ABSTRACT

Ontario initiated a universal hepatitis B immunization program for grade seven students in the fall of 1994. An ecological study was conducted within seven health units of the Greater Toronto Area to assess vaccine coverage.

The study population consisted of all grade seven students enrolled within schools in the participating health units, on October 1, 1994. There were 39,935 students enrolled in 604 schools eligible for inclusion in the study. Consent to receive the vaccine series was obtained for 88% (range across health units from 81.5% to 96.3%) of the students. Among students for whom consent was obtained, an average of 95% (range 88.1% to 99.5%) completed the series. Therefore, the total vaccine coverage for the study population was 84% (range 77.5% to 89.5%). Series completion varied by school board, education provider and the use of Ministry of Health educational material.

A limiting factor in achieving high vaccination coverage among grade seven students was obtaining consent to receive the vaccine series.

ABRÉGÉ

À l'automne 1994, l'Ontario a mis en oeuvre un programme d'immunisation universelle contre l'hépatite B à l'intention des élèves de la septième année. Une étude d'environnement a été menée au sein de sept circonscriptions sanitaires de la région métropolitaine de Toronto afin d'évaluer la couverture vaccinale.

La population à l'étude comprenait tous les élèves de la septième année qui, en date du 1^{er} octobre 1994, étaient inscrits dans les écoles des circonscriptions sanitaires participantes. Il y avait 39 935 étudiants inscrits dans les 604 écoles admissibles. Quatre-vingt-huit pour cent des élèves avaient accepté de recevoir la série vaccinale (le taux oscillait, d'une circonscription sanitaire à l'autre, entre 81,5 % et 96,3 %). Parmi les étudiants dont on avait obtenu le consentement, 95 % en moyenne (intervalle : 88,1 % à 99,5 %) avaient reçu la série vaccinale complète. Par conséquent, la couverture vaccinale totale dans la population à l'étude s'établissait à 84 % (intervalle : 77,5 % à 89,5 %). La proportion de sujets qui avaient reçu la série vaccinale complète variait selon le conseil scolaire, le responsable du programme de sensibilisation et l'utilisation du matériel de sensibilisation du ministère de la Santé.

Un facteur rendait plus difficile l'atteinte d'une couverture vaccinale élevée chez les élèves de la septième année : l'obtention du consentement à recevoir la série vaccinale.

Vaccine Coverage During a School-based Hepatitis B Immunization Program

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Hepatitis B is a disease of global importance. The virus is carried by approximately 300 million people worldwide.¹ Acute hepatitis B is fatal in up to one percent of cases, yet more important from a public health perspective, is its ability to cause chronic hepatitis. The probability of developing chronic hepatitis is age dependent, with infants at the greatest risk of becoming chronic carriers.² Chronic hepatitis B is a major cause of liver disease, accounting for a large proportion of cirrhosis and primary liver cancer diagnosed around the world.^{1,3} Chronic carriers also serve as a reservoir of infection.

The prevalence of hepatitis B varies throughout the world. Canada is considered a country of low endemicity for hepatitis B as fewer than 5% of the population are hepatitis B surface antibody (anti-HBs) positive and fewer than 0.5% are hepatitis B surface antigen (HBsAg) positive.⁴ Anti-HBs indicates immunity to infection from previous exposure to the virus or immunization, whereas HbsAg indicates acute infection or chronic carriage.⁵ In 1994, the incidence of reported acute hepatitis B in Canada was 10.5 per 100,000 population; in Ontario during the same year, the rate was 3.1 per 100,000.⁶

The single most important tool for the prevention and control of hepatitis B is the

hepatitis B vaccine.³ Since 1983, the Ontario Ministry of Health has provided publicly funded hepatitis B vaccine to selected individuals at risk of acquiring the disease. The eligibility criteria for the targeted hepatitis B immunization program was expanded in 1991 and again in 1995. The high risk approach has not led to the control of hepatitis B in Canada and therefore professional organizations, such as the Canadian Paediatric Society and the National Advisory Committee on Immunization, have recommended universal immunization.^{7,8}

In the fall of 1994, Ontario initiated a school-based universal hepatitis B immunization program for grade seven students. Every public health department of the province implemented the program within its jurisdiction. The Ministry of Health provided education packages, brochures and videos to public health departments to assist in program delivery. An education session was given to the students to maximize their participation. These sessions were provided by either public health unit staff or teachers from the local school. Teachers were trained by health unit staff and were provided with Ministry of Health educational material. Consent forms, translated into multiple languages, were sent home with students and those not obtaining parental consent were not eligible for vaccination.

Variation in program delivery occurred in the Greater Toronto Area (GTA) health units with respect to many aspects of the programs. To assist in evaluating the programs' success, data were collected from each of the participating health units within the GTA, during the first year of universal vaccination. The objectives of the study were to determine the percentage of grade

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seven students receiving the vaccine series and to determine which, if any, factors affected vaccine uptake.

METHODS

An ecological study was conducted within seven health units of the GTA. The study was ecological in design as the unit of analysis was the schools and not the individual students. The study population consisted of all grade seven students enrolled in the 1994/95 school year on October 1, 1994, at schools within the participating health units. Data regarding consent to receive the vaccine series, the number of vaccine doses, the school board, the education provider, as well as the use of the video and the brochure provided by the Ministry of Health, were collected at each health unit using a standardized form.

Data were entered into Epi-Info and analyzed using SPSS version 5.0. Since the data were analyzed by school and each school had a different number of students, the analysis was weighted. Means and frequencies were calculated for descriptive statistics and ANOVA and t-tests for inferential statistics. A p-value of 0.05 was considered statistically significant.

Two primary outcome measures were reported: the percentage of students for whom consent to receive the vaccine was obtained and the percentage of consenting students who received the complete vaccination series. These outcome measures were analyzed separately.

RESULTS

There were 39,935 students enrolled in 604 schools eligible for inclusion in the study. Figure 1 reveals that the distribution of students was not uniform across the seven health units. Private, public and separate schools participated in the vaccination program, with 60% of the population attending public schools.

Consent to receive the vaccine series was obtained for 88% of the study population. As seen in Figure 2, an analysis of variance revealed significant differences among the health units with respect to the percentage of students obtaining parental consent for the vaccine series, ranging from 81% to

96% ($p < 0.05$). There were also significant differences among the health units with respect to the percent of consenting students who received the vaccine series. Among students for whom consent was obtained, an average of 99% (range 94% to 100%; $p < 0.05$) received the first dose of the vaccine, 97% (range 93 to 98%; $p < 0.05$) the second dose and an average of 95% (range 88% to 99%; $p < 0.05$) completed the entire series. Therefore, the total vaccine coverage for the study population was 84% (range 77% to 89%; $p < 0.05$).

Rates of consent and vaccine uptake varied by school board. Students attending separate schools were significantly more likely than students attending public schools to obtain consent to receive the vaccine series (90% vs 87%; $p < 0.05$), as well as to complete the series once consent was obtained (97% vs 94%; $p < 0.05$). Students attending private schools were significantly less likely than students attending either separate or public schools to obtain consent to receive the vaccine series (82%; $p < 0.05$), however once consent was obtained, no significant difference was found in series completion (95%; $p > 0.05$).

Prior to vaccine delivery, an education session was provided to the students at the majority (99.7%) of schools. Most stu-

dents received the education from a public health nurse (78%), the remainder from a teacher. The majority of students (99%) who received the education session from a teacher were located within one health unit. Students receiving education from teachers were significantly more likely to obtain consent to receive the vaccine series than students receiving the session from public health nurses (91% vs 87%; $p < 0.05$). Once consent was obtained, the different education providers were not found to have a significant effect on vaccine completion (94% vs 96%; $p > 0.05$).

The Ministry of Health's student brochure was received by the majority of students (83%), but the video was viewed by fewer than half (44%). The brochure was found to have no significant effect on obtaining consent (88% vs 87%; $p > 0.05$), however the use of the brochure was associated with significantly greater series completion once consent was obtained (96% vs 92%; $p < 0.05$). Conversely, students having exposure to the video were significantly more likely to obtain consent to receive the vaccine series (90% vs 87%; $p < 0.05$) yet were not significantly more likely to complete the series once consent was obtained (96% vs 95%; $p > 0.05$).

Many of the health units used both the brochure and video, or neither of the two.

This may have resulted in considerable confounding of these two variables. To assess the additional benefit of the brochure when used with the video, a stratified analysis was completed. This revealed that the use of the brochure did not significantly increase the rate of consent (90% vs 86%; $p>0.05$) or series completion (96% vs 95%; $p>0.05$) among students exposed to the video. However when the video was not used, brochure use was associated with significantly greater completion of the vaccine series (96% vs 92%; $p<0.05$) but not with an increased rate of consent (86% vs 87%; $p>0.05$).

DISCUSSION

In the first year of the Hepatitis B Immunization Program, vaccine coverage for grade seven students within the study population was 84%. An average of 88% of students obtained consent to receive the vaccination and 95% of those consenting completed the entire series. These results suggest that a limiting factor in achieving high vaccination coverage among this population was obtaining consent to receive the vaccine. Once consent was obtained, the vast majority of students completed the series.

Some limitations should be noted when interpreting these data. Schools differed in how the brochure, video and education session were delivered to the students.

Some of the results obtained in this study could have been due to characteristics of the schools, notably the interest of the principal or teachers, or the general socioeconomic status in the neighbourhood of the school. Information about these potential confounders was not collected and therefore not controlled for in the analysis.

The variation in coverage across health units may be explained by differences in health unit populations, as well as differing methods of program implementation. For example, only one health unit exclusively used teachers to provide the education session to the students and this was uniform in the 131 schools within that health unit. With 100% association between these variables, it is not possible to separate the individual effect of the teacher from that of the health unit's activities.

Nonetheless, the results suggest that teachers are at least as effective as nurses in delivering the hepatitis B education session to students, and may in fact be more effective in obtaining consent. This is not unexpected given that teachers have daily contact with the students. The results also suggest that both the brochure and video were positively associated with vaccine completion. However, stratified analysis indicated that both are confounded and the relative effect of each could not be readily distinguished.

Unfortunately, relevant information was not available regarding students not

obtaining consent to receive the vaccine series. The proportion of these students immune to hepatitis B through previous infection or prior immunization is unknown. The inclusion of these individuals would underestimate coverage since immune individuals should not be included as persons eligible to receive the vaccination. However, reporting on completion only among students who obtained consent to receive the vaccine, may overestimate the coverage rate if a large proportion of students without consent were in fact susceptible to the disease.

Eleven Canadian provinces and territories have initiated universal hepatitis B immunization programs, beginning with British Columbia in the fall of 1992.^{9,10} In the first year of their program, 91% of eligible grade six students completed the series.^{9,10} Children were not considered eligible for vaccination if they were identified by their parents as previously vaccinated or if previously reported to the health unit as infected with hepatitis B.¹⁰ In our study, these children were not identified and were therefore included as eligible to receive the vaccine. This would result in lower coverage rates.

To increase vaccine coverage in future years, program planners should consider methods to increase parental consent. A recent American study examining parents' attitudes towards school-based hepatitis B immunization found that the most com-

mon reason for refusing vaccination, given by 84% (118/140) of refusing parents, was that their children had already been immunized against hepatitis B. Among parents not returning consent forms, 54% (14/26) never received forms from their children.¹¹

CONCLUSION

A vaccine completion rate of 84% in the first year of a voluntary vaccination program is noteworthy, as is a series completion rate of 95% among students who obtained consent to participate in the program. While a vaccine coverage of 84% may be less than optimal, it should be stressed that this is likely an underestimate of the true vaccine coverage as information regarding students without consent was not available. In subsequent years it will be important to obtain information about

reasons for non-consent to more accurately determine vaccine coverage.

This analysis suggests that a limiting factor in achieving high vaccination coverage among students is obtaining consent to receive the vaccine series. To improve vaccine coverage in future years, program planners should incorporate strategies to increase the proportion of students obtaining consent for immunization.

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REFERENCES

1. Sherlock S. Hepatitis B: The disease. *Vaccine* 1990;8(Suppl.):S6-S9.
2. Williams JR, Nokes DJ, Medley GF, Anderson RM. The transmission dynamics of hepatitis B in

the UK: A mathematical model for evaluating costs and effectiveness of immunization programmes. *Epidemiol Infect* 1996;116:71-89.

3. Maynard JE. Hepatitis B: Global importance and need for control. *Vaccine* 1990;8(Suppl.):S18-S20.
4. National Advisory Committee on Immunization: Statement on Hepatitis B vaccine. *Can Commun Dis Rep* 1993;19:104-15.
5. Kumar S, Pound D. Serologic diagnosis of viral hepatitis. *Post Grad Med* 1992;92(4):55-68.
6. Notifiable Diseases Annual Summary, 1994. *Can Commun Dis Rep* 1996;22(S2):68-69.
7. Report of the Hepatitis B Working Group. *Can Commun Dis Rep* 1994;20(13):105-12.
8. OMA Committee on Population Health. Hepatitis B Universal Immunization Strategy in Ontario. *Ont Med Rev* 1994;61(10):19-24.
9. Munroe V, Pielak K. A School-Based Hepatitis B Immunization Program for British Columbia, Canada. *J Sch Health* 1996;66(6):229-32.
10. Dobson S, Scheifele D, Bell A. Assessment of a universal school-based hepatitis B vaccination program. *JAMA* 1995;274(15):1209-13.
11. Woodruff BA, Unti L, Coyle K, Boyer-Chuanroong L. Parents' attitude towards school-based hepatitis B vaccination of their children. *Pediatrics* 1996;98(3):410-13.

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