Poor Validity of Self-Reported Hepatitis B Virus Infection and Vaccination Status among Young Drug Users

Irene Kuo,1 Daniel W. Mudrick,2 Steffanie A. Strathdee,1
David L. Thomas1,2 and Susan G. Sherman1

1Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, and 2 Department of Medicine, Division of Infectious Diseases, Johns Hopkins School of Medicine, Baltimore, Maryland; and 3Brigham and Women’s Hospital, Harvard School of Medicine, Boston, Massachusetts

Self-reported hepatitis B virus (HBV) infection status and immunization status were compared with HBV serological markers among 324 young injection drug users (IDUs) and noninjection drug users (NIDUs). The overall validity of self-reported status was poor; 52% claiming to be vaccinated were actually susceptible to HBV. There was no difference in validity of self-reported HBV status between IDUs and NIDUs. Clinicians should adopt a “Don’t Ask, Vaccinate” vaccination policy for young drug users.

With >300,000 new infections occurring annually in the United States [1], hepatitis B virus (HBV) infection is a major public health problem, particularly among drug users. Prevalence of past HBV infection ranges from 23% for young injection drug users (IDUs) [2] to 81% for adult IDUs [3] and 23% for adult noninjection drug users (NIDUs) [4], compared with a prevalence of 5% in the general US population [5]. One percent of 2% of acute HBV infections lead to fulminant hepatitis, for which the case-fatality rate ranges from 63% to 93% [6]. Chronic HBV infection is one of the major causes of hepatocellular carcinoma and is associated with liver cirrhosis [7], resulting in >4000 deaths per year in the United States [8].

Despite the existence of a safe and effective vaccine since 1982, the Centers for Disease Control and Prevention (CDC; Atlanta, GA) added HBV vaccination to the list of recommended childhood immunizations only in 1991 [9]. Therefore, most young, newly-initiated IDUs and NIDUs today remain susceptible to HBV infection. Of additional concern, the majority of acute HBV infections occur among young adults aged 20–29 years [10]. Because chronic hepatitis B infections are rarely completely eradicated [11], efforts to reduce HBV-related morbidity and mortality must focus on HBV vaccination and risk-reduction programs.

Young drug users may not be fully knowledgeable about their past infection and vaccination status, as seen in previous studies among adult drug users [12, 13]. Therefore, we compared the validity of self-reported past HBV infection and vaccination status between young IDUs and NIDUs to aid clinicians in improving HBV vaccination coverage in this population.

Methods. We conducted a cross-sectional HBV prevalence study nested within the Risk Evaluation Assessment of Community Health (REACH III) cohort study of young IDUs and NIDUs, the methods of which are described elsewhere [14]. Between March 1999 and August 2002, IDUs and NIDUs aged 15–30 years were recruited through targeted street outreach. From all REACH III participants, 200 IDUs were randomly selected from the 400 enrolled and were evaluated along with all 124 NIDUs who had stored serum available for HBV testing.

At the baseline visit, participants completed the survey and blood was drawn for serological testing and storage. Self-reported hepatitis B infection status was considered positive if the participant answered “Yes” to the question, “Have you ever been told by a health professional that you had hepatitis?” and identified hepatitis B as the virus type.

Self-reported vaccination status among individuals who said they were not infected in the past was determined with the question, “Since 1982, have you received the hepatitis B vaccine (shots)? (Probe: This requires three shots over a six month period).” An answer of “Yes,” or “Yes, but did not complete all doses” was considered positive for self-reported vaccinated status. Individuals reporting partial vaccination were counted as being vaccinated because antibody response rates to the vaccine are substantial even with a partial series (43% with 1 dose and 91% with 2 doses among healthy adults) [15]. Participants who did not report past infection or vaccination were coded as being susceptible to HBV infection.

HBV serostatus was determined through testing serum samples obtained at baseline for antibodies to hepatitis B core antigen (HbcAb) and hepatitis B surface antigen (HbsAb) with use of enzyme immunoabsorbant assays (Corab and Ausab,
respectively; Abbott Laboratories). Past or current HBV infection was defined as the presence of HBcAb, with or without the presence of HBsAb. Past HBV vaccination was defined as the presence of HBsAb in the absence of HBcAb. Participants lacking both HBsAb and HBcAb were considered serologically susceptible to HBV infection. Study participants were not tested for the presence of HBV antigen (HBsAg) since this information was not applicable to the study goal.

Study subjects were notified of HBV test results and were offered free HBV vaccine if they were susceptible. Individuals were referred to free medical care if they tested positive for HBcAb, an indication of past or current HBV infection. The Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health approved this study.

Percent agreement and the \( \kappa \) statistic were used to assess the degree of agreement between self-reported and serological HBV status. Percent agreement (or “concordance”) is a straightforward measurement of accuracy of self-reported status used in previously published reports [12, 13]. Participants whose self-reported status matched their serological status were classified as having concordant status, and those whose did not were classified as having discordant status.

The \( \kappa \) statistic measures agreement between 2 raters on a scale ranging from 1.0 to \(-1.0\) and takes into account chance agreement [16]. It may be used to measure validity when self-reported status is compared with a serological test result (“the gold standard”). A \( \kappa \) score of 0.8–1.0 is considered almost perfect agreement (or validity), a score of 0.6–0.79 is considered substantial agreement, a score of 0.4–0.59 is considered moderate agreement, and a score of <0.4 is considered fair to poor agreement.

Results. Of the 324 study participants, 200 (62%) were IDUs and 124 (38%) were NIDUs. More than one-half of the study population was male, the median age was 25 years (interquartile range, 21–28 years), almost 40% had not completed high school, and 124 (38%) were NIDUs. More than one-half of the study population we studied, the rate of false positive HBcAb test results was likely to be low [18]. In other cases, an isolated core serological test result represents an atypical response to prior infection, which appears to occur more often among IDUs and HIV-infected persons. The prevalence of HIV infection in this study showed poor agreement (\( \kappa = .16 \) and \( \kappa = .12 \), respectively).

A total of 96 individuals had serological evidence of past HBV infection. Of those individuals, only 4 (4%) knew they had been previously infected while 73 (76%) thought they had not been infected and 19 (20%) thought they were protected by past vaccination.

A total of 37 individuals had serological evidence of past HBV vaccination, although 92 study participants claimed to have been vaccinated in the past. Of the 92, only 25 (27%) were correct about their vaccination status. Forty-eight (52%) of those claiming past vaccination were actually susceptible to infection, and 19 (21%) had evidence of past infection.

If HBV vaccination had been withheld from the 96 persons who reported past infection or past vaccination, 48 HBV susceptible subjects (50%) would have missed a vaccination opportunity. If HBV vaccination or screening had been performed for individuals who said they had neither been vaccinated nor infected, only 85 (37%) of 228 would have been unnecessarily screened or vaccinated.

Discussion. Among young drug users in an urban setting, concordance between self-reported and serologically confirmed HBV infection and immunization status was only 53%. This finding is consistent with similar studies of older IDUs [12, 13]. When we accounted for chance agreement, knowledge of past HBV infection and vaccination status was poor. Of concern, more than one-half of those claiming to be have been vaccinated did not actually have seroprotection. These results suggest the majority of young drug users who believed they were protected by the HBV vaccine were actually susceptible to infection. Although a greater number of NIDUs were susceptible to HBV infection, there were no differences in the validity of self-reported HBV status between IDUs and NIDUs.

Several explanations for poor validity are plausible. First, some persons were misclassified as having prior HBV infection. Among adults, acute HBV infection is asymptomatic in 33%–50% of cases [6]; therefore, many HBV-infected study participants may have experienced only subclinical illness and did not realize they had been infected. In addition, 35% of individuals who tested positive for HBcAb did not have evidence of HBsAb, which is also known as “isolated core” result [17]. Some individuals with an isolated core result may actually be susceptible to HBV infection, or, in other words, may have a false positive HBcAb test result. Given the high prevalence of HBV infection in the population we studied, the rate of false positive HBcAb test results was likely to be low [18]. In other cases, an isolated core serological test result represents an atypical response to prior infection, which appears to occur more often among IDUs and HIV-infected persons. The prevalence of HIV infection in this study
Table 1. Cross-tabulation of hepatitis B virus (HBV) serostatus by self-reported status among young injection drug users (IDU) and noninjection drug users (NIDU).

<table>
<thead>
<tr>
<th>Subject group, HBV serostatus</th>
<th>No. (%) of patients</th>
<th>Self-reported HBV status</th>
<th>Vaccinated a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Susceptible</td>
<td>Infected</td>
</tr>
<tr>
<td>IDU b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susceptible</td>
<td>88</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Infected</td>
<td>52</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>7</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>147 (73.5)</td>
<td>4 (2.0)</td>
<td>49 (24.5)</td>
</tr>
<tr>
<td>NIDU c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susceptible</td>
<td>55</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>Infected</td>
<td>21</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>5</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>81 (65.3)</td>
<td>0 (0.0)</td>
<td>43 (34.7)</td>
</tr>
<tr>
<td>Both IDU and NIDU d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susceptible</td>
<td>143</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>Infected</td>
<td>73</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>12</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>228 (70.4)</td>
<td>4 (1.2)</td>
<td>92 (28.4)</td>
</tr>
</tbody>
</table>

a “Vaccinated” includes individuals who reported receiving 1 or 2 shots of the 3-shot vaccine series.
b Percentage agreement between serostatus and self-reported status, 50%; \( \kappa = 0.16 \).
c Percentage agreement between serostatus and self-reported status, 55%; \( \kappa = 0.12 \).
d Percentage agreement between serostatus and self-reported status, 52%; \( \kappa = 0.14 \).

Sample was low (<1%) and therefore likely did not affect the validity of serological test results.

Second, some individuals may have been misclassified because they confused another vaccination or injection with HBV vaccination. However, we expect this misclassification to be nondifferential and to have a limited effect on study results.

A third potential explanation of poor validity is that 10 individuals (3%) were partially vaccinated but did not develop an immune response. However, reclassifying these individuals as not having been vaccinated did not change the \( \kappa \) statistic (\( \kappa = .14 \)).

Fourth, persons who were vaccinated may have lost HBsAb over time. Although individuals were young and not immunosuppressed, some initially could have formed protective antibody responses, then seroreverted by the time this study was done. Postvaccination seroreversion rates previously demonstrated among men having sex with men, health care workers, and Alaskan Eskimos ranged from 13% to 66% [19–21]. Lastly, a proportion of fully vaccinated individuals may not have developed protective antibodies at all, as was demonstrated recently by Lum et al. in a population of young IDUs [22].

The CDC suggests preemptive HBV vaccination for high-risk populations that have poor medical follow-up, such as drug users [9]. Clinicians deciding whether to administer HBV vaccine to young drug users of unproven serostatus must balance the risk of missing vaccination opportunities with the cost of unnecessary vaccinations. However, given the high risk for HBV infection, a lower postvaccination seroprotection rate, and difficulty of following-up young drug users, it is important to administer the vaccination at every opportunity available.

In conclusion, a patient’s self-report of HBV infection susceptibility is not a useful screening tool in making the decision whether or not to administer the vaccine. Therefore, given poor agreement between serologic evidence of protection and self-report of prior vaccination, this study supports a “Don’t Ask, Vaccinate” HBV vaccination policy.

Acknowledgments

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References

1. Lum K, et al. Postvaccination seroreversion rates previously demonstrated among men having sex with men, health care workers, and Alaskan Eskimos ranged from 13% to 66% [19–21].
2. Lum K, et al. Postvaccination seroreversion rates previously demonstrated among young IDUs [22].
References


