

Improving hepatitis B immunization among high-risk adolescents: a low-cost intervention on the Mexico-United States border

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ABSTRACT

Objective. To analyze factors associated with hepatitis B immunization adherence among adolescents attending a sexually transmitted disease (STD) clinic in El Paso, a city in Texas that is on the border between Mexico and the United States of America.

Methods. In this cohort study with 248 adolescents we obtained data on demographics and health beliefs through personal interviews and medical record abstraction. We monitored each of the individuals for 8 months to determine whether the adolescents received a first, second, and third dose of the hepatitis B vaccine.

Results. Overall, 32% of the adolescents received the first immunization, 9% the second, and 2% the third. The strongest predictor of receiving either one or two doses was providing the vaccine at the STD clinic as opposed to referring adolescents to a separate vaccination clinic (relative risk (RR) for receiving the first immunization = 7.3; RR for receiving the second immunization = 3.8). Several health beliefs were also associated with receiving vaccinations.

Conclusions. The results of our study indicate that hepatitis B vaccination programs can be improved through such steps as providing vaccinations at a convenient site, educating adolescents about hepatitis B risk factors, and emphasizing the difficulty of treating hepatitis B infection.

Key words

Hepatitis B, vaccination, adolescents, Texas, Mexican-Americans.

Hepatitis B virus (HBV) is a blood-borne pathogen that causes liver in-

flammation and can result in long-term liver disease and mortality. In the United States of America as many as 320 000 new HBV infections occur each year, and there are approximately 5 000 deaths per year due to chronic liver disease resulting from HBV infection (1, 2). Infection in the United States occurs predominately through sexual contact and by drug users sharing contaminated needles (3, 4).

In 1991 the Immunization Practices Advisory Committee, a group of nationally recognized experts who review vaccination practices and report

to the United States Centers for Disease Control and Prevention, recommended that the United States utilize universal HBV immunization for all infants as well as for all adolescents living in communities where there are high rates of injecting drug use, pregnancy, and sexually transmitted diseases (STDs) (5). The American Academy of Pediatricians, an independent organization of pediatricians who review health policies that have implications for children and adolescents, later extended this recommendation to include universal immunization of

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adolescents (6). Because the policy of universal immunization of infants was implemented in November of 1991, persons who are now adolescents were not covered under this policy.

Overall, among children in the United States there has been a dramatic improvement in the control of vaccine-preventable diseases, with increasing numbers of those youngsters receiving the full complement of recommended vaccinations. However, the same level of progress has not been achieved with adolescents and young adults. With respect to hepatitis B vaccination, little is known about factors associated with adolescent adherence to the three recommended doses of the vaccine (7). The three visits required are hard to achieve with adolescents, who receive an average of less than one preventative health care visit per year (8). A Chicago study of 76 adolescent patients using an urban health center found that only 14% received all three HBV vaccine doses despite the fact that 83% indicated they intended to complete the series (9).

School-based hepatitis B vaccination programs have had fairly good success in raising adolescent immunization rates. One of these, the New Mexico "Roll Up Your Sleeves" program, demonstrated an 89% completion rate in participating high schools (10). However, these programs do not reach adolescents who are not attending school.

The purpose of our study was twofold: 1) to evaluate the impact of a low-cost intervention to increase HBV vaccination rates among high-risk adolescents, by changing the site where vaccinations were given, from a separate vaccination clinic to an STD clinic, and 2) to identify associations that the adolescents' hepatitis B vaccination adherence had with their demographic and cultural characteristics and health beliefs.

METHODS

Data collection

We conducted a prospective cohort design among 248 adolescents, aged

10–19 years, who received services from the STD clinic of the Health Department of the County of El Paso, Texas. Any adolescent who received services from April 1997 through February 1998 was asked if he or she wished to participate in the study. Each participant was then followed for a period of 8 mo to determine adherence with vaccination. The STD clinic is open to everyone on a walk-in basis and regardless of country of residence. The services are either free or reduced in price, depending on income. Services include medical examinations, treatment, and education. The clients are predominately low-income residents of El Paso, Texas. However, residency in Texas is not required and services are also available to Mexican nationals. In order to protect the privacy of the participants in our study, we did not collect information on residency.

El Paso, Texas, and its sister city in Mexico, Ciudad Juárez, Chihuahua, comprise a large, binational community of approximately 2 000 000 residents (700 000 in El Paso and 1 300 000 in Ciudad Juárez). Approximately 80% of El Paso residents are of Hispanic ethnicity, and a number of residents are recent immigrants with limited English proficiency.

None of the study participants was identified in their medical records as having HBV; rather, it is the clinic's policy that all clients be offered and encouraged to receive the hepatitis B vaccination.

The health department offers free HBV immunizations to adolescents under 20 years of age, with doses given at 0, 2, and 6 mo. At the time of the first immunization, adolescents are given appointments for subsequent vaccinations according to the above schedule. These appointments serve as guidelines for the adolescents, who may walk in to the clinic and request a subsequent vaccination. Adolescents who do not keep scheduled immunization appointments are sent reminder post cards. The county health department used to provide the HBV vaccinations at a separate, walk-in vaccination clinic with limited hours. After we had enrolled the first 137 par-

ticipants in our study, the health department changed the place of administration of HBV immunizations to the STD clinic. After making this change, the health department offered the first HBV vaccine dose during the adolescent's initial visit. With the exception of the change in location, there were no adjustments to the HBV vaccination protocols.

This study consisted of three components: personal interviews, medical record abstraction, and monitoring adherence to the three-dose HBV immunization routine. Eligible participants were informed of the study by clinic personnel and referred to the study's research assistant. Written informed consent was obtained from the adolescent. Personal interviews were conducted in either Spanish or English and took approximately 15 minutes. Interviews included questions on demographic information as well as knowledge and beliefs about hepatitis B, based on the Health Belief Model (11).

Medical record abstractions determined sexual and drug use risk factors for HBV infection, which are presented elsewhere (12). Adherence to the three-dose HBV vaccination routine was monitored for 8 mo. Institutional review board approval for this study came from the Institutional Review Board of the University of Texas at El Paso and the Committee for the Protection of Human Subjects at the University of Texas Health Science Center in Houston, Texas.

Statistical analysis

We performed bivariate analysis using the SPSS statistical program (SPSS Inc., Chicago, Illinois, United States). The multivariate analysis was performed using the Stata package (Stata Corporation, College Station, Texas). Logistic regression models were constructed to identify factors associated with HBV vaccination adherence and factors associated with perceived risk of HBV infection. All variables with a *P* value ≤ 0.25 in the bivariate analysis were evaluated in the regression models. We employed

backward stepwise logistic regression until all variables remaining in the models had a *P* value ≥ 0.20 . The Hosmer-Lemeshow goodness-of-fit test was used to evaluate the fit of the model (13).

RESULTS

Of the 266 adolescents asked to participate in the project, 248 agreed, resulting in a response rate of 93.2%. Participants ranged from 10 to 19 years old (mean age, 17), and 38% were no longer attending school. Nineteen percent of participants had been born in Mexico, and a total of 21% had lived there for at least 6 mo at some point in their life. Overall, 80 of the participants (32.3%) received the first immunization, 22 (8.9%) received the second, and 6 (2.4%) received the third.

Bivariate analysis

The percentage of adolescents receiving immunizations increased dramatically when the vaccination site was changed from the separate, walk-

TABLE 1. Number and percent of adolescents adhering to three-dose HBV vaccination regimen according to site of HBV immunizations, El Paso, Texas, 1997–1998

Adherence with immunization	Site where HBV immunizations were provided				<i>P</i> value
	Vaccination clinic (137 study participants enrolled during this phase)		STD clinic (111 study participants enrolled during this phase)		
	No.	%	No.	%	
First injection	19	13.9	61	55.0	< 0.001
Second injection	7	5.1	15	13.5	0.021
Third injection	1	0.7	5	4.5	0.092 ^a

^a Fisher's exact test.

in vaccination clinic to the STD clinic (Table 1). This change was significant for the first and second immunization but not for the third.

Demographic factors were not strongly associated with hepatitis B immunization (Table 2). Only not having lived in Mexico for at least 6 mo was significantly associated with receiving the second vaccine. Due to the small numbers of adolescents who received the third immunization, we limited the comparison of factors associated with adherence to the first and second immunizations.

Table 3 shows the association between receiving the first HBV vaccine dose and the adolescents' health beliefs. Adolescents who had the following beliefs were more likely to receive the first immunization: believing a previous vaccine does not protect one against hepatitis B, feeling health problems usually do not go away by themselves, and agreeing with the statement that doctors and nurses do not take the time to adequately explain things. Interestingly, some adolescents who felt protected by a previous vaccine felt that they were protected by

TABLE 2. Demographic characteristics of all adolescents in the study versus characteristics of adolescents who received the first and second HBV immunizations, El Paso, Texas, 1997–1998^a

Demographic characteristic	Total no. of adolescents	Adolescents receiving immunization 1			Adolescents receiving immunization 2		
		No.	%	<i>P</i> value	No.	(%)	<i>P</i> value
Age				0.601			0.696
15	25	10	40.0		3	12.0	
16–17	67	23	34.3		7	10.4	
18–19	154	47	30.5		12	7.8	
Birthplace				0.674			0.070
United States	187	63	33.7		20	10.7	
Mexico	46	14	30.4		1	2.2	
Gender				0.123			0.081
Male	125	46	36.8		15	12.0	
Female	123	34	27.6		7	5.7	
Language spoken				0.358			0.325
Primarily Spanish	53	21	39.6		6	11.3	
Bilingual	86	24	27.9		10	11.6	
Primarily English	102	33	32.4		6	5.9	
Lived in Mexico ≥ 6 mo				0.134			0.044
Yes	51	12	23.5		1	2.0	
No	188	65	34.6		21	11.2	

^a Due to missing data, the totals in some categories and subcategories may vary slightly from each other.

TABLE 3. Adolescents who did and who did not begin HBV vaccination and the number and percent of them who held particular health beliefs, El Paso, Texas, 1997–1998^a

Health belief ^b	Began immunization		Did not begin immunization		
	No.	%	No.	%	<i>P</i> value
Perceived susceptibility					
Not protected by previous vaccine	19	24.7	70	44.0	0.004
Worried about becoming infected	57	73.1	125	77.2	0.489
At risk of becoming infected	47	61.0	82	50.3	0.120
Perceived severity					
Take being sick seriously	61	78.2	116	71.2	0.257
Health problems do not go away by themselves	85	52.1	52	66.7	0.033
Would matter if I got HBV	73	93.6	155	95.7	0.487
HBV is serious even if someone is not ill	69	88.5	146	91.8	0.402
Perceived benefits					
I will not get HBV if I am vaccinated	67	89.3	146	90.7	0.745
Benefits more important than discomfort	72	93.5	148	91.4	0.566
Perceived barriers					
HBV shots don't work	25	33.8	53	35.3	0.819
Worried that people know I'm being immunized	12	15.4	39	23.9	0.129
Transportation to the clinic is a problem	19	24.4	33	20.2	0.468
Did not understand what staff said	47	60.3	98	60.1	0.984
Staff did not explain things well	7	9.1	36	22.1	0.014
Self-efficacy					
Ability to complete immunizations	77	98.7	154	96.3	0.290

^a Due to missing data, the totals in some categories and subcategories may vary slightly from each other.

^b After Rosenstock (11).

having been vaccinated even when they knew that the previous vaccine was not a hepatitis B vaccine. Although many adolescents believed they were protected against HBV by a previous vaccine, only four had actually been vaccinated against HBV.

This analysis was also run for predictors of the second immunization (data not shown), and the only significant factor was the belief that doctors and nurses did not explain things well. Adolescents who felt that doctors and nurses did not explain things well were less likely to return for the second immunization. Other variables that were not significant but had a *P* value 0.25 included the belief that a previous vaccine is not protective, concern that people would know they were being immunized, and transportation difficulties to the clinic. Although the clinic is located in the downtown area and accessible by bus, buses do not run frequently from all parts of the El Paso area and so it can

be time consuming for an adolescent without a car to attend the clinic.

Multivariate analysis

We conducted two logistic regression models, one for receiving the first immunization and the other for receiving the second immunization (Table 4).

Adolescents were more likely to receive a vaccine when it was offered at the STD clinic than at the separate vaccination clinic (Table 4). The strongest predictor of receiving the first vaccination and the second vaccination was the STD clinic vaccination site, with relative risks of receiving the vaccinations of 7.3 and 3.8, respectively. Adolescents who stated that they felt at risk of contracting hepatitis B were twice as likely to receive the first vaccination as those who did not feel they were at risk. Surprisingly, adolescents who felt they were protected against

HBV infection by a previous vaccination were twice as likely to be vaccinated as those who did not feel they were protected.

Factors associated with receiving the second immunization are shown in the lower half of Table 4. In addition to the change in immunization site, adolescents were more likely to return for a second vaccine dose if they were concerned that others knew they were being vaccinated against hepatitis B.

DISCUSSION

The strongest factor associated with both the first and second HBV immunization was the site where the HBV immunization was offered. While located in the same building, the vaccination clinic and the STD clinic are separate from each other. Following the change in the HBV vaccination site, adolescents were more likely to begin the series of HBV vaccine doses

TABLE 4. Relative risk for receiving first and second HBV immunizations, El Paso, Texas, 1997–1998

	Relative risk	95% confidence interval
Immunization 1^a		
Immunization site at STD clinic	7.30	3.7–14.4
Feels at risk of contracting HBV	2.20	1.1–4.3
Feels a prior vaccine protects against HBV	2.10	1.0–4.3
Male gender	1.79	0.9–3.5
Lived in Mexico 6 mo	0.60	0.3–1.4
Feels most health problem go away by themselves	0.60	0.3–1.2
Immunization 2^b		
Immunization site at STD clinic	3.84	1.3–10.9
Concerned that people know they are being vaccinated	3.80	1.2–11.8
Male gender	2.21	0.8–5.9
Lived in Mexico 6 mo	0.13	0.02–1.1
Has a problem with transportation to the clinic	0.27	0.1–1.3
Staff does not explain things well	0.24	0.02–1.9

^a Log likelihood = -115.908, Hosmer-Lemeshow goodness-of-fit test = 9.69, *P* value = 0.287.

^b Log likelihood = -60.987, Hosmer-Lemeshow goodness-of-fit test = 2.80, *P* value = 0.903.

and more likely to receive the second dose. This may be because adolescents could initiate vaccination at the time of the initial visit, they were already familiar with the STD clinic staff, or that it was more convenient since the vaccination clinic has more restricted hours than does the STD clinic. The STD clinic is open 5 days a week while the vaccination clinic is only open on Wednesday afternoons.

The rate of vaccination with all three doses was low, only 2.4%. One reason for this is that adolescents who attend the STD clinic are generally difficult to reach. They characteristically do not receive regular health care at the clinic and must return specifically for the vaccination series. Adolescents who received vaccination prior to the change in site needed to go to the vaccination clinic for all three vaccine doses while those who received the initial vaccine at the time of their first STD appointment only needed to return for subsequent vaccinations.

Researchers have identified adolescents with a prior STD or those exhibiting high-risk sexual and injection drug use behavior as being a group at high risk for HBV infection (1). As was true in our study, many adolescents

are no longer in school. For this group of young people STD clinics may be an important site for vaccination programs. However, studies evaluating vaccinations in STD clinics have found low adherence among adolescents. For example, a study of HBV vaccinations in a San Francisco STD clinic found the lowest rates of adherence were among those under 24 years old (14).

Other studies such as this one are needed to help health departments to establish STD clinic vaccination programs that can improve vaccination adherence. For example, in our study, adolescents who felt that they were at risk of acquiring hepatitis B were more likely to receive the first vaccine dose. We found that the adolescents who felt that most health problems went away by themselves were less likely to receive the HBV vaccination. This result suggests the need to stress to adolescents the difficulty of treating hepatitis B. Adolescents who felt a prior vaccine protected them against hepatitis B were more likely to begin the vaccination series. It may be that these adolescents had a more positive belief in vaccination, and, when encouraged to receive the HBV vaccination, they were more likely to do so.

One health belief associated with immunization appeared contradictory. Adolescents who were concerned if people knew they were being vaccinated against hepatitis B were more likely to receive the second vaccine dose. Perhaps they were even more concerned with the social consequences of a long-term HBV infection. Emphasizing the confidentiality of care at an STD clinic could potentially increase vaccination adherence.

This study had several limitations. We did not use a randomized design. However, there is no reason to expect differences between the adolescents who attended the STD clinic before and after the HBV vaccination site was changed. We did not use incentives, such as payment or gifts, to improve adherence; consequently, overall adherence was quite low. Nevertheless, this study does provide data on a low-cost intervention that can be initiated within the financial constraints of a health department clinic.

In summary, the vaccination site was a key issue in adherence with both the first and second hepatitis B immunization. Moving the site of the HBV vaccinations from the separate vaccination clinic to the STD clinic resulted in a dramatic increase in vaccination adherence. In addition, our study results indicated that a successful vaccination program needs to maintain a positive environment in the clinic and that staff should take time to adequately explain hepatitis B risk factors and the importance of adhering to the vaccination series.

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RESUMEN

Mejores prácticas de inmunización anti-hepatitis B para adolescentes en alto riesgo: intervención de bajo costo en la frontera mexicano-estadounidense

Objetivo. Analizar los factores asociados con el cumplimiento de la inmunización anti-hepatitis B entre adolescentes que acuden a una clínica para el tratamiento de las enfermedades de transmisión sexual (ETS) en El Paso, ciudad de Texas en la frontera entre México y Estados Unidos de América.

Métodos. En este estudio de cohorte que se realizó en 248 adolescentes, obtuvimos datos demográficos y sondeamos las creencias de los jóvenes en torno a la salud mediante entrevistas personales y datos extractados de expedientes clínicos. Se vigiló a cada persona durante 8 meses para determinar si los adolescentes recibían la primera, segunda o tercera dosis de la vacuna anti-hepatitis B.

Resultados. En total, 32% de los adolescentes recibieron la primera dosis de vacuna, 9% la segunda y 2% la tercera. El factor de mayor valor predictivo en relación con haber recibido una o dos dosis de vacuna fue el haber proporcionado la vacuna en la clínica para ETS, en vez de haber remitido al adolescente a una clínica independiente para la vacunación (riesgo relativo [RR] de haber recibido la primera vacuna = 7,3; RR de haber recibido la segunda = 3,8). También se encontró una asociación entre diversas creencias en materia de salud y el haber sido vacunado.

Conclusiones. Los resultados de nuestro estudio indican que los programas de vacunación contra la hepatitis B pueden mejorarse si la vacuna se aplica en un local de fácil acceso, si se instruye a los adolescentes sobre los factores de riesgo de contraer la hepatitis B y si se subrayan las dificultades que entraña el tratamiento de esta infección.