

# Progress in Coverage With Hepatitis B Vaccine Among US Children, 1994–1997

## ABSTRACT

**Objectives.** This study was done to assess progress in hepatitis B vaccination of children from 1994 through 1997.

**Methods.** We used data from the National Immunization Survey (NIS), a random-digit-dialed telephone survey that includes a mail survey to verify vaccination providers' records. The NIS is conducted in 78 geographic areas (50 states and 28 selected urban areas) in the United States.

**Results.** A total of 32 433 household interviews were completed in the 1997 NIS. An estimated 83.7% of children aged 19 to 35 months received 3 or more doses of hepatitis B vaccine. Coverage with 3 doses was greater (86.7%) among children in states that had day care entry requirements for hepatitis B vaccination than among children in states without such requirements (83.0%) and was greater among children from families with incomes at or above the poverty level (85.0%) than among children below the poverty level (80.6%). Hepatitis B vaccination of children increased from 1994 through 1996, from 41% to 84%, but coverage reached a constant level of 84% to 85% in 1996/97.

**Conclusion.** Although substantial progress has been made in fully vaccinating children against hepatitis B, greater efforts are needed to ensure that all infants receive 3 doses of hepatitis B vaccine. (*Am J Public Health.* 1999;89:1684–1689)

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An estimated 1 million to 1.25 million people in the United States are chronically infected with hepatitis B virus (HBV),<sup>1</sup> and 100 000 to 150 000 new infections occur each year (Centers for Disease Control and Prevention [CDC], unpublished data, 1996). Infants and children infected with HBV are much more likely to develop chronic HBV infections than are adults (30%–60% vs 5%–10%),<sup>2</sup> and approximately one third of chronic HBV infections in the United States result from exposures during the perinatal period and early childhood.<sup>2</sup> Persons with chronic HBV infection are at high risk of morbidity and mortality from chronic liver diseases such as cirrhosis and primary hepatocellular carcinoma.<sup>1,3</sup> It is estimated that chronic HBV infection increases the risk for developing hepatocellular carcinoma by as much as 200-fold.<sup>2</sup>

HBV infections can be prevented through routine vaccination of infants. Hepatitis B vaccines manufactured with recombinant DNA technology have been shown to be safe and efficacious and to provide long-term protection against infection with HBV.<sup>1,2</sup> Almost all of the 95% of infants who develop high titers of antibody to hepatitis B surface antigen after receiving the vaccine are protected against HBV infection.<sup>2,4,5</sup> Moreover, by producing long-term immunologic memory of HBV, hepatitis B vaccination of infants may help prevent HBV infections later in life, when these infants have become adolescents and adults and are more likely to engage in behaviors or occupations that put them at a high risk for infection.<sup>6,7</sup> Although levels of antibody decline within a year after the third dose of hepatitis B vaccine, studies have shown that vaccination protects against serious HBV infection and clinical hepatitis for at least 10 years.<sup>2</sup>

As part of a comprehensive strategy to eliminate transmission of HBV in the United

States, the Advisory Committee on Immunization Practices (ACIP) in 1991 published recommendations calling for vaccination of all infants with 3 doses of hepatitis B vaccine by 18 months of age, with the first dose preferably being administered at birth.<sup>1</sup> Similar recommendations were also published by the American Academy of Pediatrics and the American Academy of Family Physicians.<sup>8,9</sup> Although providers of pediatric care were initially slow to accept the ACIP recommendations, recent reports indicate that universal infant vaccination is becoming fully incorporated into routine pediatric practice.<sup>10–12</sup> In this report we summarize data from the National Immunization Survey (NIS) for the years 1994 to 1997 to examine the progress in hepatitis B vaccination of children 19 to 35 months of age.

## Methods

The NIS, which began collecting information on the immunization status of children

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in 1994, uses a 2-phase design.<sup>13</sup> Phase 1 involves the generation of a quarterly, list-assisted, random-digit-dialed sample of telephone numbers for each of 78 geographic areas (50 states and 28 selected urban areas) in the United States. A screening questionnaire is administered to respondents 18 years or older to identify households with 1 or more children aged 19 to 35 months. All respondents are asked to provide demographic and vaccination information, using written records with vaccination dates for all age-eligible children. In the absence of written records, reports from recall are also accepted. Respondents are also asked for consent to contact all of their children's immunization providers.

In phase 2 of the NIS, vaccination information is requested from health care providers of children surveyed in phase 1 for whom consent was obtained to get this information. Data are weighted to represent the entire group of children surveyed and to account for household nonresponse, natality data, and the lower rate of vaccination coverage of children in households without telephones (CDC, unpublished data, 1996).<sup>14</sup>

The NIS design allows 4 consecutive quarters (i.e., the 4 quarters of 1997) to be combined; it also allows pairs of adjacent quarters (i.e., the last 2 quarters of 1997) to be combined. Using NIS data from all 4 quarters of 1997, we estimated vaccination coverage by (1) race/ethnicity, (2) whether or not a child's state of residence had a day care entry requirement for hepatitis B vaccination, (3) metropolitan statistical area (MSA) vs non-MSA residence, and (4) poverty level. Progress in hepatitis vaccination coverage was assessed with NIS data from each consecutive 2 quarters (e.g., July–December of 1994) from July 1994 to December 1997.

MSA vs non-MSA residence was determined from telephone exchange and postal zip-code numbers. Poverty level was determined on the basis of self-reported family income and household size, according to thresholds established by the US Bureau of the Census for 1997. In 1995 (in time to potentially effect vaccination coverage among children who were 19 to 35 months of age by 1997), only 11 states had enacted laws requiring all children to be fully vaccinated with hepatitis B vaccine before their admission into day care centers or schools.

During 1997, a total of 32 433 household interviews were completed in the NIS, representing 32 742 children, for an average of 420 children in each of the 78 NIS geographic survey areas. The overall response rate for households with children aged 19 to 35 months for all 78 survey areas was 82.9% (range: 72.0%–89.1%). Demographic characteristics and reported vaccination histories

**TABLE 1—Coverage With 3 or More Doses of Hepatitis B Vaccine Among Children Aged 19–35 Months: National Immunization Survey, 1997**

	% (95% CI)	P <sup>a</sup>
All children	83.7 (83.2, 84.2)	
Non-Hispanic White	84.7 (84.1, 85.3)	Reference group
Non-Hispanic Black	82.7 (81.4, 84.0)	<.01
Hispanic	81.2 (79.8, 82.6)	<.01
American Indian/Alaskan Native	82.9 (78.6, 87.2)	.90
Asian/Pacific Islander	87.6 (85.2, 90.0)	<.05

Note. CI = confidence interval.

<sup>a</sup>z test P value for difference in coverage with respect to the reference group.

**TABLE 2—Coverage With 3 or More Doses of Hepatitis B Vaccine Among Children Aged 19–35 Months, by Presence of Hepatitis B Vaccine Day Care Entry Requirement, Metropolitan Statistical Area (MSA) vs non-MSA Residence, and Income Level: National Immunization Survey, 1997**

	% (95% CI)	P <sup>a</sup>
State of residence has hepatitis B vaccination day care entry, <sup>b</sup>		
yes/no	86.7 (85.7, 87.7)	Reference group
MSA residence	83.0 (82.4, 83.6)	<.01
Non-MSA residence	83.6 (83.0, 84.2)	Reference group
Income status	84.7 (83.7, 85.7)	.06
At or above poverty level	85.0 (84.4, 85.6)	Reference group
Below poverty level	80.6 (79.4, 81.8)	<.01
Unknown	83.3 (82.0, 83.6)	<.05

Note. CI = confidence interval.

<sup>a</sup>z test P value for difference in coverage with respect to the reference group.

<sup>b</sup>As of January 31, 1995, the following states required 3 doses of hepatitis B vaccination for entry into day care: Arizona, Connecticut, Georgia, Idaho, Kentucky, Montana, New Hampshire, New York, North Carolina, Rhode Island, Vermont.

were similar for children with and without provider information (CDC, unpublished data, 1997).

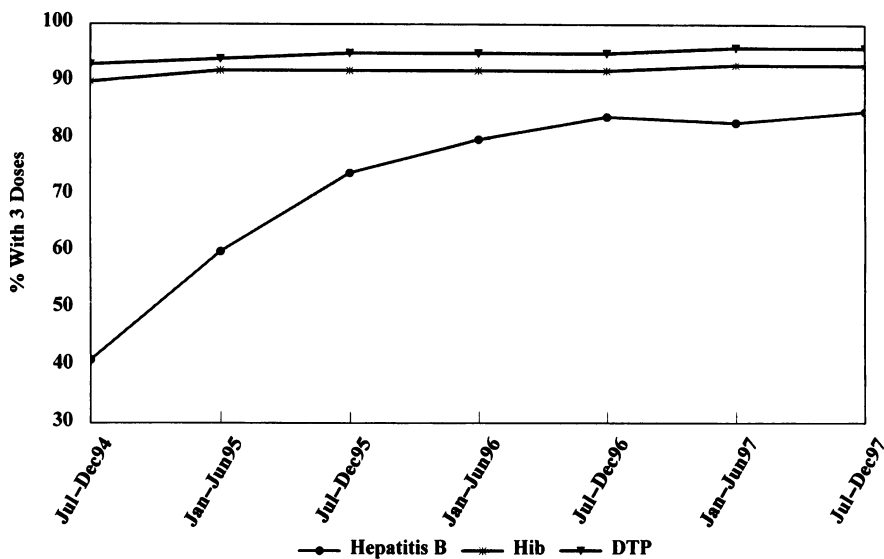
## Results

An estimated 83.7% (95% confidence interval [CI] = 83.2%, 84.2%) of children aged 19 to 35 months in 1997 (January–December) had received 3 doses of hepatitis B vaccine (Table 1). An additional 2.7% (95% CI = 2.5%, 2.9%) and 9.2% (95% CI = 8.8%, 9.6%) of children had received only 1 and only 2 doses of the vaccine, respectively (data not shown). Coverage varied slightly among non-Hispanic White, non-Hispanic Black, Hispanic, and American Indian and Alaskan Native children aged 19 to 35 months (range: 81.2%–84.7%). The coverage was somewhat greater (87.6%) among Asian and Pacific Islander children.

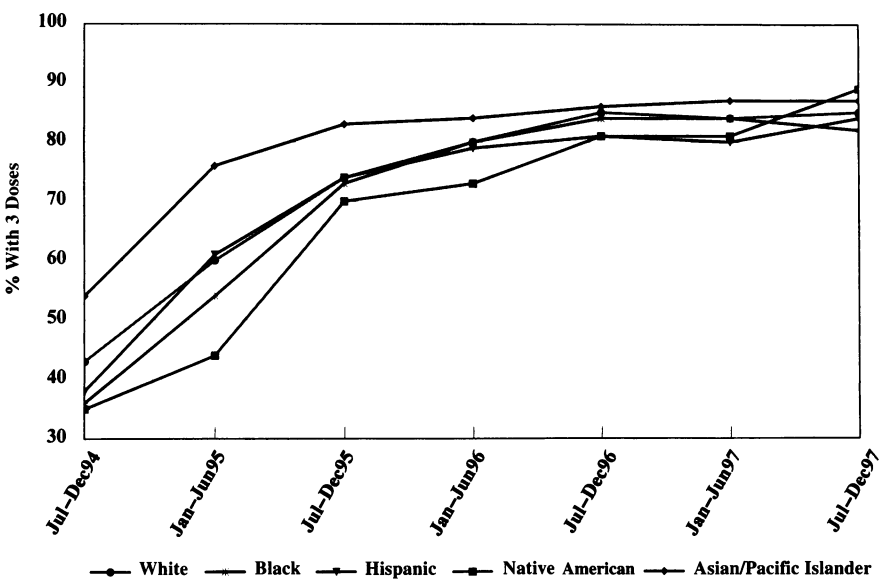
A significantly greater proportion of children in states with day care entry require-

ments for hepatitis B vaccination had received 3 doses of hepatitis B vaccine than had children in states without this requirement ( $P < .01$ ) (Table 2). In addition, coverage with 3 doses of vaccine was significantly greater among children from families with income at or above the poverty level than among children from families with income below the poverty level ( $P < .01$ ). There was no significant difference in 3-dose hepatitis B vaccination by MSA vs non-MSA residence.

Examination of NIS data for 1994 through 1997 indicated that from 1994 (July–December) to 1996 (July–December), coverage with 3 doses of hepatitis B vaccine increased rapidly (from 41.2% to 83.8%) among children aged 19 to 35 months (Figure 1); the increase in coverage from 1996 (July–December) to 1997 (July–December) was only 0.8% (from 83.8% to 84.6%). In contrast, from 1994 (July–December) to 1997 (July–December), coverage with 3 or more doses of *Haemophilus influenzae* type b (Hib) vaccine and with 3 doses of diphtheria and tetanus toxoids and



**FIGURE 1—Hepatitis B, *Haemophilus influenzae* type b (Hib), and diphtheria and tetanus toxoids and pertussis (DTP) vaccine coverage among children aged 19 to 35 months: National Immunization Survey, 1992–1997.**



Note. Native American includes American Indians and Alaskan Natives.

**FIGURE 2—Hepatitis B vaccination coverage among children, by race: National Immunization Survey, July–December 1994 through July–December 1997.**

pertussis (DTP) vaccine among children aged 19 to 35 months remained steady at greater than 90%.

After 1996 (July–December), coverage with 3 doses of hepatitis B vaccine stabilized similarly across different categories of race/ethnicity, poverty status, and MSA vs non-MSA residence (Figures 2–4). Gaps in coverage among different race/ethnicity, poverty, and resi-

dence categories, however, became narrower. Whereas in 1994 (July–December) vaccination coverage by race/ethnicity ranged from 35% (Native American children) to 54% (Asian and Pacific Islander children), in 1997 (July–December) coverage ranged from 82% (non-Hispanic Black children) to 89% (Native American children). Coverage among children who were MSA residents and those who were non-

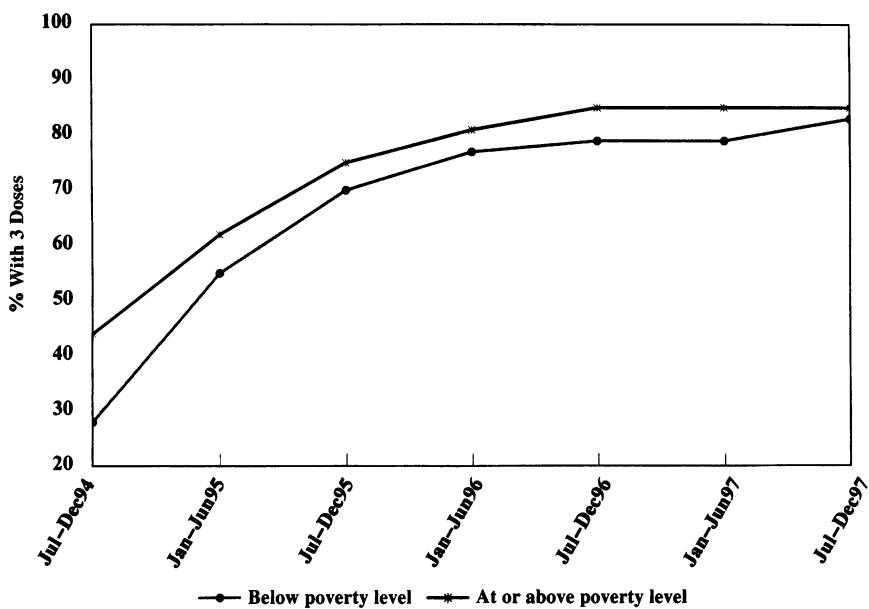
MSA residents rose from 44% and 29%, respectively, in 1994 (July–December) to 84% and 85%, respectively, in 1997 (July–December).

### Discussion

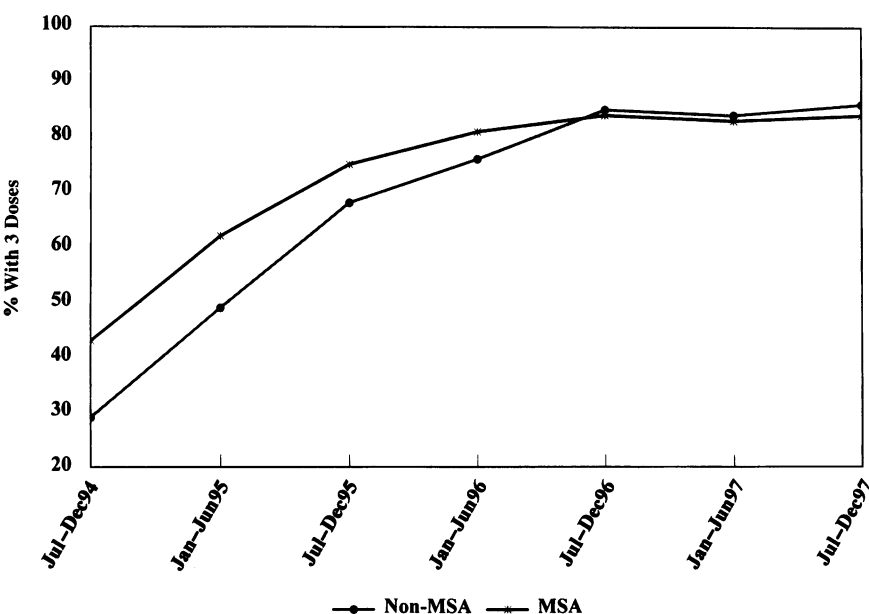
Between 4000 and 5000 persons in the United States die annually of liver diseases resulting from chronic HBV infection.<sup>1,2</sup> The potential for drastically reducing transmission of HBV through widespread vaccination has been demonstrated through routine infant immunization with hepatitis B vaccine among select US populations, including Alaskan Natives and Pacific Islanders. Achievement of a high level of vaccination coverage of children in these populations has virtually eliminated chronic HBV infection among these children.<sup>15–17</sup>

Our results indicate that substantial progress has been made in improving coverage among infants and children with hepatitis B vaccine since the publication of the ACIP recommendations. Accelerated efforts are needed, however, to further increase levels of coverage and to ensure that all children complete the 3-dose vaccination schedule by 18 months of age. We found that 96% of children who were aged 19 to 35 months in 1997 (January–December) had received at least 1 dose of hepatitis B vaccine and that 84% had completed the 3-dose schedule. Three-dose coverage of these children was slightly lower, at 81% (data not shown), by the time they were aged 18 months, which is the age recommended by the ACIP for completion of the hepatitis B vaccination schedule. The vaccination schedule recommended by the ACIP ensures that almost all children develop adequate protection against hepatitis B at an early age.

It is encouraging to see that gaps in hepatitis B vaccination coverage of children on the basis of race/ethnicity have narrowed since 1994. We found that in 1997 (July–December), coverage among non-Hispanic Black, non-Hispanic White, Hispanic, Native American and Alaskan Native, and Asian and Pacific Islander children ranged from 81% to 88%. In the context of the recent US national initiative to reduce racial/ethnic disparities for 6 markers of health, including child and adult immunization, our findings indicate that with respect to hepatitis B vaccination among children, this goal is well on its way to being met. As part of the national Initiative on Race, the US Department of Health and Human Services announced a goal of eliminating, by the year 2010, health disparities in the following critical areas: infant mortality, diabetes, cancer screening and management, heart disease, HIV/AIDS, and child and adult



**FIGURE 3—Hepatitis B vaccination coverage among children, by poverty status: National Immunization Survey, July–December 1994 through July–December 1997.**



**FIGURE 4—Hepatitis B vaccination coverage among children, by metropolitan statistical area (MSA) residence: National Immunization Survey, July–December 1994 through July–December 1997.**

immunizations. Racial/ethnic differences in national levels of coverage with the other vaccines recommended for administration during childhood have been reported, however.<sup>18-20</sup> For example, examination of the 1996 NIS data revealed significantly lower levels of coverage among non-Hispanic Black and His-

panic children than among non-Hispanic White children with all individual vaccines other than hepatitis B vaccine, as well as with the 4:3:1 and 4:3:1:3 series.<sup>20</sup>

School and day care entry requirements have previously been shown to be effective in increasing rates of immunization with vac-

cines other than hepatitis B vaccine, and these requirements have a positive effect on such coverage regardless of race or socioeconomic status.<sup>20</sup> The 1997 NIS data support this, showing significantly higher coverage among 19- to 35-month-old children residing in states with day care entry requirements for hepatitis B vaccination than among those in states without such requirements. Twenty-seven states currently have day care or kindergarten entry requirements or both for hepatitis B vaccination.

Three-dose coverage with hepatitis B vaccine increased steadily, from 41% to 84%, from 1994 (July–December) to 1996 (July–December), and during this period the coverage among all 5 racial/ethnic groups investigated in our study exceeded the goals set by the Childhood Immunization Initiative for these respective years. The Childhood Immunization Initiative is an intensive program for increasing immunization coverage that was put into effect by President Clinton in 1993. This initiative was a comprehensive response to unacceptably low vaccine coverage among children in many areas of the United States,<sup>21,22</sup> and has the goal of ensuring that all children receive the recommended series of 11 to 15 doses of vaccine by their second birthday.<sup>23</sup> The Childhood Immunization Initiative coverage goals for 3-dose hepatitis B vaccination among 2-year-old children were 30% in 1994, 50% in 1995, 70% in 1996, and 90% in 1998. From the end of 1996 to 1997 (July–December), however, there was some leveling off in 3-dose hepatitis B vaccination coverage. Moreover, this leveling was further evident when coverage was observed across race/ethnicity, income status, and MSA vs non-MSA residence. If the trend observed between 1996 and 1997 continues, it is doubtful that the 1998 Childhood Immunization Initiative goal of 90% coverage with 3 doses of hepatitis B vaccine will be met.

In contrast to childhood coverage with hepatitis B vaccine, notwithstanding the progress that has been made, the rate of coverage with 3 doses of Hib vaccine, recommended by the ACIP in 1990, is currently greater than 90%. Coverage with 3 doses of DTP vaccine has remained level, also exceeding 90%. Additionally, the greater than 90% coverage with 3 doses of Hib vaccine and 3 doses of DTP vaccine indicates that this percentage of children made at least 3 visits to providers at which they received vaccines. If the potential for administering the first dose of hepatitis B vaccine at birth (before discharge from the hospital) is included, then more than 90% of US children aged 19 to 35 months have had at least 4 opportunities for receiving hepatitis B vaccine. Clearly, barriers other than contact with a provider are influencing the failure to

attain 90% coverage with 3-dose hepatitis B vaccine.

The current deceleration in coverage levels of hepatitis B vaccination may reflect residual resistance among providers toward the recommendations for universal hepatitis B vaccination. Provider acceptance of these recommendations for infants has risen slowly since their promulgation. A provider survey done in North Carolina in 1991, soon after the ACIP recommendations were published, indicated that only 32% of pediatricians and 17% of family practitioners agreed that all infants should receive hepatitis B vaccine.<sup>11</sup> A survey conducted in late 1993 among more than 3000 pediatricians and family physicians in 9 states found that although 98.4% of the respondents were aware of the recommendations for routine hepatitis B vaccination of infants, only 77.7% had adopted these recommendations, 70.4% were in agreement with them, and 30.1% were adherent to them.<sup>24</sup> Factors affecting provider agreement with and adoption of the infant hepatitis B vaccination recommendations included providers' beliefs that their patients were at low risk for hepatitis B infection, the perception that the vaccine does not give long-term protection, and parental resistance to the vaccine.<sup>24,25</sup> Providers were also concerned about administering multiple injections during a single visit.<sup>10</sup> Another barrier to achieving high coverage may be the lack of funding at state and local levels for hepatitis B vaccination programs and activities.<sup>10,26</sup> State and local immunization programs may find it difficult to address a number of competing priorities (e.g., infant vaccination, perinatal prevention of hepatitis B, adolescent immunization) with limited and sometimes shrinking budgets.

Although current assessment of provider knowledge, attitudes, and practice regarding hepatitis B vaccination is needed, the need for continued provider and parental education about vaccination of all infants is clear. Previous research has shown that provider and/or parental education, conducted as part of a multicomponent strategy that includes other interventions, is effective in increasing immunization coverage.<sup>27</sup> Funding priorities for state and local infant vaccination activities need to be increased or at least maintained. A number of strategies have been effective at the local and community levels in increasing coverage with hepatitis B and/or other vaccinations.<sup>27</sup> These include reminder/recall procedures to advise patients and providers that specific immunizations are due or overdue; assessment of the immunization performance of providers coupled with provider feedback; community education as part of a multicomponent intervention program; and use of the assessment, referral, and vaccine delivery activities of the

US Department of Agriculture's Special Supplemental Nutrition Program for Women (WIC).<sup>27</sup> These strategies should be used wherever feasible to maintain and increase 3-dose hepatitis B vaccination coverage among infants and young children. Special emphasis should be given to identifying populations and groups at risk of lacking 3 doses of hepatitis B vaccine and to implementing targeted strategies to reach these groups. Interventions implemented through the WIC program, for example, can potentially reach a very large number of infants and children in low-income families.<sup>18,28</sup> Additionally, and in accord with the objectives of *Healthy People 2000*<sup>29</sup> and the proposed objectives of *Healthy People 2010* (CDC, unpublished data, 1998), all states should consider establishing school and day care entry requirements for hepatitis B vaccination.

Limitations of this report include the basis of the NIS in a random-digit-dialed telephone survey that does not obtain information from households lacking telephones. The NIS data are weighted to account for children in households without telephones, however, through the use of data from the National Health Interview Survey, which is a face-to-face survey among a nationally representative sample of noninstitutionalized individuals in the United States. This adjustment helps make NIS coverage estimates nationally representative. In addition, because the NIS was begun in April 1994, we were unable to assess hepatitis B vaccination coverage before that time or the progress made in such coverage from 1991, when the universal infant hepatitis B vaccination recommendations were published.

It has been estimated that more than 90% of the US population will need to receive hepatitis B vaccine to effectively eliminate transmission of HBV within the United States.<sup>30</sup> This is a feasible goal, given the achievement of high hepatitis B vaccination coverage among successive birth cohorts, along with adolescent catch-up and high-risk adult vaccination strategies. Effective strategies exist for increasing immunization coverage among target populations. To have the greatest impact, such strategies need to be implemented collaboratively among state and local health departments, communities, and health care providers. □

## Contributors

H. R. Yusuf planned the study, consulted on data analysis, and wrote the paper. V. G. Coronado assisted in designing the study and writing the paper. F. A. Averhoff assisted in planning the study and writing the paper. E. F. Maes assisted in interpreting the data and writing the paper. L. E. Rodewald assisted in planning the study, interpreting the data, and writing the paper. M. P. Battaglia supervised data

analysis and assisted in writing the paper. F. J. Mahoney assisted in planning the study and writing the paper.

## References

- Centers for Disease Control. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep.* 1991;40(RR-13):1-25.
- Mahoney FJ. Hepatitis B virus. In: Long S, Pickering L, Prober C, eds. *Principles and Practice of Infectious Disease*. New York, NY: Churchill Livingstone; 1996:1194-1202.
- Centers for Disease Control. Protection against viral hepatitis: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR Morb Mortal Wkly Rep.* 1990;39:5-22.
- Stevens CE, Taylor PE, Tong MJ, et al. Yeast-recombinant hepatitis B vaccine: efficacy with the hepatitis B immune globulin in prevention of perinatal hepatitis B virus transmission. *JAMA.* 1987;257:2612-2616.
- Poovorawan Y, Sanpavat S, Pongpuniert W, Chumdermpadetsuk S, Sentrakul P, Safary A. Protective efficacy of a recombinant DNA hepatitis B vaccine in neonates of HBeAg positive mothers. *JAMA.* 1989;261:3278-3281.
- Wainwright RB, McMahon BJ, Bulkow LR, et al. Duration of immunogenicity and efficacy of hepatitis B vaccine in a Yupik Eskimo population—preliminary results of an 8-year study. In: Hollinger FB, Lemon SM, Margolis HS, eds. *Viral Hepatitis and Liver Disease*. Baltimore, Md: Williams and Wilkins; 1991:762-766.
- Shapiro CN, Margolis HS. Impact of hepatitis B virus on women and children. *Infect Dis Clin North Am.* 1992;6:75-95.
- American Academy of Pediatrics, Committee on Infectious Diseases. Policy statement: universal hepatitis B immunization. *Pediatrics.* 1992;89:795-800.
- American Academy of Family Physicians. *Recommendations for Hepatitis B Preexposure Vaccination and Postexposure Prophylaxis, 1992*. Kansas City, Mo: American Academy of Family Physicians; 1992. Reprint No. 529.
- Woodruff BA, Stevenson J, Yusuf H, et al. Progress toward integrating hepatitis B vaccine into routine immunization schedules in the United States, 1991 through 1994. *Pediatrics.* 1996;97:798-803.
- Freed GL, Bordley WC, Clark SJ, Konrad TR. Reactions of pediatricians to a new Centers for Disease Control recommendation for universal immunization of infants with hepatitis B vaccine. *Pediatrics.* 1993;91:699-702.
- Mahoney FJ, Smith N, Alter MJ, Margolis H. Progress towards elimination of hepatitis B virus transmission in the United States. *Viral Hepatitis Rev.* 1997;3:105-119.
- Cochran WG. Double sampling. In: Cochran WG. *Sampling Techniques*. 3rd ed. New York, NY: John Wiley & Sons Inc; 1977:327-358.
- Massey JT, Botman SL. Weighting adjustments for random digit dialed surveys. In: Groves RM, Biemer PP, Lyberg LE, Massey JT, Nicholls WL, Waksborg J, eds. *Telephone Survey Methodology*. New York, NY: John Wiley & Sons Inc; 1988:143-160.

15. McMahon B, Rhoades ER, Heyward WL, et al. A comprehensive program to reduce the incidence of hepatitis B virus infection and its sequelae in Alaskan natives. *Lancet*. 1987;2: 1134-1136.
16. Mahoney FJ, Woodruff BA, Erben JJ, et al. Effect of hepatitis B vaccination program on the prevalence of hepatitis B virus infection. *J Infect Dis*. 1993;167:203-207.
17. Mahoney FJ, Woodruff BA, Auerbach S, et al. Progress in the elimination of hepatitis B virus transmission in Micronesia and American Samoa. *Pacific Health Dialog*. 1996;3:140-146.
18. Centers for Disease Control and Prevention. Vaccination coverage by race/ethnicity and poverty level among children aged 19-35 months: United States 1996. *MMWR Morb Mortal Wkly Rep*. 1997;46(RR-xx): 963-969.
19. National Center for Health Statistics. *Health, United States, 1988*. Hyattsville, Md: US Dept of Health and Human Services; 1989:80. DHHS publication PHS 89-1232.
20. National Center for Health Statistics. *Health, United States, 1995*. Hyattsville, Md: US Dept of Health and Human Services; 1993:163. DHHS publication PHS 96-1232.
21. Centers for Disease Control and Prevention. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep*. 1994;43(RR-1): 1-35.
22. Centers for Disease Control and Prevention. Vaccination coverage of 2-year-old children: United States, 1991-1992. *MMWR Morb Mortal Wkly Rep*. 1993;42:985-988.
23. Centers for Disease Control and Prevention. Reported vaccine-preventable diseases: United States, 1993, and the Childhood Immunization Initiative. *MMWR Morb Mortal Wkly Rep*. 1994;43:57-60.
24. Pathman DE, Konrad TR, Freed GL, Freeman VA, Koch GG. The awareness-to-adherence model of the steps to clinical guideline compliance. *Med Care*. 1996;34:873-889.
25. Freed GL, Freeman VA, Clark SJ, Konrad TR, Pathman DE. Pediatrician and family physician agreement with and adoption of universal hepatitis B immunization. *J Fam Pract*. 1996;42: 587-592.
26. Ganiants TG, Bowersox MT, Ralph LP. Universal neonatal hepatitis B immunization: are we jumping on the bandwagon too early? *J Fam Pract*. 1993;36:147-149.
27. Shefer A, Briss P, Rodewald J, et al. Improving immunization coverage rate: an evidence-based review of the literature. *Am J Epidemiol*. In press.
28. LeBaron CW, Chaney M, Baughman AL, et al. Impact of measurement and feedback on vaccination coverage in public clinics, 1988-1994. *JAMA*. 1997;277:631-635.
29. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Washington, DC: US Dept of Health and Human Services; 1991. DHHS publication PHS 91-50212.
30. Halsey NA. Discussion of Immunization Practices Advisory Committee/American Academy of Pediatrics recommendations for universal infant hepatitis B vaccination. *Pediatr Infect Dis J*. 1993;12:446-449.

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