

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.

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). URL: <http://www.pediatrics.org/cgi/content/full/108/6/e98>; *policy, hepatitis B, immunization, infant, pediatrician, practice, provider, vaccination.*

ABBREVIATIONS. HBV, hepatitis B virus; ACIP, Advisory Committee on Immunization Practices; AAP, American Academy of Pediatrics; HBsAg, hepatitis B surface antigen; Hib, *Haemophilus influenzae* type b; DTaP, diphtheria and tetanus toxoids and acellular pertussis vaccine.

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-

From the National Immunization Program, Centers for Disease Control and Prevention, Atlanta, Georgia.

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Reprint requests to (H.Y.) National Immunization Program/Centers for Disease Control and Prevention, 1600 Clifton Rd, Mailstop E-52, Atlanta, GA 30333. E-mail: hyusuf@cdc.gov

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tration did not rebound to the levels seen before the temporary changes in the policy.^{11–15}

The addition of more vaccines and introduction of combination vaccines add to the increasingly complex infant immunization schedule. Combination vaccines will help to decrease the number of injections an infant receives at 1 visit, but they are not approved for administration at birth. The currently available *Haemophilus influenzae* type b (Hib)–hepatitis B combination vaccine and a diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), inactivated poliovirus vaccine, and hepatitis B combination vaccine (pentavalent vaccine) currently under development should not be given in the newborn period. Infants born to HBsAg-positive mothers or mothers of indeterminate serologic status would continue to require prophylaxis against vertical transmission of HBV at birth.

We report results of a study about factors influencing pediatricians' decisions to offer the birth dose of hepatitis B vaccine. The objectives of this study were to evaluate 1) the attitudes and practices of pediatricians in the United States regarding the decision to offer the hepatitis B vaccine at birth or at 1 to 2 months of age to all infants, 2) perceived barriers to giving a birth dose, 3) the effect that combination vaccines may have on use of the birth dose, and 4) the desired roles of pediatricians in establishing and implementing hospital policy regarding prevention of perinatal hepatitis B infection.

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 questionnaire 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 hepatitis 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 advantages of the birth dose were asked using multiple-choice and Likert scale responses.

Study variables were constructed from survey responses. Bivariate association between provider and practice characteristics and whether the respondent offered the birth dose was assessed using the χ^2 test.

RESULTS

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

remaining 563 completed the survey giving an overall 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 vaccinated 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 administer 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 practices 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 providers 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 residency 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 because it decreases risk of perinatal HBV transmission, and 65% agreed or strongly agreed that the birth dose is important because it increases the likelihood of completion of the 3-dose hepatitis B vaccine

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

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

* Number of providers do not sum to 270 for some questions because of missing responses.

† χ^2 P value for difference in percent who give the birth dose by group.

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

Belief Regarding the Birth Dose	Number of Providers*	Number in Each Group Who Give Birth Dose (%)	P Value†
The birth dose is important because:			
It decreases the risk of perinatal HBV transmission.			
Strongly agree or agree	195	106 (54%)	.02
Neutral	41	14 (33%)	
Disagree or strongly disagree	27	10 (37%)	
It increases likelihood of completion of the 3-dose series.			
Strongly agree or agree	171	108 (63%)	<.001
Neutral	54	15 (27%)	
Disagree or strongly disagree	39	8 (21%)	
The birth dose is difficult to give because:			
Tracking vaccines given in the hospital is difficult.			
Strongly agree or agree	102	30 (29%)	<.001
Neutral	31	14 (45%)	
Disagree or strongly disagree	132	87 (66%)	
There is increased cost to vaccinating in the hospital.			
Strongly agree or agree	73	18 (25%)	<.001
Neutral	65	28 (43%)	
Disagree or strongly disagree	129	87 (67%)	
Insurance may not reimburse for vaccination in the hospital.			
Strongly agree or agree	68	16 (24%)	<.001
Neutral	77	37 (48%)	
Disagree or strongly disagree	116	77 (66%)	
Parents are unwilling to vaccinate their child at such early age.			
Strongly agree or agree	54	25 (46%)	.07
Neutral	51	19 (37%)	
Disagree or strongly disagree	158	87 (55%)	
There are safety concerns related to administering a vaccine to neonates.			
Strongly agree or agree	29	9 (31%)	.07
Neutral	46	21 (46%)	
Disagree or strongly disagree	184	98 (53%)	

* Number of providers do not sum to 270 for some questions because of missing responses.

† χ^2 P value for difference in percent who give the birth dose by group.

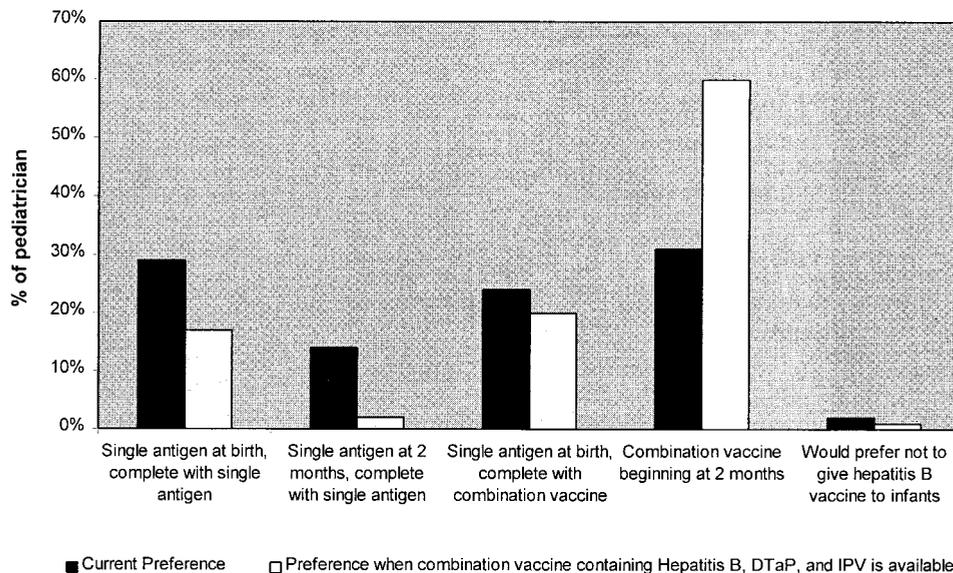


Fig 1. Pediatricians' current preferred option for infant hepatitis B vaccination and preference if a pentavalent vaccine became available.

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 in-

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

Current Vaccination Schedule	N	Preferred Immunization Schedule When DTaP, Inactivated Polio Virus, Hepatitis B Combination Vaccine Becomes Available				Total
		Single Antigen at Birth, Complete With Single Antigen	Single Antigen Vaccine at Birth, Complete With Combination Vaccine	Single Antigen Vaccine at 2 Months, Complete With Single Antigen	Combination Vaccine, Begin at 2 Months	
Single antigen at birth, complete series with single antigen	74	32%	24%	3%	41%	100%
Single antigen vaccine at birth, complete series with Comvax	63	22%	46%	0%	32%	100%
Single antigen vaccine at 2 months, complete series with single antigen	35	8%	3%	6%	83%	100%
Combination vaccine, begin series at 2 months	80	4%	5%	0%	91%	100%

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

Responsible party for transfer of maternal HBsAg status to infant's pediatrician

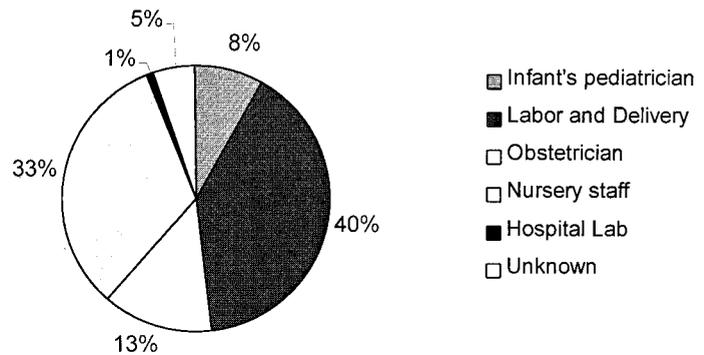
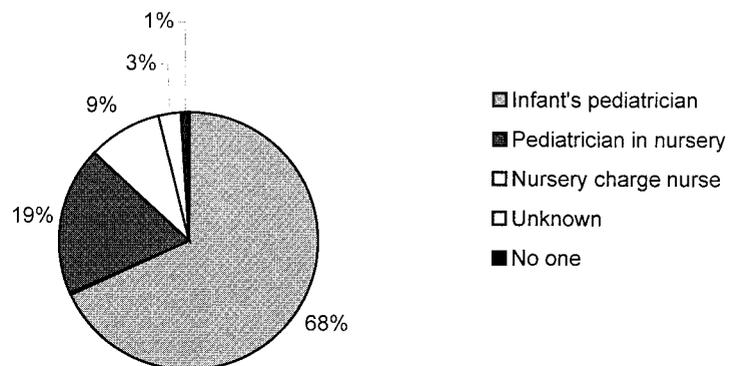


Fig 2. Person or party identified by pediatrician as being responsible for perinatal prevention of hepatitis B infection.

Person responsible for assuring proper immunoprophylaxis is given to infants of HBsAg positive or unknown mothers



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

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.¹²⁻¹⁶ Furthermore, the policy change was misinterpreted by some hospitals that even stopped immunizing infants of mothers who were not screened for HBsAg.¹³ 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.¹³⁻¹⁵

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 al¹⁷ 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 peri-

natal 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.¹⁸ 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.¹⁸ 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.¹⁹ 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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