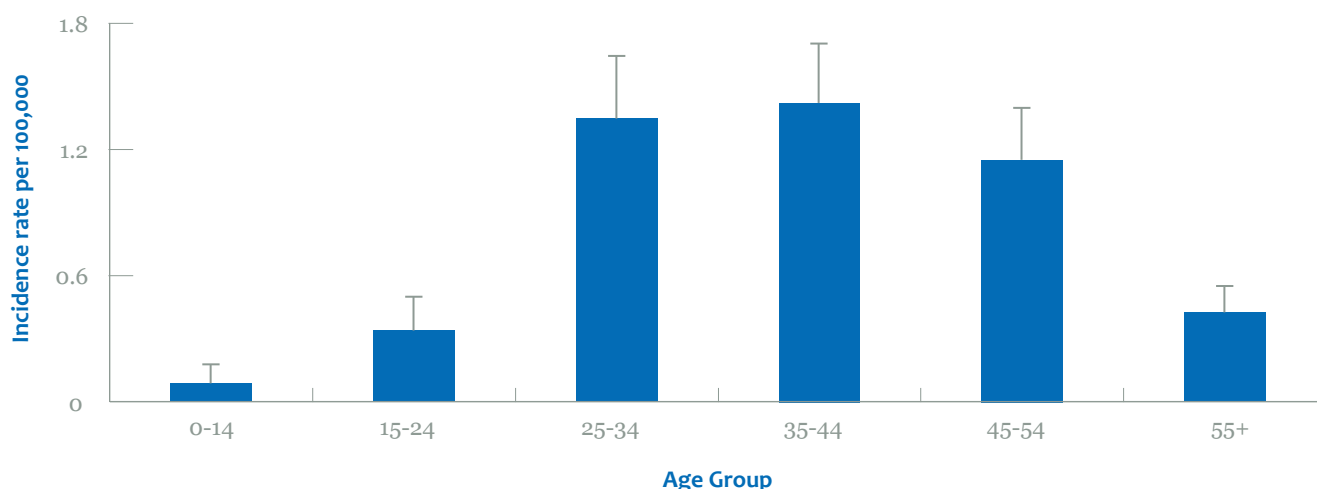
¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 2001 and 2006 census data and intercensal population estimates

²From January 1, 2005 through September 30, 2010

Table 2: Distribution of the reported cases of acute HBV infection aged 0-24 years according to diagnosis year and birthplace, EHSSS, 2007-2010

Birthplace	2007	2008	2009	2010	Total
non-Canadian-born	3	4	3	3	13
Canadian-born	1	0	3	0	4
Missing	1	0	0	1	2

Figure 8: Cumulative incidence rates¹ of reported acute HBV infection by age group, EHSSS, 2005-2010^{2,3}



¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 2001 and 2006 census data and intercensal population estimates

²From January 1, 2005 through September 30, 2010

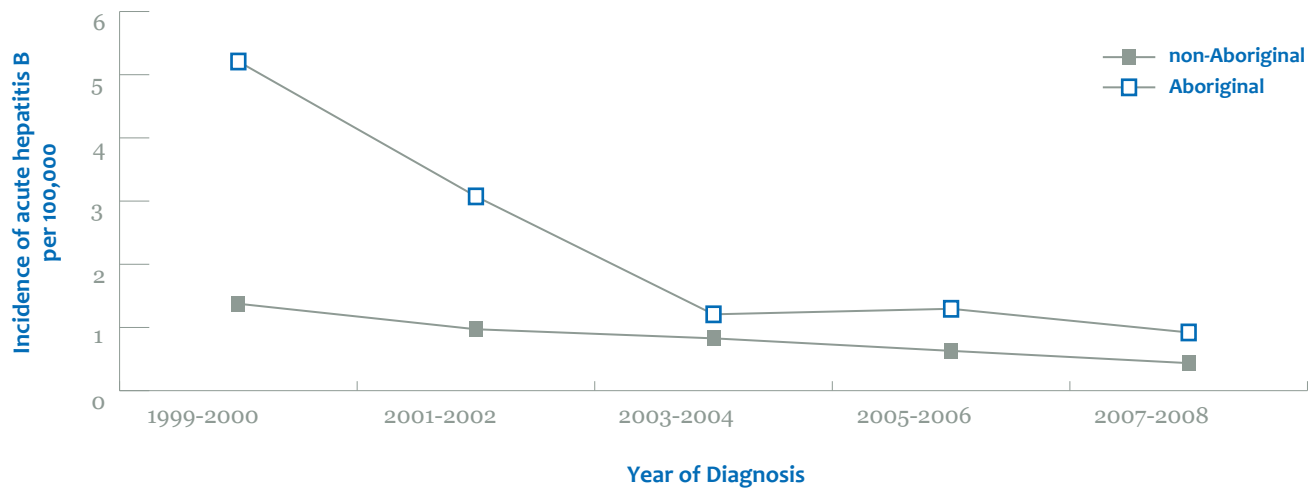
³Bars indicate 95% confidence interval

The reported rate of acute HBV infection is higher among Aboriginal peoples compared to non-Aboriginal peoples in the health jurisdictions that participated in the EHSSS.

▶ Between January 1999 and September 2008, among cases with known information on ethnicity, cumulatively reported incidence rate of acute HBV infection per 100,000 inhabitants was 1.92 (95% confidence interval [CI] 1.46-2.53) for Aboriginal peoples and 0.78 (95% CI 0.72-0.85) in non-Aboriginal peoples. Poisson regression analysis revealed that Aboriginal Canadians were more likely than non-Aboriginal Canadians to develop acute hepatitis B (adjusted rate ratio 3.32, 95% CI 2.39-4.61) (Figure 9).

- ▶ Poisson regression models suggested that there were interactions between gender and ethnic group. For females, reported incidence rates of acute hepatitis B were 4.34 (95% CI 2.76-6.83) times higher among Aboriginal peoples than among non-Aboriginal peoples (Figure 10). For males, reported incidence rates of acute hepatitis B were 1.86 (95% CI 1.27-2.74) times higher among Aboriginal peoples than among non-Aboriginal peoples (Figure 10).
- ▶ The disparity in the incidence rate of reported acute hepatitis B between Aboriginal people and non-Aboriginal people has narrowed since 2003 (Figure 9).

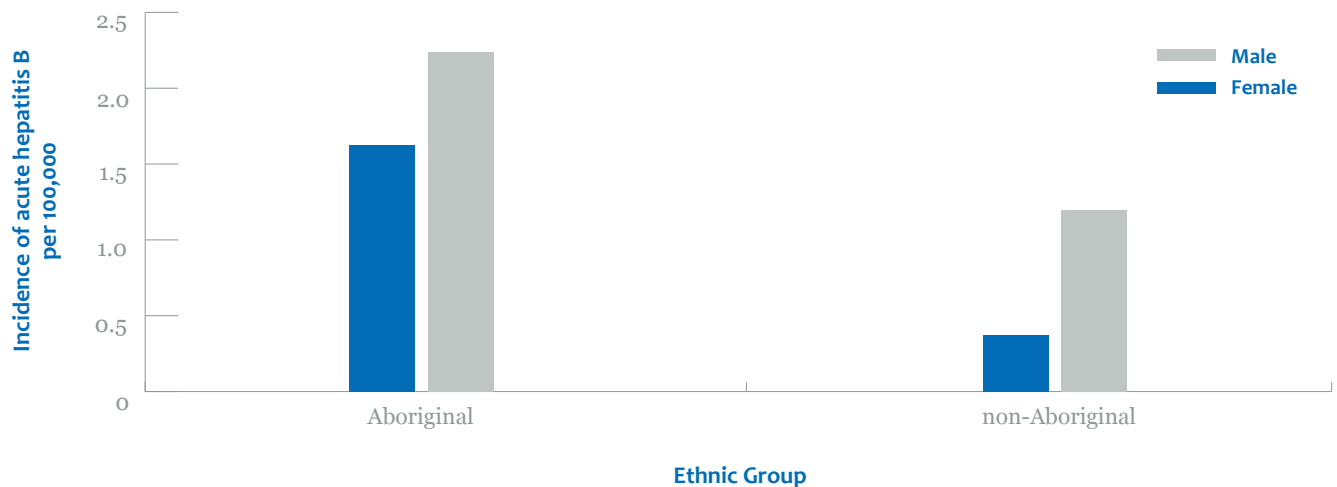
Figure 9: Reported incidence rate¹ of acute HBV infection by year and ethnic group, EHSSS, 1999-2008²



¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 1996, 2001 and 2006 census data and intercensal population estimates

²From January 1, 1999 through September 30, 2008

Figure 10: Cumulatively reported incidence rate¹ of acute HBV infection by gender and ethnic group, EHSSS, 1999-2008²



¹Incidence rates of acute hepatitis B were calculated through the use of health-region-specific 1996, 2001 and 2006 census data and intercensal population estimates

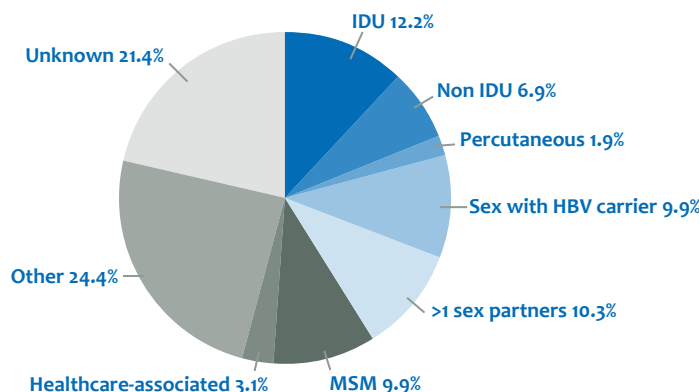
²From January 1, 1999 through September 30, 2008

Sexual transmission appears to be the most common route of HBV infection.

► Of the 405 reported cases of acute HBV infection, 262 (64.7%) individuals consented to be interviewed. Of these, IDU accounted for 12.2%, drug snorting for 6.9%, and high-risk sexual behaviours for 30.1% (Figure 11).

► A high proportion of these cases occurred among individuals with risk factors for HBV infection (e.g., IDU, Men who have Sex with Men (MSM), and persons with multiple sex partners) (Figure 11).

Figure 11: Distribution of Mutually Exclusive Risk Factors for HBV Infection among Cases of acute hepatitis B, EHSSS, 2005-2010*



Discussion

A decrease in the hepatitis B incidence observed in both routine (CNDSS) and enhanced (EHSSS) hepatitis surveillance can be a result of the introduction of public health measures, such as refinement in blood screening, the use of universal precautions in medical settings and implementation of HBV vaccination.

The decline of acute hepatitis B incidence in the cohort aged 10 to 19 years who were eligible to have received vaccines since the middle 1990s suggests that person-to-person HBV transmission within this age group has been decreasing. HBV transmission may be further reduced by improving immunization coverage among certain high-risk groups (IDU, MSM, household and sexual exposure to an infected partner) and by implementing effective and cost-effective interventions, including educational interventions.

A decrease in the incidence rate of reported acute hepatitis B was observed among both Aboriginal people and non-Aboriginal people. However, the incidence rate of reported acute hepatitis B was disproportionately higher among Aboriginal women compared with non-Aboriginal women. This suggests the need for focused preventive efforts to reduce disparities. Further investigations across remote Aboriginal people are recommended to detect those with chronic HBV infection and provide access to ongoing monitoring and treatment.

In recent years, the number of reported cases of acute HBV infection in the cohort aged 0 to 24 years has stabilized. This is probably due, at least in part to the substantial increase in the reported cases within the non-Canadian-born population. A further reduction would likely require efforts directed towards vaccinating immigrants and adopted children coming from countries where mass HBV vaccination programmes have still not been launched.

Many P/Ts implemented a universal HBV immunization strategy aimed at infants and children in the early 1990s. This continued strategy is required to maintain the reduction in number of acute infections and thereby reducing the number of chronically infected persons in the future. In conjunction with the timely incidence data, surveillance data and risk factor data are essential for informed HBV vaccination and control policies.

Given that approximately half of all hepatitis B cases are asymptomatic, the reported cases are most likely a significant underestimation of the true incidence of acute HBV infection. Many individuals with HBV are unaware that they carry the infection. Of those who are chronically infected, only a minority receive routine, scheduled follow-up to monitor their disease status.

Chronic HBV infection is frequently undiagnosed until symptoms of late-stage complications develop, many years after infection. An estimated 15 to 40% of chronically infected people will eventually develop complications, the most common and deadliest of which are primary liver cancer and end-stage liver disease [16]. When these complications are diagnosed, they require expensive treatments and are most often fatal [16]. Given the relatively long latency period between chronic HBV infection and clinical manifestation of the disease, hepatitis B will remain a major health concern in Canada despite the declining incidence. HBV-related chronic liver disease rates may therefore remain elevated for decades.

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