Adolescent Hepatitis B Vaccination
Comparison Among 2 High School–Based Health Centers and an Adolescent Clinic
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Objective: To compare the completion rate of hepatitis B vaccination among adolescents who receive primary care at 2 comprehensive high school–based health centers (SBHCs) and a hospital-based adolescent health center (AHC) to assess predictors for successful immunization.

Methods: A retrospective chart review of patients seen for comprehensive history and physical examinations from September 1997 to March 1998 at 2 SBHCs and an AHC was conducted to determine the immunization status for hepatitis B. One SBHC (SBHC-A) had previously implemented an outreach strategy consisting of advertising through the school’s loudspeaker, whereas the other SBHC (SBHC-B) and the AHC did not. Completion rates were assessed among all students requesting comprehensive history and physical examinations. A subset analysis among those without prior immunizations was performed.

Results: Of 510 records reviewed, 406 had documented data for hepatitis B immunization status, and 191 (37 for SBHC-A, 59 for SBHC-B, 95 for AHC) did not have any prior hepatitis immunizations. The completion rate of hepatitis B vaccination was significantly higher at SBHC-A (76%) compared with the other 2 sites (29% for SBHC-B and 24% for AHC) (P<.001).

Conclusion: Patients with access to SBHC services that strongly emphasize outreach were more likely to complete the hepatitis B vaccination series.


Approximately 6 million people in the United States have been infected with the hepatitis B virus (HBV), and 300,000 HBV infections occur annually, resulting in 20,000 chronic infections and more than 4000 deaths.1-4 Most infections occur among adolescents and young adults 15 to 39 years of age through sexual contact and injecting drug use.5,6 Routine immunization of all adolescents against HBV was recommended whenever feasible by the American Academy of Pediatrics in 1982.7,8

School-based immunization programs represent an alternative to primary care settings to increase completion of the hepatitis B vaccination series. For example, the San Francisco (California) Unified School District Department of School Health Programs implemented a 3-year (1992-1995) demonstration project to immunize seventh-grade students against hepatitis B. In each year, more than 90% of students completed all 3 doses of the vaccine series.9,10 Key components of the success included offering an educational component for students, providing an incentive to get timely parental consent, planning distribution and collection of parent materials, and planning vaccination clinics to minimize interrupting the school day.9,10 These researchers found the recommended vaccination schedule of 0 to 1 to 6 months difficult to follow during a single school year and suggested that a schedule of 0 to 2 to 4 months might be easier to implement.

Similarly, in New Mexico a school-based hepatitis B immunization program was implemented in which 66% of the middle schools and 56% of the high schools participated. The completion rate of the vaccination series was 88% in middle schools and 89% in high schools.11 The success of the program was attributed to close collaboration among the school nurse, local public health nurse, and school administration, a hospital-planned “Adopt a School” project, intensive district level nurse coordinator support, radio and television general public education, and the use of incentives. Another program that was implemented by the Chinatown Health Clinic in New York City targeted 2 high schools and 1 junior high school in lower Manhattan. They developed an active outreach program. The completion rate of hepatitis B vaccine series was 95%.12 Furthermore, in Baton Rouge, La, a successful program of hepatitis B vaccination targeted 68 schools and 3400 students. Student education was provided during science classes. Their completion rate for 3 hepatitis B vaccines was 82% among white students and...
MATERIALS AND METHODS

CLINICAL SETTINGS

School-based health center A (SBHC-A) was established in 1983. It receives approximately 2800 visits per year (including medical and reproductive health, mental health, and health education) and is staffed by a nurse practitioner who works 30 hours per week and is supervised by an adolescent medicine subspecialist pediatrician. SBHC-A serves a population of students who range in age from 13 to 19 years and are mostly interested in pursuing a college education. Most students (80%) are enrolled in this SBHC.

Loudspeaker announcements were made at SBHC-A advertising “senior hepatitis B day,” when 12th-grade students could walk into the center and receive their first dose of the vaccine. This program was conducted in 2 days in November and 1 day in December in 1994, 1995, and 1996. Students who received their first dose but missed a subsequent vaccination appointment were sent a letter providing a new scheduled hepatitis B vaccination appointment.

School-based health center B (SBHC-B) was established in 1984 and received approximately 3500 visits (including medical and reproductive health, mental health, and health education) per year. It is staffed by a physician assistant who works 30 hours per week and is supervised by an adolescent medicine subspecialty-trained pediatrician. SBHC-B serves a heterogeneous population of students who range in age from 13 to 19 years, with a large proportion of students who are recent immigrants. Similar to SBHC-A, 80% of the students are enrolled participants in the health clinic. In contrast to SBHC-A, loudspeaker announcements advertising hepatitis vaccinations were not made to students. Rather, immunization histories were obtained during a comprehensive physical examination (CPE), and, if needed, the first dose was administered. Appointments for subsequent visits were made in advance, but there were no reminder letters sent or letters rescheduling missed appointments.

The Mount Sinai Adolescent Health Center (AHC) is an urban, high-volume, university-based, multidisciplinary clinic that receives approximately 48000 visits per year (including medical and reproductive health, mental health, and health education). Medical services that constitute half of the total visits are provided by 10 subspecialty-trained adolescent medicine physicians, 3 nurse practitioners, 3 fellows and rotating residents, and medical students. The AHC serves an ethnically diverse population that ranges in age from 10 to 21 years. Similar to SBHC-B, an immunization history is obtained during the CPE. If the patient does not report an immunization history for hepatitis B, the first dose is administered. Routinely, patients are sent a letter rescheduling a missed appointment, but the letter does not specify that the appointment was for missing the second or third vaccination dose.

In all settings, the vaccination and the medical visits are provided regardless of the patients’ ability to pay. All patients without prior immunizations are offered the hepatitis B vaccination series and are provided with an appointment to return in 4 to 6 weeks for the second vaccine dose.

STUDY DESIGN

After obtaining institutional review board approval, a retrospective review was performed of the medical records of teens (ages 13 to 19 years) who presented for a routine CPE to SBHC-A and SBHC-B between September 1997 and March 1998 and a random sample of 205 medical records of adolescents seen for a CPE during this same period at the AHC. These SBHCs and the AHC were chosen based on convenience, since all are administered through The Mount Sinai School of Medicine and Mount Sinai New York University Health System.

Data collected from each medical record included the following: age, sex, ethnicity, education level, date of CPE, previous documented vaccination for hepatitis B, and exact dates of first, second, and third hepatitis B vaccines. In addition, we identified a subset of patients who had no history of hepatitis B immunizations to evaluate the difference in hepatitis B vaccination completion rates among the 3 sites and to identify predictors of successful completion.

Completion of hepatitis B vaccination was defined as successful if the subject’s medical record indicated 3 delivered dosages independent of the time parameter. Although at the time of this study the most commonly used hepatitis B vaccination dosing schedule was 0, 1, and 6 months, we did not enforce this time parameter to satisfy successful completion. We considered students who may have completed their hepatitis B vaccination at other settings to be “not successful completers.”

DATA ANALYSIS

To begin, we compared demographic characteristics and completion rates of hepatitis B vaccination among the 3 groups. Then we assessed the association between setting and hepatitis B vaccination completion rates using chi² analysis with no history of hepatitis B immunizations. For each site, we calculated relative risks for successful completion of immunization. Finally, logistic regression was used with the patient subset with no hepatitis B immunizations, and analyses included adjustments for covariates (age, ethnicity, and education level). The level of significance for these analyses was .05.

68% among black students. Another Louisiana study using student, patient, and faculty education as well as incentives reported a completion rate of 65% of 654 students in a middle school setting.

Unfortunately, immunization completion rates vary considerably among hospital- and community-based health centers. For example, a study of an adolescent health clinic, which was part of a prepaid health maintenance organization, demonstrated an 11% completion rate among a small sample of teenagers. Another study using a hospital-based adolescent clinic reported a hepatitis B vaccination completion rate of 85%. Most recently, a prospective study by Middleman et al examined the completion rates between school-based and hospital-based populations and factors affecting completion time of hepatitis B vaccination. These researchers found no differences in completion rates between these 2 settings. Moreover, times to completion of hepatitis B vaccination by site of care (ie, hospital vs SBHC) were not significantly different. However, having higher mean household income, being white and female, and not having smoked cigarettes were independent predictors of shorter times to completion.
The purpose of this study was 2-fold. First, we considered hepatitis B vaccination completion rates among 2 SBHC settings and an urban hospital-based center to determine whether differences existed among these 3 settings. Second, we identified a subset of patients who presented at each of these health care settings with no history of HBV immunization to examine completion rates among health care sites and to examine variables associated with successful completion.

Of the 510 medical records reviewed (106 for SBHC-A, 199 for SBHC-B, 205 for AHC), only 406 (98 for SBHC-A, 129 for SBHC-B, 179 for AHC) had documented data for hepatitis B immunizations.

Table 1 presents the demographic characteristics in the 3 settings, considering those with documented data regarding hepatitis B vaccinations. The mean age of the patients was 15.6 years at both SBHCs and 16.1 years at the AHC ($P<.05$). There were no significant sex differences among the 3 settings. Ethnicity was significantly different only for the group labeled “other” (predominantly adolescents of Asian and black Hispanic descent) between the 2 schools and between SBHC-B and the AHC. All the patients were in high school at the 2 SBHCs. At the AHC, 60% of the patients were currently enrolled in school, 10% at a graduate equivalency diploma program, 8% at college, and 22% out of school.

Table 2 shows a significantly higher percentage of students who had previously successfully completed HBV immunization at SBHC-A (42%) compared with SBHC-B (20%) and the AHC (26%). Thus, among students with some history of hepatitis B dosing, the overall completion rate for hepatitis B vaccination (regardless of timing or prior immunizations) was significantly higher at SBHC-A (85%) compared with SBHC-B (59%) and the AHC (51%) ($P<.001$). Characteristics of subjects with no history of hepatitis B vaccination across the 3 sites are outlined in Table 3. The mean age of patients was 15.3 years at each SBHC and 16.5 years at the AHC ($P<.001$). Sex did not differ significantly among the sites, and ethnicity was significantly different only for the group labeled “other” (Asian and black Hispanic) between the 2 schools.

The completion rate of hepatitis B vaccination was significantly higher at SBHC-A (76%) compared with the other 2 sites (29% for SBHC-B, 24% for AHC) ($P<.001$). There were no significant differences for the completion rate of hepatitis B vaccination between the SBHC-B and the AHC (Table 4).

Prevention of hepatitis B by universal immunization is considered very important in the teenage population, particularly because of the high-risk behaviors of adolescents. In fact, the proposed goals for adolescent hepatitis B vacci-
nation coverage are 65% for the year 2000 and 90% for the year 2002. We found remarkable differences in hepatitis B vaccination completion rates among our 3 settings. The highest completion rate was found in the SBHC that used a system to recall patients for missed appointments and advertised specific days to “catch up” with the hepatitis B vaccination series. This completion is similar to Kollar et al, who reported a high successful completion rate in a primary care adolescent clinic using reminder postcards and letters to reschedule missed appointments. Interestingly, Cassidy and Mahoney reported a slightly lower hepatitis B vaccination completion rate (65%) that used incentives to middle school students to participate. Thus, our data suggest that the use of reminder postcards, letters to reschedule appointments, and specific days to complete the hepatitis B vaccination series are important components to successful completion.

In contrast, successful completion rates in our other SBHC and the hospital-based AHC were surprisingly low, 29% and 24%, respectively. Although disappointing, these rates are higher than those reported by Wong et al, who found a completion rate of 11% in an adolescent medicine practice that was part of a prepaid health maintenance organization where no outreach strategy had been implemented. Outreach strategies to enhance hepatitis B vaccination completion have been described in several studies, in the pediatric population, and the most effective include reminder-recall letters and telephone calls. In fact, data reported by Udovic and Lien and Santelli et al suggest that missed opportunities have the greatest impact on populations with low baseline rates of immunizations. Other factors that may have had an impact on the differences of completion rates among our 3 sites include future academic aspiration (a large number of SBHC-A students pursue attending college) and the stability of the different school populations (SBHC-B has a greater immigrant population). In addition, differences in provider background, training, and related hepatitis B vaccination education to patients may have also affected successful completion across sites. Limitations to our study included its retrospective study design, the inability to establish reasons for noncompliance, and the fact that our study population was limited to inner-city adolescents. The fact that we have not followed the patients beyond the study period may have influenced the completion rate of hepatitis B vaccination, since the longer the patients are followed up, the more likely they will complete the vaccine series. The cost of the vaccination would have not interfered with the completion rates, since the medical visits and the vaccines were free and, therefore, not considered a limitation.

Our data support that school-based programs provide a unique opportunity to afford required immunizations to adolescents, especially when vaccination efforts are coordinated with educational and motivational approaches to encourage student participation. In addition to innovative outreach strategies, providing students who may have missed subsequent vaccination appointments with a new scheduled hepatitis B vaccination appointment appears beneficial. It is likely that missed vaccine doses can be more easily completed, because within an SBHC additional health care visits or parental involvement is not required and this setting minimizes school absenteeism. Although SBHCs have potential limitations to successful vaccination completions, such as student transfer or suspension, the 8- to 9-month school year allows ample time to complete a 3-dose vaccination series with adequate outreach and follow-up.

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### Table 4. Vaccination Data for Subset of 191 Patients With No Prior Hepatitis B Vaccination History Stratified by Setting*

<table>
<thead>
<tr>
<th>Dosage</th>
<th>SBHC-A (n = 37)</th>
<th>SBHC-B (n = 59)</th>
<th>AHC (n = 95)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None, %†</td>
<td>0.0</td>
<td>0.0</td>
<td>7.4</td>
</tr>
<tr>
<td>Received 1 dose, %‡</td>
<td>10.8</td>
<td>32.2</td>
<td>38.9</td>
</tr>
<tr>
<td>Received 2 doses, %¶</td>
<td>13.5</td>
<td>39.0</td>
<td>29.5</td>
</tr>
<tr>
<td>Received 3 doses, %*</td>
<td>75.7</td>
<td>28.8</td>
<td>24.2</td>
</tr>
</tbody>
</table>

* SBHC-A indicates high school-based health center A; SBHC-B, high school-based health center B; and AHC, adolescent health center.

†P < .05
‡P < .01
¶P < .001.