Attitudes, Practices, and Preferences of Pediatricians Regarding Initiation of Hepatitis B Immunization at Birth

Amanda Cooper, MD; Hussain Yusuf, MBBS; Lance Rodewald, MD; Tasneem Malik, MPH; Robert Pollard, MA; and Larry Pickering, MD

ABSTRACT. Objectives. To explore practices and attitudes of pediatricians toward administration of the first dose of hepatitis B vaccine to infants, and to identify factors influencing the decision of pediatricians to initiate immunization at birth versus at 1 to 2 months of age.

Methods. A random sample of 600 pediatricians obtained from the American Academy of Pediatrics membership database was surveyed by mail.

Results. Three hundred eighty (68%) of the 563 pediatricians who were located responded to the survey. Of these 380 pediatricians, 279 provided routine immunization to children. Of the 270 pediatricians who vaccinated children with hepatitis B vaccine and indicated their practice regarding the birth dose, 50% offered the first dose of hepatitis B vaccine at birth to all infants; the rest either offered the vaccine at birth only to infants of hepatitis B surface antigen-positive mothers and mothers whose serostatus is unknown, or did not offer the birth dose to any infants at all. Practicing in the inner city, working for a medical school or government hospital, and living in a state with universal immunization supply policies were associated with the respondent giving the birth dose. The strongest perceived barriers to giving the birth dose in the hospital were the difficulty tracking these vaccines (39%), the increased cost (27%), and the lack of reimbursement from insurance companies (26%). If a combination vaccine that includes hepatitis B; diphtheria, tetanus, pertussis (diphtheria and tetanus toxoids and acellular pertussis vaccine); and polio (inactivated poliovirus vaccine) antigens become available in the near future, then 38% of physicians who currently give the birth dose to infants would prefer to wait until 2 months of age to initiate hepatitis B immunization.

Conclusions. Efforts to achieve high implementation of hepatitis B birth dose administration may falter once a hepatitis B-containing pentavalent combination vaccine becomes available. Programmatic efforts should ensure prevention of perinatal hepatitis B virus transmission through universal prenatal hepatitis B surface antigen screening and immunoprophylaxis of high-risk newborn infants. Pediatrics 2001;108(6).

Numerous studies demonstrate the effectiveness of routine infant hepatitis B immunization in preventing chronic hepatitis B virus (HBV) infection and its sequelae, which includes chronic liver disease and hepatocellular carcinoma.1–5 In 1991, the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Pediatrics (AAP) recommended immunization of all infants against hepatitis B to provide broad population-based immunity to HBV infection. The recommended schedule calls for the first dose to be given at birth or at 1 to 2 months of age. Initiating the hepatitis B vaccine series at birth in infants born to hepatitis B surface antigen (HBsAg)-positive mothers is highly effective in preventing transmission of HBV infection to these infants.6 The birth dose also provides a safety net for preventing HBV infection among infants born to HBsAg-positive mothers who fail to be identified. In addition, administering hepatitis B vaccine at birth to infants born to HBsAg-negative mothers is associated with an increased likelihood of completion of the hepatitis B immunization series.7,8 In a national study, compared with children who received the birth dose, children initiating hepatitis B vaccination at 1 to 2 months of age were approximately 8 times more likely not to complete the series.7

In 1998, 87% of children 19 to 35 months of age in the United States received 3 doses of hepatitis B vaccine, and 97% of children received at least 1 dose. Among children receiving at least 1 dose of hepatitis B vaccine, 55% received the first dose at birth.9 However, many challenges have arisen with regard to initiation of the hepatitis B immunization at birth. For example, because of concerns of the mercury-containing preservative thimerosal in hepatitis B vaccines used at the time, in July 1999 the ACIP and AAP recommended postponing initiation of hepatitis B immunization among infants of HBsAg-negative mothers until 2 to 6 months of age.10 This policy change caused a marked decrease in the use of the birth dose of hepatitis B vaccine, and after thimerosal preservative-free hepatitis B vaccines became available in October 1999, the rate of birth dose adminis-
The percentage of pediatricians who currently admin- 
ister the birth dose varied significantly by loca- 
tion of practice, with pediatricians practicing in in- 
er-city, urban areas being more likely to administer 
the birth dose compared with rural, suburban, 
and noninner-city urban area pediatricians (Table 1). Pe- 
diatricians in hospital or medical school-based prac- 
tices and those in city or county hospitals and non- 
profit clinics were more likely to give the birth dose 
than those in solo, group, or health maintenance 
organization practices. Pediatricians living in a state 
with universal vaccine distribution policies were also 
more likely to offer the birth dose. Pediatricians who 
were aware of the maternal HBsAg status <75% of 
the time while visiting a newborn in the hospital 
were more likely to give the birth dose than provid- 
ers who were aware of the maternal status of such 
infants >75% of the time. There were no differences 
in the percentage of respondents giving the birth dose 
by practice size, physician gender, finishing a resi- 
dency before or after 1999, and living in a state with 
laws requiring the screening of all pregnant women 
for HBsAg or laws requiring the reporting of women 
who are HBsAg-positive to state health officials.

Perceived Advantages and Barriers to 
Giving the Birth Dose

Seventy percent of respondents agreed or strongly 
agreed that giving the birth dose is important be- 
cause it decreases risk of perinatal HBV transmis- 
sion, and 65% agreed or strongly agreed that the 
birth dose is important because it increases the like- 
lihood of completion of the 3-dose hepatitis B vaccine

Hepatitis B Vaccination Practices and Beliefs

Approximately half (50%) of pediatricians who 
give hepatitis B vaccine indicated that they offered 
the vaccine to all infants at birth (Table 1). When 
asked “which infants do you believe should be vac-
cinated at birth, before discharge from the hospital?” 
49% of respondents chose “all infants” and 50% 
chose “infants of HBsAg-positive or unknown status 
mothers.” Ten percent of respondents who currently 
offer the birth dose to only infants of HBsAg-positive 
or unknown mothers believe that all infants should 
receive the birth dose, and 7% of respondents who 
give the birth dose to all infants believe only infants 
of HBsAg-positive or unknown mothers should re-
ceive the birth dose. Among pediatricians who did 
not offer the birth dose to all infants, 18% offered 
hepatitis B vaccine at birth to infants of HBsAg-
positive mothers only, and 87% offered it to infants 
of HBsAg-positive and unknown status mothers 
only.

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only.
series; both of these groups were more likely to give the birth dose than pediatricians who did not hold these beliefs (Table 2). Thirty-nine percent of respondents agreed or strongly agreed that difficulty tracking immunizations given in the hospital is a barrier to giving the birth dose, 27% agreed or strongly agreed that the higher cost of immunization in the hospital is a barrier, 26% agreed or strongly agreed that insurance companies not reimbursing for vaccines administered in the hospital is a barrier, 21% agreed or strongly agreed parent unwillingness to immunize infants at such an early age is a barrier, and 11% agreed or strongly agreed that safety concerns are a barrier. Identifying each of these barriers, with the exception of parent unwillingness, was associated with offering the birth dose.

**Preferred Options for Immunizing Against Hepatitis B in the Future (Fig 1)**

Currently, 24% of respondents prefer to give the birth dose using single antigen vaccine and then complete the series with the Hib-hepatitis B combination vaccine, whereas 31% of respondents prefer to initiate immunization at 2 months of age using the combination vaccine for all doses. Respondents who used the Hib-hepatitis B combination vaccine were less likely to offer the birth dose to all infants compared with respondents who use the single antigen vaccine for all doses (45% vs 62%, \( P = .008 \)). If a hepatitis B-containing pentavalent vaccine becomes available, the majority (61%) of pediatricians will prefer to initiate hepatitis B vaccination at 1 to 2 months using a combination vaccine; 2% of the pediatricians would initiate vaccination at 1 to 2 months with a single antigen vaccine.

Among pediatricians who currently prefer to use only the single antigen hepatitis B vaccine and initiate vaccination at birth, 41% will prefer initiating vaccination at 1 to 2 months with a combination vaccine when a pentavalent vaccine becomes available (Table 3). Thirty-two percent of pediatricians who currently prefer to give the birth dose but complete the series with the Hib-hepatitis B combination vaccine will prefer to use only a combination vaccine when a pentavalent vaccine becomes available.

**TABLE 1.** Pediatricians Who Give the Birth Dose of Hepatitis B Vaccine to All Infants by Practice Characteristics

<table>
<thead>
<tr>
<th>Practice Characteristic</th>
<th>Number of Providers*</th>
<th>Number in Each Group Who Give the Birth Dose</th>
<th>( P ) Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>270</td>
<td>135 (50%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Location of practice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>122</td>
<td>46 (38%)</td>
<td></td>
</tr>
<tr>
<td>Urban—not inner city</td>
<td>68</td>
<td>38 (56%)</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>42</td>
<td>22 (52%)</td>
<td></td>
</tr>
<tr>
<td>Urban—inner city</td>
<td>36</td>
<td>27 (75%)</td>
<td></td>
</tr>
<tr>
<td>Practice type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group practice: 5 or more doctors</td>
<td>113</td>
<td>54 (48%)</td>
<td>.002</td>
</tr>
<tr>
<td>Group practice: 2 to 4 doctors</td>
<td>62</td>
<td>28 (45%)</td>
<td></td>
</tr>
<tr>
<td>Hospital-medical school-based</td>
<td>34</td>
<td>25 (74%)</td>
<td></td>
</tr>
<tr>
<td>Solo practice</td>
<td>32</td>
<td>14 (44%)</td>
<td></td>
</tr>
<tr>
<td>City or county hospital, nonprofit clinic</td>
<td>12</td>
<td>9 (75%)</td>
<td></td>
</tr>
<tr>
<td>Health maintenance organization</td>
<td>11</td>
<td>1 (9%)</td>
<td></td>
</tr>
<tr>
<td>Practice size (number of newborns entering practice per month)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 or fewer newborns per month</td>
<td>117</td>
<td>59 (50%)</td>
<td>.92</td>
</tr>
<tr>
<td>11–20</td>
<td>58</td>
<td>28 (48%)</td>
<td></td>
</tr>
<tr>
<td>&gt;30</td>
<td>93</td>
<td>48 (52%)</td>
<td></td>
</tr>
<tr>
<td>Provider gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>137</td>
<td>63 (46%)</td>
<td>.25</td>
</tr>
<tr>
<td>Female</td>
<td>130</td>
<td>69 (53%)</td>
<td></td>
</tr>
<tr>
<td>Finished residency before 1991</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>148</td>
<td>76 (51%)</td>
<td>.62</td>
</tr>
<tr>
<td>No</td>
<td>122</td>
<td>59 (48%)</td>
<td></td>
</tr>
<tr>
<td>State of practice: screening laws for maternal HBsAg status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>148</td>
<td>75 (51%)</td>
<td>.7</td>
</tr>
<tr>
<td>No</td>
<td>122</td>
<td>59 (48%)</td>
<td></td>
</tr>
<tr>
<td>State of practice: reporting of HBsAg-positive mother laws</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>154</td>
<td>79 (51%)</td>
<td>.62</td>
</tr>
<tr>
<td>No</td>
<td>116</td>
<td>56 (48%)</td>
<td></td>
</tr>
<tr>
<td>State of practice: distribution policies for vaccinating children</td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Vaccines supplied for VFC only</td>
<td>129</td>
<td>55 (43%)</td>
<td></td>
</tr>
<tr>
<td>Vaccines for underinsured and VFC</td>
<td>95</td>
<td>43 (45%)</td>
<td></td>
</tr>
<tr>
<td>Universal vaccination policy</td>
<td>46</td>
<td>37 (80%)</td>
<td></td>
</tr>
<tr>
<td>How often the pediatrician is aware of maternal HBsAg status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>while visiting an infant in the hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;75% of the time</td>
<td>18</td>
<td>13 (72%)</td>
<td>.04</td>
</tr>
<tr>
<td>&gt;75% of the time</td>
<td>242</td>
<td>114 (48%)</td>
<td></td>
</tr>
<tr>
<td>How often the mother identifies pediatrician as infant’s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>provider before birth of the infant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50% of the time</td>
<td>101</td>
<td>62 (61%)</td>
<td>.004</td>
</tr>
<tr>
<td>&gt;50% of the time</td>
<td>162</td>
<td>69 (43%)</td>
<td></td>
</tr>
</tbody>
</table>

* Number of providers do not sum to 270 for some questions because of missing responses.
† \( \chi^2 \) \( P \) value for difference in percent who give the birth dose by group.
Role of Pediatricians in Making Hospital Policy (Fig 2)

Forty percent of pediatricians indicated that labor and delivery is responsible for transferring information regarding maternal HBV serostatus to the infant’s pediatrician, and 36% of pediatricians indicated this is the responsibility of the nursery staff. Sixty-eight percent of pediatricians identified the infant’s pediatrician as the person responsible for ensuring infants of mothers who are seropositive or of unknown serostatus for HBV receive the proper immunoprophylaxis. Most respondents agreed that pediatricians should be included on hospital committees forming policy on maternal screening (93%), transfer of information regarding maternal HBsAg
status (98%), and immunoprophylaxis of infants born to HBsAg-positive mothers (99%). Living in a state with mandatory screening laws was independent of a pediatrician’s opinion concerning the pediatrician’s role in hospital policy-making regarding maternal screening.

**DISCUSSION**

Although almost all pediatricians have adopted the recommendation for universal infant hepatitis B immunization, pediatricians were evenly divided between initiating the first dose at birth or at 2 months of age. Offering the vaccine at birth was significantly associated with practicing in an inner-city location and being hospital-based or associated with a medical school. These findings are encouraging in that these providers are probably more likely to care for infants born to women who are at higher risk of chronic HBV infection. However, not all pediatricians with these practice characteristics offered the

<table>
<thead>
<tr>
<th>Current Vaccination Schedule</th>
<th>N</th>
<th>Preferred Immunization Schedule When DTaP, Inactivated Polio Virus, Hepatitis B Combination Vaccine Becomes Available</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single Antigen at Birth, Complete With Single Antigen</td>
<td>Single Antigen Vaccine at Birth, Complete With Combination Vaccine</td>
</tr>
<tr>
<td>Single antigen at birth, complete series with single antigen</td>
<td>74</td>
<td>32%</td>
<td>24%</td>
</tr>
<tr>
<td>Single antigen vaccine at birth, complete series with Comvax</td>
<td>63</td>
<td>22%</td>
<td>46%</td>
</tr>
<tr>
<td>Single antigen vaccine at 2 months, complete series with single antigen</td>
<td>35</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>Combination vaccine, begin series at 2 months</td>
<td>80</td>
<td>4%</td>
<td>5%</td>
</tr>
</tbody>
</table>

* Respondents who preferred not to give hepatitis B vaccine to infants (n = 6) are not included in this table.

**Fig 2.** Person or party identified by pediatrician as being responsible for perinatal prevention of hepatitis B infection.
birth dose. Commonly perceived barriers to offering the birth dose included difficulty in tracking vaccines given in the hospital and increased cost of immunizing in the hospital.

Living in a state with a universal immunization distribution policy was associated with offering the birth dose to all infants. The cost of an immunization does not act as a barrier against the birth dose for providers in these states. When a DTaP, inactivated poliovirus vaccine, and hepatitis B combination vaccine becomes available, the number of pediatricians who prefer not to give the birth dose is likely to increase. In addition, over 80% of pediatricians in this survey will prefer to use a combination vaccine either for all doses or for doses subsequent to the birth dose.

Pediatricians feel responsible for ensuring that proper immunoprophylaxis is given to infants of mothers whose HBsAg status is positive or unknown, but feel labor and delivery and the nursery staff should be responsible for transfer of information regarding maternal HBsAg status. Ninety-nine percent of pediatricians in this survey believe pediatricians should play a role in establishing hospital policies regarding the prevention of perinatal hepatitis B transmission.

Reports have shown that the 1999 hepatitis B policy shift toward thimerosal-free vaccines had a major impact on the use of the birth dose. Furthermore, the policy change was misinterpreted by some hospitals that even stopped immunizing infants of mothers who were not screened for HBsAg. Our study blends into the literature by identifying factors related changes in birth dose practices and since the consistent with previous reports indicating that 55% of pediatricians in this survey will prefer to use a combination vaccine either for all doses or for doses subsequent to the birth dose.

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This study shows that most pediatricians are practicing within current recommendations regarding hepatitis B immunization of infants. In the awareness-to-adherence model, Pathman et al showed that in regards to hepatitis B immunization, physicians generally must agree with a recommendation before they adopt it into their practice. Our study fits this model well, with a similar rate of respondents agreeing and adopting the birth dose recommendation. Ninety percent of pediatricians who offered the birth dose believed the birth dose should be offered.

Conducting the study more than a year after thimerosal-free vaccine has been available and before introduction of the pentavalent combination vaccine affords an evaluation of pediatrician attitudes and practices at an important time in development of childhood vaccine policy. A major implication of this study is that efforts to achieve high rates of hepatitis B birth dose practice may falter once a pentavalent combination vaccine is introduced. The use of the birth dose at projected rates may not provide an effective safety net for preventing perinatal HBV transmission if screening for HBsAg is not performed universally. These results underscore the need to ensure that effective mechanisms are in place to identify and administer timely immunoprophylaxis to infants born to HBsAg-positive women. In addition, all infants born to mothers not screened for HBsAg before or after delivery should receive the birth dose of hepatitis B vaccine.

Addressing barriers to birth dose immunization, such as increased vaccine cost, may improve birth dose rates. Strategies to improve birth dose immunization, especially in areas where prevalence of chronic HBV among women of childbearing age may be high, should include educating providers about the risk of perinatal transmission of HBV and the association of the birth dose with increased likelihood of completion of the 3-dose series.

A strength of this study is that our sample population was derived from the AAP membership database. More than 75% of pediatricians are listed in this database, and the vast majority of children receive their immunizations from pediatricians. A weakness of the study is that we have little information about how characteristics, attitudes, and practices may differ among pediatricians who are not listed in the AAP database. We also have little information about birth dose-related attitudes and practices of other types of providers, including family physicians. In 1999, a national study reported that of children receiving vaccines within a medical home, 70% were vaccinated solely by pediatricians, 12% solely by family physicians, and 18% by a combination of provider types. In our survey questionnaire, we did not include open-ended questions to examine whether there were additional reasons why providers found it difficult to provide the birth dose. This study assessed self-reported attitudes and practices that were not verified by chart review.

Although the birth dose is associated with a greater likelihood of completion of the hepatitis B vaccine series, the use of combination vaccines may also increase the likelihood of series completion by reducing the number of vaccine doses that need to be administered simultaneously. Administration of the birth dose is a good public health practice because it acts as a safety net in protecting infants of HBsAg-positive mothers who fail to be identified. However, the current recommendations allow for selective use of the birth dose, and initiation of hepatitis B vaccination at 1 to 2 months of age for a child whose mother is HBsAg-negative is an acceptable schedule according to the ACIP and the AAP. In this context, it is incumbent on the provider of the child to ensure that if the birth dose is not given, the mother’s HBsAg status is documented to be negative.

Research should be conducted to identify methods to improve universal screening of women for HBsAg. A hospital-based evaluation conducted nationally in 1993 reported that only 22% of infants born to mothers of unknown HBsAg status received the birth dose. However, limited information is available regarding how well providers currently administer the birth dose to infants born to unscreened mothers. Our findings indicate that some pediatri-
cians do not offer hepatitis B vaccine at birth to infants of HBsAg status unknown mothers. Additional research can also help identify the most effective strategies for ensuring every high-risk infant receives the birth dose of hepatitis B vaccine.

With the addition of new vaccines to the recommended childhood immunization schedule, providers will increasingly favor using combination vaccines and initiating hepatitis B vaccination at 1 to 2 months of age of the child. If this occurs, identification of HBsAg-positive pregnant women must be intensified to ensure that prophylaxis of these infants at birth is provided. Administering a birth dose to all infants avoids a missed opportunity for immunization and reduces the number of doses that need to be given subsequently. In this context, perhaps novel immunization strategies, such as using new combination vaccines at birth, could be studied.

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REFERENCES

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