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 immunizations 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 all infants would prefer to wait until 2 months of age to initiate hepatitis B immunization.


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 answers "answer 20 of 7 tionnaire, 37 could not be located by additional fol-
Survey Questions and Analysis
phone call was made to physicians
questionnaire was mailed to sampled subjects. Pediatricians who
represents approximately 77% of practicing pediatricians in the
in the United States. Participants were selected randomly from the
by practice size, physician gender, finishing a resi-
ner-city, urban areas being more likely to administer
the birth dose compared with rural, suburban, and
noninner-city urban area pediatricians (Table 1). Pediatric-
ne participation, with pediatricians practicing in inner-
organization practices. Pediatricians living in a state
remaining 563 completed the survey giving an over-
all response rate of 68%. One hundred three of 382
respondents were excluded from the study because they
did not provide routine immunizations. Two hundred seventy-seven (99%) of the remaining 279 respondents provided hepatitis B vaccine to infants. Among these, 7 did not respond to the question regarding whether they offered the birth dose. The remainder of this report presents information provided by the remaining 270 respondents.

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 receive 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.
The percentage of pediatricians who currently admin-
ister the birth dose varied significantly by location of practice, with pediatricians practicing in inner-
city, urban areas being more likely to administer
the birth dose compared with rural, suburban, and noninner-city urban area pediatricians (Table 1). Pediatricians 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
then 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 responders 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

METHODS
Subjects and Design
We surveyed a national sample of 600 pediatricians practicing
in the United States. Participants were selected randomly from the
AAP membership database of 35,770 eligible pediatricians, which
represents approximately 77% of practicing pediatricians in the
United States (T. L. Joseph, AAP, written communication, October
2001). Study eligibility criteria included active AAP membership,
address listed as being in the United States, and AAP status of
fellow or lifetime member. In November 2000, a standardized
questionnaire was mailed to sampled subjects. Pediatricians who
did not respond to the initial mailing were mailed the question-
naire up to 2 more times between January and March 2001. One
phone call was made to physicians’ offices to locate pediatricians
who failed to respond to the second mailing. The institutional
review board of the Centers for Disease Control and Prevention
approved this study.

Survey Questions and Analysis
Participants were asked: “To which infants do you offer hepa-
titis B vaccine at birth, before discharge from the hospital?” The
answer “all infants” was categorized as offering the birth dose.
The answers “infants of HBsAg-positive mothers only” or “infants of
HBsAg-positive and unknown status mothers only” were
categorized as not offering the birth dose to all infants. Practice
characteristics, preferences, and perceived barriers and advan-
tages of the birth dose were asked using multiple-choice and
Likert scale responses.
Study variables were constructed from survey responses. Biva-
riate association between provider and practice characteristics and
whether the respondent offered the birth dose was assessed using
the χ2 test.

RESULTS
Of the 600 pediatricians initially mailed the ques-
37 could not be located by additional follow-up attempts. Three hundred eighty-two of the
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.
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

**TABLE 2.** Pediatricians Who Give the Birth Dose of Hepatitis B Vaccine to All Infants by Selected Provider Beliefs Regarding the Birth Dose

<table>
<thead>
<tr>
<th>Belief Regarding the Birth Dose</th>
<th>Number of Providers*</th>
<th>Number in Each Group Who Give Birth Dose (%)</th>
<th>$P$ Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The birth dose is important because:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It decreases the risk of perinatal HBV transmission.</td>
<td>195</td>
<td>106 (54%)</td>
<td>.02</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>195</td>
<td>106 (54%)</td>
<td>.02</td>
</tr>
<tr>
<td>Neutral</td>
<td>41</td>
<td>14 (33%)</td>
<td>.02</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>27</td>
<td>10 (37%)</td>
<td>.02</td>
</tr>
<tr>
<td>It increases likelihood of completion of the 3-dose series.</td>
<td>171</td>
<td>108 (63%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>171</td>
<td>108 (63%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neutral</td>
<td>54</td>
<td>15 (27%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>39</td>
<td>8 (21%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>The birth dose is difficult to give because:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracking vaccines given in the hospital is difficult.</td>
<td>102</td>
<td>30 (29%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>102</td>
<td>30 (29%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neutral</td>
<td>31</td>
<td>14 (45%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>132</td>
<td>87 (66%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>There is increased cost to vaccinating in the hospital.</td>
<td>73</td>
<td>18 (25%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>73</td>
<td>18 (25%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neutral</td>
<td>65</td>
<td>28 (43%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>129</td>
<td>87 (67%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Insurance may not reimburse for vaccination in the hospital.</td>
<td>68</td>
<td>16 (24%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>68</td>
<td>16 (24%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neutral</td>
<td>77</td>
<td>37 (45%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>116</td>
<td>77 (66%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Parents are unwilling to vaccinate their child at such early age.</td>
<td>54</td>
<td>25 (46%)</td>
<td>.07</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>54</td>
<td>25 (46%)</td>
<td>.07</td>
</tr>
<tr>
<td>Neutral</td>
<td>51</td>
<td>19 (37%)</td>
<td>.07</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>158</td>
<td>87 (55%)</td>
<td>.07</td>
</tr>
<tr>
<td>There are safety concerns related to administering a vaccine to neonates.</td>
<td>29</td>
<td>9 (31%)</td>
<td>.07</td>
</tr>
<tr>
<td>Strongly agree or agree</td>
<td>29</td>
<td>9 (31%)</td>
<td>.07</td>
</tr>
<tr>
<td>Neutral</td>
<td>46</td>
<td>21 (46%)</td>
<td>.07</td>
</tr>
<tr>
<td>Disagree or strongly disagree</td>
<td>184</td>
<td>98 (53%)</td>
<td>.07</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.

![Fig 1. Pediatricians' current preferred option for infant hepatitis B vaccination and preference if a pentavalent vaccine became available.](http://pediatrics.aappublications.org/)

**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

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**TABLE 3.** Pediatricians’ Projected Immunization Practices When Combination DTaP, Inactivated Polio Virus, and Hepatitis B Vaccine Becomes Available in Relation to Current Immunization Practices*

<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.

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**Fig 2.** Person or party identified by pediatrician as being responsible for perinatal prevention of hepatitis B infection.

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**Fig 2.** Person responsible for assuring proper immunoprophylaxis is given to infants of HBsAg positive or unknown mothers.
birth dose. Commonly perceived barriers to offering the birth dose included difficulty in tracking vaccines given in the hospital and increased cost of immunization 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 associated with use of the birth dose and the desired role of pediatricians in establishing hospital policy for perinatal hepatitis B prevention. Our findings are consistent with previous reports indicating that 55% of infants received the birth dose before thimerosal-related changes in birth dose practices and since the availability of thimerosal-free vaccine, rates have increased but not fully rebounded to their previous levels of immunization.

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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