

Research letter

Impact of universal preadolescent vaccination against hepatitis B on antenatal seroprevalence of hepatitis B markers in British Columbia women

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Abstract

COUNTRIES WITH A LOW RISK OF HEPATITIS B (HB) lack data on the effectiveness of universal HB vaccination programs for children. British Columbia began a program in 1992, offering HB vaccination to 11 year olds. We conducted an anonymous, unlinked serologic survey 7 years later, analyzing a random sample of specimens ($n = 1215$) from women aged 15–44 years who had undergone antenatal rubella testing. Among those aged 15–19 years inclusive there was no evidence of chronic HB (HB surface antigen), the proportion with evidence of acute HB (anti-HB core antibody) was only 0.6% (compared with 6.5% for the entire sample), and evidence of protective immunity was strong: the prevalence of anti-HB surface antibody (anti-HBs) was 79.1% (compared with 41.4% for the entire sample) and the geometric mean titre was 34.9 IU/mL (compared with 0.6–0.8 IU/mL for the older groups [$p < 0.001$]).

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There is ample evidence for the effectiveness of hepatitis B (HB) vaccination of infants in countries with a high burden of infection.^{1–3} In low-risk countries, such as Canada, similar population-based effectiveness data are lacking. In 1992, British Columbia became the first Canadian province to implement a universal HB vaccination program aimed at preadolescents — children aged 11 years (in grade 6). In the first year of the program 43 000 students (95.4% of those eligible) were vaccinated.⁴ By 1999, the vaccinated BC cohort was aged 11–19 years inclusive.

We determined the seroprevalence of HB markers in pregnant BC women aged 15–44 years. Pregnant women in British Columbia have access to antenatal care regardless of socioeconomic status and thus had equal opportunity to be included in the study. An antenatal seroprevalence study was therefore an ideal opportunity to examine the short-term impact of the vaccination program in the BC population.

The study was an anonymous, unlinked survey that used frozen serum left over from antenatal rubella testing in 1999. The protocol was reviewed and authorized by the institu-

tional review board at the University of British Columbia.

Using a computerized randomization strategy, we selected 135 specimens from each of 9 age strata; a total of 1215 specimens were sampled. The strata were structured to allow denser sampling between ages 15 and 24 years. We analyzed the serum for HB surface antigen (HbsAg; evidence of active infection), anti-HB core antibody (anti-HBc; evidence of past, natural infection) and anti-HB surface antibody (anti-HBs; evidence of protective immunity). In 2 specimens there was insufficient serum to do the testing.

We calculated prevalence rates for the total sample, each age stratum and each provincial region, then age-standardized the rates according to the 1999 population of Canadian women.⁵ We also calculated geometric mean titres (GMTs) of anti-HBs for the total sample, by age and by stratum, and used linear regression to analyze the relation between GMT and both age and membership in the vaccinated cohort (aged 15–19).

As shown in Table 1 (available at www.cmaj.ca) and Fig. 1, the sample showed evidence of a high rate of natural HB

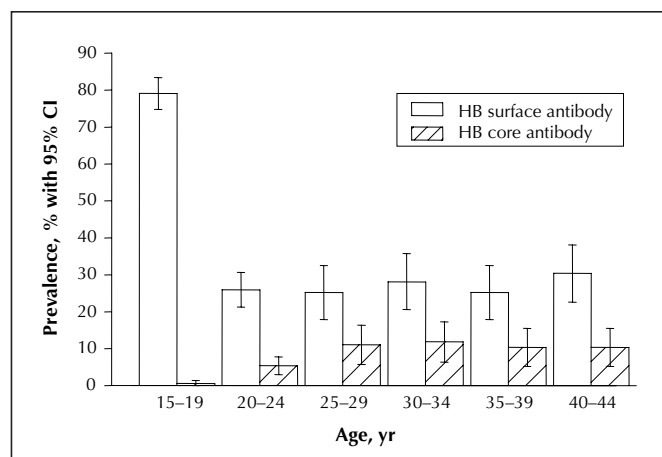


Fig. 1: Prevalence of hepatitis B (HB) antibodies among pregnant women in British Columbia in 1999, by age. CI = confidence interval.

infection among pregnant BC women, the anti-HBc prevalence being 6.5% (age-standardized rate, 8.6%). The lowest prevalence was in the group aged 15–19 years (0.6%). The highest regional prevalence was in Vancouver and Richmond (17.2%); the proportion of immigrants from countries with a high prevalence of HB is higher in this region than the average proportion in the rest of the province. The standardized anti-HBc prevalence for the province, excluding the Lower Mainland and Vancouver Island, was 3%, similar to the 3.9% prevalence found in a British survey of pregnant women aged 15–44 years.⁶

The age-standardized prevalence of HBsAg (indicating carrier status) in our sample was 1.4%, comparable to the 1.0% crude annual prevalence in all antenatal blood specimens tested at the BC and Yukon Centre of the Canadian Blood Services in 1996–2000 inclusive (Dr. Jane Buxton, BC and Yukon Blood Centre, Canadian Blood Services: personal communication, 2001) but higher than rates for the pregnant populations of Nova Scotia (0.1%, $n = 5754$) and of Barrie, Ont. (0.3%, $n = 716$).^{7,8} HbsAg was not detected in the stratum eligible for the universal preadolescent vaccination program, likely owing to protection by the vaccine and the lower cumulative risk of exposure to HB virus in this group than in the older women.

Overall, 41.4% of the specimens had detectable anti-HBs (age-standardized rate, 34.7%). Of the specimens from the cohort aged 15–19 years, 79.1% had detectable anti-HBs. This is consistent with the high rate of vaccination in the universal program and the high immunogenicity of the vaccine. The GMT for this group was 34.9 IU/mL, as compared with 0.6–0.8 IU/mL for the women aged 20 years and over. Membership in the vaccinated cohort predicted a high GMT even after adjustment for age ($p < 0.001$).

This population-based study was limited to pregnant women. However, the HB vaccination rate and immunologic response of grade-6 boys were unlikely to have differed significantly from those of grade-6 girls. Some women at high risk of HB infection (e.g., injection drug users) may have been less likely to use health care services and thus to have been represented in the sample. In addition, some of the women in the group aged 15–19 years may not have been vaccinated in grade 6 either by choice or because they did not attend school in British Columbia.

This cross-sectional study did not directly measure vaccine efficacy. The methodology did allow, however, for broad sampling of a target population, and the results are highly consistent with protection of those who received HB

vaccine in grade 6. Surveillance data for the province provide further evidence of the program's effectiveness: among people aged 10–19 years the reported rate of acute HB declined from 3–4/100 000 before 1995 to 0.6/100 000 in 2000 (Dr. David M. Patrick, director, Communicable Disease Epidemiology Services, University of British Columbia Centre for Disease Control: personal communication, 2001).

In conclusion, we have presented evidence of widespread vaccine-induced protection against HB among pregnant women 7 years after implementation of a universal preadolescent vaccination program. Seroepidemiologic follow-up, together with monitoring of surveillance data for acute HB, will help document the benefit of this program into the future.

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Contributors: Dr. Patrick conceived and designed the study. Dr. Kraiden designed the testing protocol and, along with Mr. Cook, supervised the testing. Mr. Cook assembled the data. Dr. Dawar, along with Ms. Ng, analysed the data and, along with Dr. Bigham, interpreted it. Dr. Dawar drafted the manuscript; the other authors critically reviewed it and approved the final version.

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