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Hepatitis B vaccination among adolescents 13–17 years, United States, 2006–2012

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Abstract

Background—Hepatitis B (HepB) vaccination is the most effective measure to prevent HBV infection. Routine HepB vaccination was recommended for infants in 1991 and catch-up vaccination has been recommended for adolescents since in 1995. The purpose of this study is to assess HepB vaccination among adolescents 13–17 years.

Methods—The 2006–2012 NIS-Teen were analyzed. Vaccination trends and coverage by birth cohort among adolescents were evaluated. Multivariable logistic regression and predictive marginal models are used to identify factors independently associated with HepB vaccination.

Results—HepB vaccination coverage increased from 81.3% in 2006 to 92.8% in 2012. Coverage varied by birth cohort and 79–83% received vaccination before 2 years of age for those who were born during 1995 and 1999. Among those who had not received vaccination by 11 years of age, for the 1993–1995 birth cohorts, 9–15% were vaccinated during ages 11–12 years, and 27–37% had been vaccinated through age 16 years. Coverage among adolescents 13–17 years in 2012 ranged by state from 84.4% in West Virginia to 98.7% in Florida (median 93.3%). Characteristics independently associated with a higher likelihood of HepB vaccination included living more than 5 times above poverty level, living in Northeastern or Southern region of the United States, and having a mixed facility as their vaccination provider. Those with a hospital listed as their vaccination provider and those who did not have a well-child visit at age 11–12 years were independently associated with a lower likelihood of HepB vaccination.

Conclusions—Efforts focused on groups with lower coverage may reduce disparities in coverage and prevent hepatitis B infection. Parents and providers should routinely review

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Conflict of interest statement

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adolescent immunizations. Routine reminder/recall, expanded access in health care settings, and standing order programs should be incorporated into routine clinical care of adolescents.

Keywords

Hepatitis B vaccine; Vaccination; Coverage; Adolescent vaccination; The National Immunization Survey-Teen (NIS-Teen)

1. Introduction

Hepatitis B virus (HBV) is transmitted by percutaneous or mucosal exposure to the blood or body fluids of an infected person. Among infants who acquire HBV infection at birth, as many as 90% remain chronically infected, whereas approximately 30–50% of children infected at age 1–5 years and 5% of healthy adults remain chronically infected [1,2]. An estimated 800,000–1.4 million persons in the United States live with chronic HBV infection; many are not aware of their infection [1–3].

Preventing HBV infection through vaccination is the most effective way to reduce HBV-related, life-long complications, reduce the reservoir of persons with chronic infection, and thereby eliminate HBV transmission. Hepatitis B (HepB) vaccines have proved safe, and approximately 95% effective at preventing HBV infection [1,2,4,5]. Protection induced by HepB vaccines has been monitored among populations for more than 22 years and remains high [6].

In 1981, HepB vaccine was first approved for use in the United States. In 1982, the Advisory Committee on Immunization Practices (ACIP) recommended HepB vaccination for adults at increased risk for HBV infection [7]. In 1991, recognizing the difficulty of vaccinating high-risk adults and the substantial burden of HBV-related infections acquired from childhood infection (an estimated 30–50%) [1,2,8,9], the ACIP recommended children receive a HepB vaccine series starting in infancy [8]. It is important for children to receive HepB vaccination starting in infancy since sexual activity and risk behaviors may start in adolescence. Additionally, since adolescents and adults with risk behaviors may be difficult to identify, opportunities to offer vaccination are missed [8]. In 1995, ACIP recommended routine vaccination for all previously unvaccinated adolescents 11–12 years [10], and in 1999, the recommendations were broadened to include all previously unvaccinated children and adolescents 0–18 years.

Ensuring adolescents are vaccinated to protect against HBV infection has been an important public health concern since 1995 [11]. School immunization laws were modified in many states to reflect the new recommendations [12] and HepB vaccine coverage has been increasing among adolescents [13–15]. To reach the goal of eliminating HBV transmission in the United States and reduce the hepatitis B disease burden, high rates of protection among adolescents must be achieved for each adolescent cohort [1,2,16,17]. To determine the status of HepB coverage among adolescents 13–17 years in the United States, we used data from the 2006–2012 National Immunization Survey-Teen (NIS-Teen). We also sought to identify factors independently associated with higher or lower vaccination coverage, and evaluate the extent of adolescent HepB vaccination catch-up.

2. Methods

The National Immunization Survey-Teen (NIS-Teen) was analyzed in 2014. The NIS-Teen is a national, random-digit-dialed (RDD) telephone survey sponsored by the Centers for Disease Control and Prevention (CDC). The objective of the NIS-Teen is to provide timely, detailed information regarding vaccination among adolescents 13–17 years for vaccines recommended by the ACIP, including those given during childhood and during adolescence as catch up. The NIS-Teen is a two-phase survey. During the first phase, a telephone household interview is conducted to identify households with age-eligible adolescents. Initially, NIS-Teen only used a landline sample. However, beginning in 2011, the survey included landline and cellular telephone households [18,19]. After completing the household interview, consent is requested to contact the vaccination provider(s) to collect vaccination records.

The second phase of NIS-Teen is a Provider Record Check (PRC). An Immunization History Questionnaire is mailed to the vaccination provider to complete or to attach a copy of the vaccination record of the adolescent and mail back to the data collector. The questionnaire includes documented vaccinations for the adolescent, whether the adolescent had a well-child visit or check-up at the practice during ages 11–12 years, and selected characteristics of the provider and practice.

In 2012, the Council of American Survey Research Organizations (CASRO) landline response rate was 55.1%. A total of 14,133 adolescents with provider-reported vaccination records were included, representing 62% of all adolescents from the landline sample with completed household interviews. The cellular-telephone sample CASRO response rate was 23.6%. A total of 5066 adolescents with provider-reported vaccination records were included, representing 56.4% of all adolescents from the cellular-telephone sample with completed household interviews. The overall sample size (landline and cellphone sample) was 19,199 [14]. Poverty status was defined using 2012 poverty thresholds published by the U.S. Census Bureau with below poverty defined as a total family income of <\$23,492 for a family of four.

In the United States, there were two monovalent HepB vaccines for pediatric use (through age 18 years) and one combination vaccine available to adolescents who were 13–17 years in 2012. We used fully immunized as the outcome measure of HepB vaccination. Being fully immunized with HepB vaccine was defined as receipt of 3 doses of 0.5 ml of [1]: Engerix-B[®], Recombivax HB[®], or Comvax[®] [20], combinations of these three vaccines, or [2]: receipt of 2 doses of 1.0 ml of Recombivax HB[®] approved in 2000 as a two dose series for adolescents 11–15 years. Comvax[®] might have been available for infants born from 1996 to 1999, who are now adolescents 13–16 years. We assessed the association of the outcome measure with demographic and access to care characteristics. To assess missed opportunities, we evaluated the percentage of those who had not been fully vaccinated against hepatitis B by 11 years of age who had a vaccination visit, defined as those who had received a vaccination other than HepB during the period from their 11th year birthday through their age at interview (13–17 years).

SUDAAN (Software for the statistical analysis of complex sampling data, Research Triangle Institute, Research Triangle Park, NC) was used to calculate point estimates and 95% confidence intervals (CIs). Weighting is adjusted to minimize non-response bias (e.g., to compensate for the non-coverage of teens in non-telephone households, a post-stratification adjustment is done based on whether the teen's household experienced an interruption in telephone service). *T*-tests were used to examine associations with the significance level set at $\alpha < 0.05$. Using combined data from 2006 to 2012, Kaplan–Meier survival analysis was conducted to estimate, by birth cohort, the cumulative vaccination coverage by age overall, and among those who had not been vaccinated before their 11th year birthday (adolescent catch-up vaccination). To assess the independent effects of demographic and access-to-care variables on HepB vaccination, we conducted multivariable logistic regression and predictive marginal models which yielded adjusted prevalence difference (PD). The NIS-Teen was approved by the Centers for Disease Control and Prevention, National Center for Health Statistics Research Ethics Review Board.

3. Results

A total of 19,199 adolescents 13–17 years with adequate provider data from the 2012 NIS-Teen were included in the study. Table 1 shows the demographic characteristics of the 2012 sample.

Among adolescents 13–17 years, overall HepB coverage was 92.8% (95% confidence interval (CI) = 92.1–93.5%) in 2012 (Table 2). Vaccination coverage was similar by age group and sex. Hispanics had significantly lower coverage (91.1%) compared to non-Hispanic whites (93.7%). Adolescents with a mother who had more than a college degree (94.9%) were significantly more likely to receive HepB vaccination than those with a mother who had less than high school education (90.8%) ($p < 0.05$). HepB vaccination coverage was significantly higher among adolescents living in a household with 3–5 times above poverty level (93.6%) ($p = 0.02$) or more than 5 times above poverty level (95.9%) compared with those living below the poverty level (91.2%) ($p < 0.01$) (Table 2).

Adolescents with military medical insurance (85.0%) were significantly less likely to receive HepB vaccination than those with private medical insurance (94.2%) ($p = 0.03$). HepB vaccination coverage was significantly higher among those with one physician contact (94.1%) compared to those who had no physician contacts in the past year (91.2%) ($p = 0.01$). Adolescents who did not have a well-child visit at ages 11–12 years (based on provider reported data) were significantly less likely to obtain vaccination (92.2%) than those who had a visit (96.0%) ($p < 0.01$) (Table 2).

HepB vaccination coverage varied by region of residence; it was significantly higher among persons who lived in the Northeast (95.3%) and the South (93.7%) than those who lived in the West (90.9%) ($p < 0.01$, $p = 0.01$, respectively). Adolescents who received vaccinations at facilities such as hospital and “other” facilities (coverage was 86.5%, and 73.8%, respectively) were significantly less likely to be vaccinated with HepB than those who received vaccinations at private facilities (93.7%) ($p < 0.01$). Adolescents who received

vaccinations at mixed facilities (95.8%) were significantly more likely to be vaccinated with HepB than those who received vaccinations at private facilities (93.7%) ($p < 0.01$) (Table 2).

Multivariable logistic regression modeling and predictive marginal analysis were conducted using the 2012 data to identify factors independently associated with HepB vaccination among adolescents 13–17 years (Table 2). Characteristics independently associated with a higher likelihood of HepB vaccination included: living more than 5 times above the poverty level compared with living below the poverty level (PD = 3.2), living in the Northeastern (PD = 3.4) or the Southern region (PD = 2.3) of the United States compared with those living in the West, and having a mixed facility as their vaccination provider compared with a private facility (PD = 3.7). Adolescents with a hospital (PD = -4.6) or “other” facility (PD = -10.4) listed as their vaccination provider compared with a private facility and those who did not have a well-child visit at ages 11–12 years (PD = -3.3) compared with those who had a well-child visit at ages 11–12 years were independently associated with a lower likelihood of HepB vaccination (Table 2). Race/ethnicity, mother’s educational level, and number of physician contacts within the past year were significant in the bi-variable analysis but were no longer significant in the multivariable model.

Overall, vaccination coverage by state ranged from 84.4% in West Virginia to 98.7% in Florida, with a median across all states of 93.3% (Table 3). Coverage before 11 years of age by state ranged from 81.1% in West Virginia to 96.9% in New Hampshire, with a median of 91.3%. Catch-up vaccination proportion after 11 years of age by state ranged from 0.0% in Kentucky and Ohio to 78.3% in Florida, with a median of 24.6% (Table 3). The proportion of adolescents not fully vaccinated before age 11 years who were subsequently vaccinated ranged from 0.0% to 78.2% (median 24.6%). The median catch-up vaccination proportion at or after 11 years of age among states with HepB vaccination middle school requirements was 22.5% compared to 19.4% among states without HepB vaccination middle school requirements.

Tables 4–5 and Figs. 1–3 are based on the combined 2006–12 data. Sample sizes for 2006, 2007, 2008, 2009, 2010, and 2011 were 1882, 2947, 17,835, 20,066, 19,257, 23,564, respectively. Among adolescents born during 1995–1999, 79–83% had been fully vaccinated before two years of age, 85–89% had been fully vaccinated before five years of age, and 90–93% had been fully vaccinated before 11 years of age (Table 4). Among those born during 1993–1995 who had not been vaccinated before 11 years of age, adolescent catch-up vaccination coverage was 9–15% during ages 11–12 years, and increased for each birth cohort for later ages, reaching 27–37% before age 17 years. For all ages of receipt, adolescent catch-up coverage has declined from the earliest to the most recent birth cohorts. For the most recent cohort followed to age 17 years (born in 1995, or turned 11 in 2006), catch-up coverage was 27% (Table 5). Adolescent catch-up coverage during ages 11–12 years declined from 48% among those born in 1989 to 29% among those born in 1992, and ranged from 9 to 15% among those born during 1993–1999 (Fig. 1, Table 5).

Overall, HepB vaccination coverage among adolescents aged 13–17 years significantly increased from 81.3% in 2006 to 92.8% in 2012 (test for trend, $p < 0.05$) (Fig. 2), with an average 2.0 percentage point increase annually. Coverage among non-Hispanic whites

significantly increased from 82.4% in 2006 to 93.7% in 2012 (test for trend, $p < 0.05$), and coverage among non-Hispanic blacks significantly increased from 74.8% in 2006 to 92.5% in 2012 (test for trend, $p < 0.05$) (Fig. 2). HepB vaccination coverage did not change significantly between 2006 and 2012 for Hispanics and Asians (Fig. 2). Numbers were too small to examine trends for American Indians/Alaskan Natives. Coverage for adolescents 13–15 years significantly increased from 84.3% in 2006 to 93.3% in 2012 (test for trend, $p < 0.05$), and coverage for adolescents 16–17 years increased from 76.4% in 2006 to 92.1% in 2012 (test for trend, $p < 0.05$) (Fig. 3).

Among those not fully vaccinated against HepB vaccination in the 2012 NIS-Teen sample, 59.5% did not receive any dose, 15.4% received 1 dose, and 25.1% received 2 doses of HepB vaccination. Among those not fully vaccinated against HepB vaccination, overall, 78.0% had at least one vaccination visit (received a vaccination other than HepB), and 22.0% did not have any vaccination visits. Among those who did not receive any dose of HepB, overall, 85.2% had at least one vaccination visit. Among those who received one dose of HepB, overall, 56.7% had at least one vaccination visit. Among those who received two doses of HepB, overall, 74.3% had at least one vaccination visit.

4. Discussion

Our study using the NIS-Teen showed that 93% of adolescents 13–17 years in the United States in 2012 were fully vaccinated against hepatitis B, an increase of 12 percentage points compared to 2006 [13,15]. Among adolescents aged 13–17 years in 2012 (born 1995–1999), the percentage with completed HepB vaccination was 79–83% before age two years, 85–89% before five years of age, and 90–93% before age 11 years. Thus, a large proportion of the high HepB vaccination coverage among adolescents was likely due to ACIP recommendations for universal infant vaccination in 1991 and well-established childhood vaccination programs, decreasing the need for vaccination later in childhood or adolescence [8]. HepB vaccination “catch-up” recommendations in 1995 and 1999 contributed to the resulting HepB coverage above 90% for cohorts born from 1996 to 1999 [10,12,15]. Among adolescents who had not received the full HepB vaccination by 11 years of age, the proportion who received catch-up HepB vaccination during ages 11–12 years was low (9–15%) for the most recently measured cohorts (those turning age 11 years during 2004–2010). HepB catch-up vaccination coverage increased with age but remained low (27–37%) by age 17 years for the most recent cohorts followed to age 17 (those turning 11 years during 2004–2006).

Gaps may not be apparent when coverage is at a high level. Despite the substantial gains in HepB vaccination, 7.2% of adolescents 13–17 years had not received a complete HepB vaccination series in 2012. Studies have reported racial/ethnic differences among adult vaccination in the United States [21–23]. However, recent studies indicate that racial/ethnic disparities among childhood vaccination have been significantly reduced or not observed for some vaccinations [24,25]. Among adolescents 13–17 years, differences in HepB vaccination coverage among Hispanics and non-Hispanic whites were no longer significant after controlling for demographic characteristics and access to care variables in the multivariable model. Middle-school mandates may contribute to the reduced racial and

ethnic disparities in HepB vaccination coverage [15,26]. Additionally, the Vaccine for Children (VFC) program, which provides vaccines at no cost to eligible children through the age of 18 years if families might not otherwise be able to afford vaccines, and enrollment in the State Children's Health Insurance Plan may also help reduce racial and ethnic disparities in receipt of preventive services that include vaccination [15,27].

This study indicated disparities in HepB vaccination coverage based on health insurance status in the bi-variable analysis. However, health insurance status was not independently associated with HepB vaccination when controlling for demographic and access to care variables in the multivariable analysis. Our study and other previous studies estimated that approximately 6–7% of adolescents were uninsured [15,28] and these children were at greater risk of not being vaccinated as recommended [15,28]. Our finding of similar HepB vaccination coverage by insurance status may be due to the contribution of the VFC program and CDC's Vaccines for Children and Section 317 Cooperative Agreement [29–32]. The Vaccines for Children and CDC's Section 317 Cooperative Agreement provides federal funds to state and local health departments to support immunization infrastructure to ensure access to vaccination services. These programs may help improve vaccination coverage among uninsured adolescent populations. Federal, state, and local partners should continue to build support for adolescent vaccination and address pockets of need for uninsured adolescents. Additionally, military health insurance is associated with lower vaccination rates through this association did not remain in the multivariable analysis. The population may be more transient which may have implications for more preventive services including vaccination. Further study is needed to look into reasons for gaps in HepB vaccination between adolescents with military health insurance and other health types of health insurances.

HepB vaccination coverage among adolescents 13–17 years varied by state and region of residence. Factors that might have contributed to the variability in vaccination coverage include differences in the way state vaccination programs are implemented, in medical-care delivery infrastructure; in the effectiveness of interventions being implemented by states other stakeholders; in population attitudes toward vaccinations; in immunization resources; in reimbursements for vaccines and vaccine administration; and in state and local policies (e.g., laws requiring vaccines for school entry) [33–40].

We found that about 7% of adolescents 13–17 years in 2012 had not received the complete HepB vaccination series, placing them at risk for infection and cancer and highlighting the need for continued provision of catch up vaccinations. However, our study showed that adolescent HepB vaccination catch-up coverage during ages 11–12 years decreased four-fold from 48% for those born in 1989 to only 12% for those born in 1999. This may reflect a decreasing emphasis by clinicians on assessing HepB vaccination status over time as more adolescents were vaccinated during infancy or early childhood, and many adolescents had opportunities to receive HepB vaccination when receiving other vaccinations. The ACIP and other partner organizations, including the American Academy of Pediatrics, American Medical Association, and Society for Adolescent Medicine, recommend a well-child visit for children ages 11–12 years to receive recommended vaccinations and indicated preventive services such as vaccinations required to attend middle school [15,26,41]. Our study showed

that the majority of adolescents not fully vaccinated against HepB had at least one visit where other vaccinations were provided. Approximately 80% of adolescents who did not receive any doses of HepB vaccine could have received at least one dose if the opportunity to provide a vaccination was not missed. Approximately 63% of adolescents with only one dose of HepB vaccine could have received the second dose if the opportunity to provide a vaccination was not missed. Using Immunization Information Systems (IIS) and client reminder and recall systems with standing orders, provider reminders for vaccinations or provider assessment/feedback have been shown to be effective strategies to assist vaccinations providers to routinely provide HepB vaccination to their patients, ensuring fewer missed opportunities and higher vaccination coverage [42].

The findings in this study are subject to limitations. First, household response rate is 55.1%, and some bias may remain after weighting adjustments designed to minimize non-response bias [43]. However, the basic demographic characteristics by age, gender, and race/ethnicity from the 2012 National Immunization Survey-Teen were similar to those observed in the child core data of the 2012 National Health Interview Survey (CDC unpublished data). Second, provider-confirmed vaccination histories might not include all vaccinations received, such as a HepB vaccination received in a birth hospital or HepB vaccinations provided by someone other than the vaccination provider listed by the parent or guardian. This could result in underestimated vaccination coverage as measured by the NIS-Teen. Third, vaccination estimates from landline only (2007–2010) and dual sampling frames (2011–2012) might not be comparable. However, prior methodological assessment suggests that the addition of cellular telephone numbers beginning in 2011 should have had limited effects on annual national coverage estimates [14]. Fourth, NIS-Teen excluded persons without telephones and subsequently may result in possible selection bias. Finally, there may be some associations between insurance status, socioeconomic status and facility type where vaccines are received and further study or investigation is needed to assess the association and its impact on vaccination.

HepB vaccination coverage among adolescents is now at a high level; however, additional improvement is feasible and opportunities for adolescent catch-up vaccination efforts should not be missed. Increasing use of HepB vaccine has resulted in decreased cases of acute HBV infections among persons aged 19 years (incidences among persons aged 19 years were 0.61 in 2000, and 0.03 in 2012, respectively, per 100,000 population) [17]. NIS results indicate HepB vaccination is stable around 90%. But by 2012, about 7% of adolescents 13–17 years had not received the complete HepB vaccination series and among adolescents who had not received the full HepB vaccination by 11 years of age, the proportion who received catch-up HepB vaccination during ages 11–12 years was low (9–15%) indicating catch-up as part of school entry may not reach all those unvaccinated as infants. Even though vaccination at younger ages is recommended and preferred to reduce serious complications from infection, catch-up vaccination is particularly important since catch up vaccination can provide protections and may be the last opportunity to provide protection before risk behaviors are likely to be initiated [8,10]. Eligible adolescents can receive recommended vaccines at no cost through Vaccines for Children (VFC) program. Providers, parents, and adolescents should use every health-care visit, whether for health problems, well-checks, or physicals for sports, school, or camp, as an opportunity to review adolescents' vaccination

histories and ensure that every adolescent is fully vaccinated with HepB vaccine and other recommended vaccines [41,44].

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Proportion of adolescents receiving hepatitis B vaccination at 11-12 years of age among those who had not received vaccination by 11 years of age, 2006-2012.

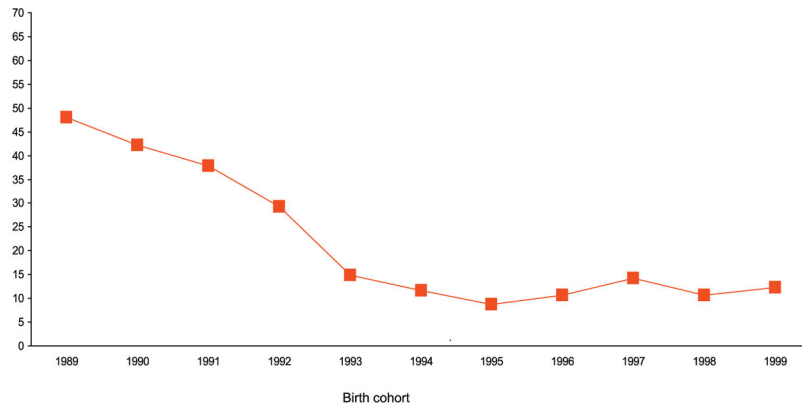


Fig. 1. Proportion of adolescents receiving hepatitis B vaccination at 11–12 years of age among those who had not received vaccination by 11 years of age, 2006–2012. *Source:* National Immunization Survey-Teen, 2006–2012.

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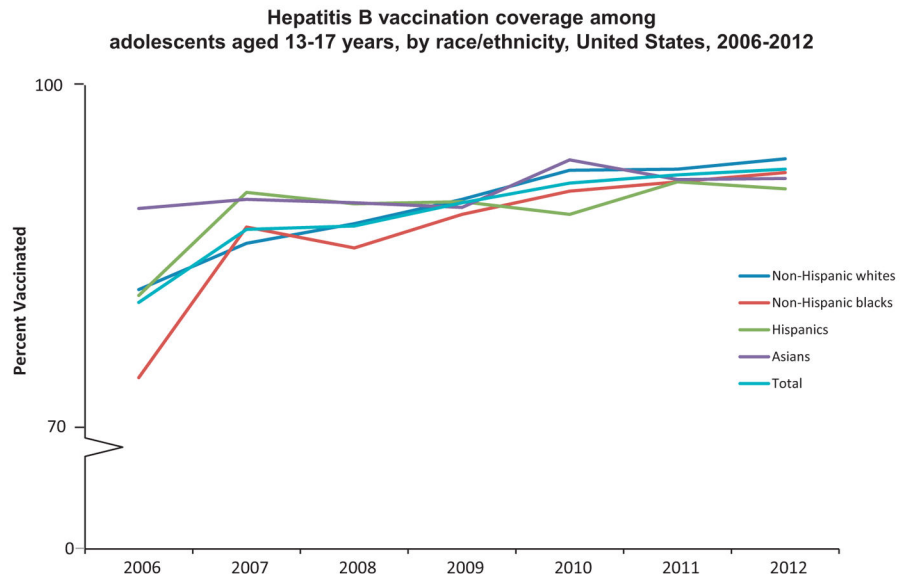


Fig. 2. Hepatitis B vaccination coverage among adolescents aged 13–17 years, by race/ethnicity, United States, 2006–2012.

Source: National Immunization Survey-Teen 2006–2012.

Hepatitis B vaccination coverage among adolescents aged 13-17 years, by age group, United States, 2006-2012

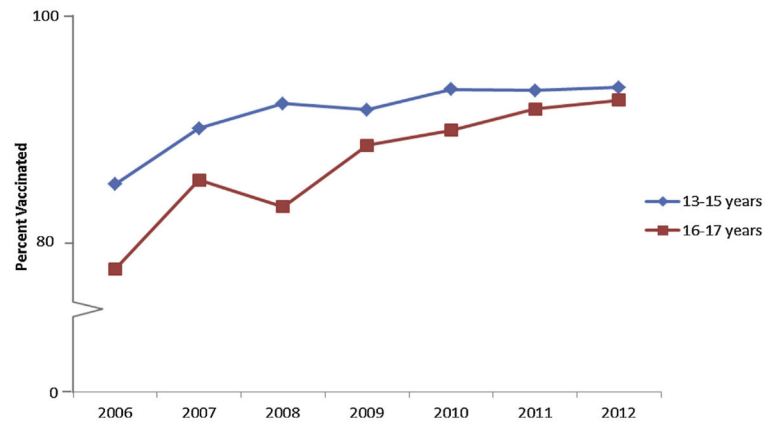


Fig. 3. Hepatitis B vaccination coverage among adolescents aged 13–17 years, by age group, United States, 2006–2012.

Source: National Immunization Survey-Teen 2006–2012.

Table 1
 Sample characteristics of participants 13–17 years in the United States, by demographic and access-to-care variables—NIS-Teen, 2012.

Characteristic	All adolescents			Vaccinated ^a		Not vaccinated	
	Sample (N)	Weighted % (95% CI) ^c	Sample	% (95% CI)	Sample	% (95% CI)	
Total	19,199		17,869		1330		
Age (years)							
13–15	11,790	61.0 (59.7–62.3)	11,048	61.3 (60.0–62.6)	742	56.8 (51.8–61.7)	
16–17	7409	39.0 (37.7–40.3)	6821	38.7 (37.4–40.0)	588	43.2 (38.3–48.2)	
Sex							
Male	10,141	51.2 (49.9–52.5)	9448	51.1 (49.8–52.4)	693	52.4 (47.3–57.4)	
Female	9058	48.8 (47.5–50.1)	8421	48.9 (47.6–50.2)	637	47.6 (42.6–52.7)	
Race/ethnicity ^e							
Non-Hispanic White	12,930	55.0 (53.7–56.2)	12,079	55.5 (54.1–56.8)	851	48.5 (43.5–53.4)	
Non-Hispanic Black	1928	14.1 (13.2–15.0)	1801	14.0 (13.1–15.0)	127	14.7 (11.1–19.1)	
Hispanic	2552	21.8 (20.6–23.0)	2335	21.4 (20.1–22.7)	217	27.0 (22.1–32.6)	
American Indian/Alaskan Native	261	1.0 (0.8–1.3)	253	1.0 (0.8–1.3)	8	NA	
Asian	622	3.8 (3.3–4.5)	559	3.8 (3.2–4.5)	63	4.3 (2.6–6.9)	
Other	906	4.4 (3.9–4.9)	842	4.3 (3.8–4.9)	64	4.8 (3.2–7.2)	
Mother's educational level							
<High School	1874	14.0 (13.0–15.1)	1715	13.7 (12.7–14.8)	159	18.0 (13.9–22.9) ^g	
High School	3664	24.9 (23.7–26.1)	3373	24.6 (23.4–25.8)	291	28.2 (23.8–33.0)	
Some college or college graduate	5376	26.6 (25.5–27.8)	4987	26.4 (25.3–27.6)	389	29.3 (24.8–34.2)	
>College graduate	8285	34.5 (33.3–35.6)	7794	35.2 (34.0–36.4)	491	24.5 (21.1–28.4)	
Mother's married status							
Married	14,217	65.2 (63.9–66.5)	13,278	65.6 (64.3–67.0)	939	59.5 (54.1–64.6)	
Widowed/divorced/separated	3337	24.3 (23.1–25.5)	3074	24.0 (22.8–25.3)	263	27.6 (23.0–32.7)	
Never married	1477	10.6 (9.7–11.5)	1367	10.4 (9.5–11.3)	110	12.9 (9.3–17.7)	
Mother's age							
34 years	1434	10.0 (9.1–10.9)	1326	9.9 (9.0–10.9)	108	10.9 (8.2–14.3)	
35–44 years	7811	46.4 (45.1–47.7)	7244	46.3 (45.0–47.7)	567	46.9 (41.9–52.0)	

Characteristic	All adolescents		Vaccinated ^a		Not vaccinated	
	Sample (N)	Weighted % (95% CI) ^c	Sample	% (95% CI)	Sample	% (95% CI)
45 years	9954	43.7 (42.4–44.9)	9299	43.8 (42.5–45.1)	655	42.2 (37.3–47.3)
Immigration status						
Born in U.S.	18,469	94.7 (94.0–95.3)	17,213	94.8 (94.0–95.4)	1,256	94.0 (91.6–95.7)
Born outside U.S.	676	5.3 (4.7–6.0)	605	5.2 (4.6–6.0)	71	6.0 (4.3–8.4)
Income to poverty ratio ^b						
<133%	4502	35.7 (34.3–37.0)	4117	35.0 (33.7–36.4)	385	43.7 (38.7–48.9) ^g
133–<322%	5569	28.3 (27.2–29.5)	5168	28.2 (27.0–29.4)	401	30.1 (25.5–35.1)
322–<503%	4275	17.3 (16.4–18.1)	4000	17.4 (16.6–18.3)	275	15.4 (12.4–18.9)
>503%	4853	18.8 (17.9–19.6)	4584	19.4 (18.5–20.3)	269	10.8 (8.9–13.1)
Medical insurance						
Private Only	9488	42.1 (40.9–43.4)	8923	42.8 (41.5–44.0)	565	34.0 (29.6–38.7) ^g
VFC Eligible-Medicaid/IHS/AIAN (All)	7633	45.1 (43.8–46.4)	7089	44.9 (43.5–46.2)	544	47.7 (42.7–52.8)
VFC Eligible-Uninsured	885	6.1 (5.4–6.8)	782	6.0 (5.3–6.7)	103	7.2 (5.1–10.0)
SCHIP (Public)	554	3.7 (3.2–4.4)	515	3.6 (3.0–4.2)	39	NA
Military	497	2.1 (1.8–2.5)	430	1.9 (1.6–2.3)	67	4.4 (3.1–6.3)
Other	142	0.9 (0.6–1.3)	130	0.9 (0.6–1.3)	12	NA
Physician contacts within past year						
None	2963	17.4 (16.4–18.4)	2689	17.1 (16.0–18.2)	274	21.3 (17.7–25.5)
1	5291	27.2 (26.0–28.3)	4963	27.5 (26.3–28.8)	328	22.4 (18.4–27.1)
2–3	6803	35.5 (34.3–36.7)	6342	35.4 (34.1–36.6)	461	37.3 (32.4–42.6)
4	4034	19.9 (19.0–21.0)	3775	20.0 (19.0–21.1)	259	18.9 (15.7–22.7)
Well child visit at age 11–12 years ^d						
Yes	8482	41.8 (40.6–43.1)	8144	43.2 (41.9–44.5)	338	23.4 (19.7–27.6) ^g
No	5373	28.0 (26.9–29.2)	4976	27.9 (26.7–29.1)	397	30.3 (25.9–35.1)
Do not know	5344	30.1 (29.0–31.4)	4749	28.9 (27.7–30.1)	595	46.3 (41.2–51.4)
Number of vaccination providers						
1	8964	47.5 (46.2–48.7)	8332	47.5 (46.1–48.8)	632	47.5 (42.5–52.6)
2	5918	30.4 (29.2–31.6)	5509	30.3 (29.1–31.6)	409	31.7 (27.4–36.4)
3	4303	22.1 (21.1–23.2)	4028	22.2 (21.1–23.4)	275	20.8 (16.6–25.6)

Characteristic	All adolescents			Vaccinated ^a		Not vaccinated	
	Sample (N)	Weighted % (95% CI) ^c	Sample	% (95% CI)	Sample	% (95% CI)	
MSA							
Urban area	7428	39.1 (37.9–40.4)	6876	39.0 (37.8–40.3)	552	40.7 (35.8–45.9)	
Suburban area	7552	45.6 (44.3–46.9)	7077	45.7 (44.4–47.0)	475	43.8 (38.8–48.9)	
Rural area	4219	15.3 (14.5–16.0)	3916	15.3 (14.5–16.1)	303	15.5 (12.8–18.5)	
Region ^b							
Northeast	3614	17.0 (16.5–17.5)	3455	17.5 (16.9–18.0)	159	11.1 (8.8–14.0) ^g	
Midwest	4204	21.8 (21.2–22.4)	3909	21.5 (20.8–22.2)	295	25.6 (21.7–30.0)	
South	6844	37.1 (36.3–37.9)	6368	37.5 (36.6–38.3)	476	32.8 (28.7–37.2)	
West	4537	24.1 (23.2–24.9)	4137	23.6 (22.7–24.5)	400	30.4 (25.4–35.9)	
Facility type							
All private facilities	9309	51.6 (50.3–52.9)	8695	51.9 (50.6–53.3)	614	46.8 (41.7–51.9) ^g	
All public facilities	2720	15.1 (14.1–16.1)	2524	14.8 (13.8–15.8)	196	19.0 (14.8–24.1)	
All hospital facilities	1771	7.5 (6.9–8.2)	1564	7.0 (6.4–7.7)	207	14.6 (11.6–18.1)	
All STD/school/teen clinics or other facilities	235	1.4 (1.1–1.7)	209	1.3 (1.0–1.6)	26	NA	
Mixed ^d	4918	23.7 (22.6–24.8)	4730	24.4 (23.3–25.5)	188	14.2 (11.0–18.2)	
Other ^f	189	0.8 (0.6–1.0)	147	0.6 (0.4–0.9)	42	2.9 (1.8–4.6)	

^aBeing fully immunized with Hepatitis B vaccine includes either received 3 doses of 0.5 ml Engerix[®] or Recombivax[®] or Comvax[®] vaccine or 2 doses of 1.0 ml of Recombivax[®] vaccine.

^bNortheast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^cConfidence interval.

^dMixed indicates that the facility is identified to be in more than one of the facility categories such as private, public, hospital, STD/school/teen clinics.

^eRace/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, American Indian/Alaska Native, Asian, and other race (including multiple races).

^fIncludes military, WIC clinics, and pharmacies.

^gSignificant difference between those who received vaccination and those who did not (by chi-square test, $p < 0.05$).

^hWe calculated the federal poverty level (PVL) by using the reported household income and the 2012 federal PVL thresholds defined by the U.S. Census Bureau.

Status of health-care visit at age 11–12 years based on provider reported data.

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Table 2

Hepatitis B vaccination coverage and multivariable logistic regression analysis among adolescents 13–17 years in the United States, by demographic and access-to-care characteristics – NIS-Teen 2012.

Characteristic	Hepatitis B vaccination coverage ^a		Prevalence Difference (PD) (adjusted)	
	% (95% CI)	<i>p</i> -Value [†]	% (95% CI)	<i>p</i> -Value [‡]
Total	92.8 (92.1–93.5)			
Age (years)				
13–15 ^c	93.3 (92.3–94.2)		Ref.	
16–17	92.1 (90.9–93.1)	0.08	–1.0 (–2.5 to 0.4)	0.15
Sex				
Male ^c	92.7 (91.6–93.6)			
Female	93.0 (92.0–93.9)	0.63	0.3 (–1.0 to 1.6)	0.69
Race/ethnicity ^d				
Non-Hispanic White ^c	93.7 (92.9–94.3)		Ref.	
Non-Hispanic Black	92.5 (90.1–94.4)	0.31	–0.2 (–2.8 to 2.4)	0.88
Hispanic	91.1 (88.8–93.0)	0.02	–1.1 (–3.3 to 1.1)	0.33
American Indian/Alaskan Native	94.1 (84.8–97.9)	0.88	0.7 (–5.1 to 6.5)	0.81
Asian	92.0 (87.3–95.1)	0.41	–1.8 (–5.7 to 2.1)	0.37
Other	92.1 (88.4–94.8)	0.35	–1.5 (–4.8 to 1.9)	0.39
Mother's educational level				
<High School ^c	90.8 (88.0–93.0)		Ref.	
High School	91.9 (90.2–93.3)	0.48	–0.0 (–2.5 to 2.4)	0.98
Some college or college graduate	92.1 (90.5–93.5)	0.38	–0.0 (–2.6 to 2.6)	0.98
>College graduate	94.9 (94.1–95.6)	<0.01	1.7 (–0.9 to 4.3)	0.20
Mother's married status				
Married ^c	93.5 (92.7–94.2)		Ref.	
Widowed/divorced/separated	91.9 (90.0–93.4)	0.08	–0.7 (–2.6 to 1.1)	0.43
Never married	91.3 (87.8–93.8)	0.15	–1.1 (–4.3 to 2.1)	0.49
Mother's age				
34 years ^c	92.2 (89.6–94.2)		Ref.	
35–44 years	92.7 (91.6–93.7)	0.66	0.2 (–2.0 to 2.4)	0.87
45 years	93.1 (92.0–94.0)	0.49	–1.1 (–3.6 to 1.5)	0.42
Immigration status				
Born in U.S. ^c	92.9 (92.1–93.6)		Ref.	
Born outside U.S.	91.8 (88.6–94.2)		–0.2 (–2.9 to 2.6)	0.91
Income to poverty ratio ^e				
<133% ^c	91.2 (89.7–92.5)		Ref.	
133–<322%	92.4 (90.8–93.7)	0.25	0.7 (–1.3 to 2.8)	0.50
322–<503%	93.6 (92.1–94.8)	0.02	0.8 (–1.7 to 3.4)	0.53
>503%	95.9 (95.0–96.6)	<0.01	3.2 (1.0–5.3)	<0.01

Characteristic	Hepatitis B vaccination coverage ^a		Prevalence Difference (PD) (adjusted)	
	% (95% CI)	<i>p</i> -Value [†]	% (95% CI)	<i>p</i> -Value [‡]
Medical insurance				
Private Only ^c	94.2 (93.3–95.0)		Ref.	
VFC Eligible-Medicaid/IHS/AIAN (All)	92.4 (91.2–93.4)	0.07	0.1 (–1.7 to 1.9)	0.89
VFC Eligible-Uninsured	91.5 (88.2–93.9)	0.55	0.1 (–2.6 to 2.8)	0.94
SCHIP (Public)	89.5 (81.1–94.4)	0.59	–2.7 (–8.6 to 3.2)	0.36
Military	85.0 (79.2–89.4)	0.03	–4.9 (–10.8 to 1.0)	0.11
Other	90.4 (79.5–95.8)	0.79	–2.2 (–10.2 to 5.7)	0.58
Physician contacts within past year				
None ^c	91.2 (89.3–92.7)		Ref.	
1	94.1 (92.7–95.2)	0.01	1.6 (–0.4 to 3.5)	0.11
2–3	92.4 (91.0–93.7)	0.08	–0.1 (–2.2 to 1.9)	0.89
4	93.2 (91.8–94.4)	0.34	0.4 (–1.6 to 2.4)	0.66
Well-child visit at age 11–12 years				
Yes ^c	96.0 (95.2–96.6)		Ref.	
No	92.2 (90.8–93.5)	<0.01	–3.3 (–5.1 to 1.6)	<0.01
Do not know	89.0 (87.2–90.5)	<0.01	–4.8 (–6.5 to 3.0)	<0.01
Number of vaccination provider				
1	92.9 (91.8–93.8)	0.71	1.0 (–1.3 to 3.2)	0.38
2	92.6 (91.3–93.7)	0.64	–0.3 (–2.4 to 1.8)	0.79
3 ^c	93.3 (91.5–94.8)		Ref.	
MSA				
Urban area	92.5 (91.3–93.6)	0.83	0.2 (–1.7 to 2.0)	0.86
Suburban area	93.1 (92.0–94.1)	0.66	0.1 (–1.7 to 1.8)	0.94
Rural area ^c	92.7 (91.3–93.9)		Ref.	
Region ^b				
Northeast	95.3 (94.1–96.3)	<0.01	3.4 (1.2 to 5.6)	<0.01
Midwest	91.6 (89.9–93.0)	0.61	0.5 (–2.0 to 2.9)	0.71
South	93.7 (92.7–94.5)	0.01	2.3 (0.1 to 4.4)	<0.01
West ^c	90.9 (88.7–92.7)		Ref.	
Facility type				
All private facilities ^c	93.7 (92.7–94.5)		Ref.	
All public facilities	91.2 (88.6–93.3)	0.05	0.5 (–2.1 to 3.1)	0.71
All hospital facilities	86.5 (83.3–89.2)	<0.01	–4.6 (–7.6 to 1.6)	<0.01
All STD/school/teen clinics or other facilities	86.9 (77.4–92.8)	0.08	–2.9 (–9.1 to 3.4)	0.37
Mixed ^f	95.8 (94.5–96.8)	<0.01	3.7 (1.8 to 5.5)	<0.01
Other ^g	73.8 (60.4–83.9)	<0.01	–10.4 (–22.0 to 1.1)	0.08

[†] *p* Value by *t* test for comparisons within each variable with the indicated reference level.

[‡] *p* Value by *t* test for comparisons within each variable with the indicated reference level based on multivariable logistic model.

^aBeing fully immunized with Hepatitis B vaccine includes either received 3 doses of 0.5 ml Engerix[®] or Recombivax[®] or Comvax[®] vaccine or 2 doses of 1.0 ml of Recombivax[®] vaccine.

^b**Northeast:** Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; **Midwest:** Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; **South:** Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, **South** Carolina, Tennessee, Texas, Virginia, and West Virginia; **West:** Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^cReference level.

^dRace/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, American Indian/Alaska Native, Asian, and other race (including multiple races)).

^eWe calculated the federal poverty level (PVL) by using the reported household income and the 2012 federal PVL thresholds defined by the U.S. Census Bureau.

^fMixed indicates that the facility is identified to be in more than one of the facility categories such as private, public, hospital, STD/school/teen clinics.

^gIncludes military, WIC clinics, and pharmacies.

Table 3

Hepatitis B vaccination coverage of adolescents aged 13–17 years by state, NIS-Teen 2012.

	Sample size	Vaccination coverage ^a	Vaccination coverage before 11 years of age ^a	Proportion vaccinated at or after 11 years of age ^{a,b}
	<i>N</i>	% (95% CI)	% (95% CI)	
National	19,199	92.8 (92.1–93.5)	90.6 (89.8–91.4)	23.4
Alabama	317	96.4 (93.8–97.9)	95.1 (91.9–97.1)	26.5
Alaska	340	91.1 (87.2–93.9)	88.8 (84.5–92.1)	20.5
Arizona	360	84.5 (78.2–89.2)	83.5 (77.2–88.3)	6.1
Arkansas	322	92.6 (88.5–95.3)	90.4 (85.6–93.7)	22.9
California	430	92.4 (88.1–95.2)	90.3 (85.4–93.7)	21.6
Colorado	311	96.4 (93.7–98.0)	95.5 (92.3–97.4)	20.0
Connecticut	323	95.7 (92.0–97.8)	94.5 (90.4–96.9)	21.8
Delaware	341	94.8 (90.9–97.0)	91.7 (86.7–94.9)	37.3
District of Columbia	342	92.7 (86.8–96.1)	89.9 (83.4–94.0)	27.7
Florida	325	98.7 (96.5–99.5)	94.0 (87.1–97.3)	78.3
Georgia ^c	328	97.1 (92.8–98.9)	94.7 (88.8–97.6)	45.3
Hawaii	342	92.3 (88.0–95.2)	90.2 (85.1–93.7)	21.4
Idaho	357	91.1 (86.8–94.0)	88.7 (83.7–92.4)	21.2
Illinois	632	90.7 (85.6–94.0)	89.2 (84.0–92.9)	13.9
Indiana	341	94.9 (90.5–97.3)	93.9 (89.1–96.6)	16.4
Iowa ^c	325	93.8 (89.4–96.4)	92.0 (86.7–95.3)	22.5
Kansas	340	91.3 (85.9–94.7)	88.4 (82.8–92.3)	25.0
Kentucky	333	95.0 (91.3–97.1)	95.0 (91.3–97.1)	0.0
Louisiana	370	95.6 (92.1–97.6)	94.1 (90.2–96.5)	25.4
Maine ^c	319	93.6 (89.7–96.1)	90.8 (86.3–93.9)	30.4
Maryland	325	94.5 (89.9–97.1)	93.5 (88.9–96.2)	15.4
Massachusetts	347	95.9 (91.7–98.0)	92.5 (87.8–95.5)	45.3
Michigan	368	93.3 (88.6–96.2)	92.5 (87.8–95.5)	10.7
Minnesota	322	94.1 (90.4–96.5)	91.5 (86.6–94.7)	30.6
Mississippi ^c	321	93.5 (87.3–96.8)	92.9 (86.8–96.3)	8.5
Missouri	292	87.9 (82.1–92.0)	85.9 (79.3–90.7)	14.2
Montana ^c	325	89.8 (85.4–92.9)	89.1 (84.7–92.3)	6.4
Nebraska	328	90.0 (84.5–93.7)	88.6 (83.1–92.5)	12.3
Nevada ^c	329	90.5 (85.8–93.8)	87.4 (81.3–91.7)	24.6
New Hampshire	278	97.3 (94.6–98.7)	96.9 (94.0–98.4)	12.9
New Jersey	330	96.9 (93.4–98.6)	94.7 (90.1–97.3)	41.5
New Mexico	331	89.9 (85.3–93.3)	85.5 (79.4–90.0)	30.3
New York	627	94.6 (92.0–96.4)	91.4 (88.5–93.7)	37.2
North Carolina	347	95.6 (92.0–97.6)	92.9 (88.1–95.9)	38.0
North Dakota ^c	324	91.2 (85.1–95.0)	88.8 (82.1–93.1)	21.4

	Sample size	Vaccination coverage ^a	Vaccination coverage before 11 years of age ^a	Proportion vaccinated at or after 11 years of age ^{a,b}
	<i>N</i>	% (95% CI)	% (95% CI)	
Ohio	327	88.4 (81.9–92.8)	88.4 (81.9–92.8)	0.0
Oklahoma	322	95.0 (91.9–96.9)	93.3 (89.6–95.7)	25.4
Oregon	381	92.7 (88.9–95.2)	91.5 (87.7–94.3)	14.1
Pennsylvania	741	94.8 (91.7–96.8)	93.1 (89.5–95.5)	24.6
Rhode Island	327	94.3 (89.5–97.0)	91.5 (86.3–94.8)	32.9
South Carolina	310	92.9 (88.1–95.9)	92.8 (88.1–95.8)	1.4
South Dakota ^c	298	90.3 (85.4–93.6)	88.3 (83.1–92.1)	17.1
Tennessee	331	96.2 (93.2–97.9)	94.3 (90.0–96.8)	33.3
Texas	1594	87.6 (84.6–90.1)	84.1 (80.8–86.9)	22.0
Utah ^c	345	85.5 (79.6–89.9)	84.8 (78.8–89.3)	4.6
Vermont	322	93.4 (88.7–96.3)	90.8 (86.0–94.1)	28.3
Virginia	334	92.7 (88.1–95.5)	90.3 (84.6–94.0)	24.7
Washington	353	86.5 (80.2–91.0)	83.3 (76.5–88.3)	19.2
West Virginia ^c	282	84.4 (77.6–89.4)	81.1 (73.6–86.9)	17.5
Wisconsin	307	94.1 (91.0–96.2)	91.2 (86.5–94.3)	33.0
Wyoming	333	94.5 (91.0–96.7)	93.7 (89.9–96.2)	12.7
Median		93.3	91.3	24.6
Range		84.4–98.7	81.1–96.9	0.0–78.3

^aBeing fully immunized with Hepatitis B vaccine includes either received 3 doses of 0.5 ml Engerix[®] or Recombivax[®] vaccine or 2 doses of 1.0 ml of Recombivax[®] vaccine.

^bProportion vaccinated after turning 11 years of age among those not fully vaccinated against HepB vaccination before 11 years of age.

^cIndicate that states without middle school HepB vaccination requirement.

Cumulative percent receiving full Hepatitis B vaccination^a by age and birth cohort, adolescents aged 13–17 years, NIS-Teen 2006–2012.

Table 4

Birth cohort	Age in years																
	<1	<2	<3	<4	<5	<6	<7	<8	<9	<10	<11	<12	<13	<14	<15	<16	<17
1989	0.8	0.8	1.0	2.8	6.4	11.6	13.8	18.2	25.1	31.3	39.8	51.9	68.5	73.4	75.8	76.9	78.1
1990	1.5	2.2	5.5	9.5	12.6	17.5	21.0	26.1	32.3	39.7	49.7	59.1	70.9	75.5	77.6	79.3	80.5
1991	1.2	7.1	12.1	14.5	19.6	27.7	35.6	41.0	45.9	51.9	57.1	64.4	73.3	77.3	79.3	81.6	82.6
1992	23.0	38.0	42.5	46.0	53.1	63.4	68.1	70.6	72.9	74.9	77.3	80.9	83.9	85.0	86.1	86.8	87.6
1993	52.3	66.7	70.4	73.6	76.9	81.5	83.1	84.0	85.0	85.4	86.4	87.6	88.4	89.1	89.7	90.3	90.8
1994	61.3	74.6	78.4	80.9	83.1	85.5	86.6	87.2	87.8	88.3	88.9	89.4	90.2	90.6	91.0	91.7	93.0
1995	66.7	79.2	81.7	83.6	85.5	87.6	88.6	89.0	89.34	89.9	90.5	91.0	91.3	91.8	92.1	92.7	93.1
1996	71.3	82.4	85.1	86.6	88.0	89.3	89.9	90.1	90.3	90.7	91.1	91.5	92.1	92.6	92.8	93.3	
1997	71.4	83.3	85.3	86.9	88.1	89.5	90.5	90.9	91.3	91.7	92.5	93.1	93.6	93.8	94.2		
1998	70.7	83.3	85.5	87.0	88.8	90.0	90.5	91.1	91.4	91.6	92.4	92.9	93.2	93.5			
1999	56.0	81.7	85.1	87.3	89.0	90.1	90.4	90.8	91.0	91.1	91.5	91.8	92.4				

^aBeing fully immunized with Hepatitis B vaccine includes either received 3 doses of 0.5 ml Engerix[®] or Recombivax[®] vaccine or 2 doses of 1.0 ml of Recombivax[®] vaccine. The standard errors for the estimates ranged from 0.2 to 2.6.

Cumulative percent receiving full Hepatitis B adolescent catch-up vaccination^a by age and birth cohort, among adolescents aged 13–17 years who had not received full HepB vaccination before age 11 years, NIS-Teen 2006–2012.

Table 5

Birth cohort	Indicate that vaccinations are counted if received on or after the 11th birthday ^a						
	<12	<13	<14	<15	<16	<17	
1989	20.5	48.0	56.1	60.1	61.9	63.8	
1990	18.7	42.2	51.4	55.5	58.9	61.3	
1991	17.1	37.8	47.3	51.8	57.1	59.6	
1992	15.9	29.3	33.9	39.0	42.1	45.3	
1993	8.6	14.8	19.7	23.8	28.5	32.2	
1994	4.8	11.7	15.7	19.5	25.4	37.2	
1995	5.8	8.8	13.6	16.8	23.1	27.4	
1996	4.0	10.7	16.4	19.1	24.1		
1997	7.9	14.3	17.6	22.8			
1998	6.9	10.7	15.0				
1999	4.9	12.3					

^aBeing fully immunized with Hepatitis B vaccine includes either received 3 doses of 0.5 ml Engerix[®] or Recombivax[®] vaccine or 2 doses of 1.0 ml of Recombivax[®] vaccine. The standard errors for the estimates ranged from 0.8 to 4.6.