HPV Vaccination Coverage of Male Adolescents in the United States

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abstract

BACKGROUND: In 2011, the Advisory Committee for Immunization Practices (ACIP) recommended routine use human papillomavirus (HPV) vaccine for male adolescents.

METHODS: We used the 2013 National Immunization Survey-Teen data to assess HPV vaccine uptake (≥1 dose) and series completion (≥3 doses). Multivariable logistic regression analysis and a predictive marginal model were conducted to identify independent predictors of vaccination among adolescent males aged 13 to 17 years.

RESULTS: HPV vaccination coverage with ≥1 dose was 34.6%, and series completion (≥3 doses) was 13.9%. Coverage was significantly higher among non-Hispanic blacks and Hispanics compared with non-Hispanic white male adolescents. Multivariable logistic regression showed that characteristics independently associated with a higher likelihood of HPV vaccination (≥1 dose) included being non-Hispanic black race or Hispanic ethnicity; having mothers who were widowed, divorced, or separated; having 1 to 3 physician contacts in the past 12 months; a well-child visit at age 11 to 12 years; having 1 or 2 vaccination providers; living in urban or suburban areas; and receiving vaccinations from >1 type of facility ($P < .05$). Having mothers with some college or college education, having a higher family income to poverty ratio, living in the South or Midwest, and receiving vaccinations from all sexually transmitted diseases/school/teen clinics or other facilities were independently associated with a lower likelihood of HPV vaccination ($P < .05$).

CONCLUSIONS: Following recommendations for routine HPV vaccination among male adolescents, uptake in 2013 was low in this population. Increased efforts are needed to improve vaccination coverage, especially for those who are least likely to be vaccinated.

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WHAT'S KNOWN ON THIS SUBJECT: HPV is the most common sexually transmitted infection in the United States. More than 50% of sexually active men and women will acquire HPV infection in their lifetime. In 2011, HPV was recommended for routine use among male adolescents.

WHAT'S THIS STUDY ADDS: This is the first study to evaluate HPV vaccination coverage among male adolescents in the United States using provider-reported vaccination data. HPV coverage was low among male adolescents, leaving a large population susceptible to HPV infection maturing into adulthood.

Human papillomavirus (HPV) is the most common sexually transmitted infection in men and women in the United States.[1,2] More than 50% of sexually active men and women will acquire HPV infection in their lifetime.[2,3] Recent studies showed that ~79 million persons are currently infected with HPV, and 14 million persons are newly infected each year in the United States.[4,5] Most infections cause no symptoms, but persistent infection may result in disease or cancer. Each year in the United States, an estimated 26 000 new cancers are attributable to HPV, ~17 000 in women and 9000 in men.[5,6] HPV-related cancers in males include many anal, penile, and oropharyngeal cancers.[2,7–10] HPV-associated oropharyngeal and anal cancers have increased among males.[2,9–11]

Vaccination is an important tool to prevent and control HPV infection and its complications.[1] In 2006, quadrivalent HPV vaccine (HPV4) was licensed by the US Food and Drug Administration for use in females.[1] In 2009, the Advisory Committee on Immunization Practices (ACIP) voted and provided guidance that the HPV4 vaccine may be given to males 9 through 26 years, noting that men who have sex with men are particularly at risk for conditions associated with HPV infection.[12,13] In 2011, ACIP recommended routine use of HPV4 among males aged 11 or 12 years and recommended HPV4 for males aged 13 to 21 years who have not been vaccinated previously or who have not completed the 3-dose series.[2] A previous study showed that early uptake of HPV vaccination of male adolescents was 1.4% in 2010 and 8.3% in 2011.[14]

We analyzed data from the 2013 National Immunization Survey-Teen (NIS-Teen) to evaluate HPV vaccination uptake and identify reasons for not receiving vaccination and factors independently associated with HPV vaccination among male adolescents aged 13 to 17 years. The results from this study may inform relevant interventions to increase vaccination coverage.

METHODS

We analyzed data from the NIS-Teen, a national, random-digit-dial 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 aged 13 to 17 years for vaccines recommended by the ACIP, including HPV vaccine, and to evaluate factors associated with vaccination. Data are collected in the NIS-Teen in 2 phases. In the first phase, a random-digit-dial household telephone interview is conducted to identify households with age-eligible adolescents and to collect demographic information from the parent or guardian on adolescent, maternal, and household characteristics. Also, the household interview included questions on the teen's reported vaccination history, reasons for no intent of receiving vaccine among those who have not received HPV vaccination, and access to care. After completing the household interview, consent is requested to contact the immunization provider(s) to collect provider-reported immunization records. If consent is obtained, the adolescent's vaccination providers are mailed a questionnaire to collect provider-reported vaccination histories of each recommended adolescent vaccine as well as any childhood vaccines. Regarding HPV vaccine, date of vaccination, and type of HPV vaccines (HPV2, HPV4) from the provider record were collected. Among male adolescents 13 to 17 years, those who were reported by provider that they received unknown type of vaccine or HPV2 vaccine (0.67%, n = 64) were considered receiving HPV4 vaccination because HPV4 is the only HPV vaccine that is recommended for male adolescents.[2]

In 2013, the NIS-Teen sampling plan included independent samples of households with a landline and households with a cell phone.[15,16] In 2013, the Council of American Survey Research Organizations landline response rate was 51.1%. A total of 6039 adolescents with provider-reported vaccination records were included, representing 59.5% of all adolescents from the landline sample with completed household interviews. The cellular-telephone sample response rate was 23.3%. A total of 12 225 adolescents with provider-reported vaccination records were included, representing 54.5% of all adolescents from the cellular-telephone sample with completed household interviews. The overall sample size (landline and cellphone sample) was 18 264.[15,16] Our analysis was restricted to male adolescents aged 13 to 17 years.

Covariates were selected from survey questions to measure associations of HPV vaccination with age group, race/ethnicity, mother's educational level, mother's marital status, mother's age, US-born status, poverty level, type of medical insurance, number of physician contacts within past 12 months, provider-reported health care visit at age 11 to 12 years, number of provider-reported vaccination providers, facility type (public, private, hospital, sexually transmitted diseases [STD]/school/teen clinics, mixed [including facilities in >1 category such as private, public, hospital, STD/school/teen clinics], and others [eg, military; Women, Infants, and Children program clinics; and pharmacies]), metropolitan statistical area, and US region. There were missing values for some of the variables listed here, and the proportions of missing values were small, ranging from 0.1% to 1.3%.

SUDAAN 11.0.1 (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 adjusted for the complex sample design of the NIS-Teen. All analyses account for the complex sampling plan of the NIS-Teen and the survey sampling weights.[16] *t* tests were used to examine associations with the significance level set at $\alpha < .05$. Multivariable logistic regression and predictive marginal models were conducted to derive the adjusted prevalence ratio. The models were checked for multicollinearity. All variables selected were included in the model. Additionally, Kaplan-Meier survival analysis was conducted to estimate the cumulative proportion of adolescents vaccinated over time by birth cohort. The NIS-Teen was approved by the CDC, National Center for Health Statistics Research Ethics Review Board.

RESULTS

The 2013 NIS-Teen included a total of 9554 male adolescents aged 13 to 17 years with sufficiently detailed provider data. Table 1 shows the demographic characteristics of the study population. Most were non-Hispanic white (54.3%), had mothers with more than a high school education (61.8%), had mothers who were currently married (66.7%), were born in the United States (95.3%), were living in a household with an income >133% of the federal poverty level (66.0%), had 1 vaccination provider (50.7%), had at least 1 physician contact within the past year (82.0%), and had all private reported vaccination providers (52.2%).

HPV Vaccination Uptake (≥1 Dose)

Overall, HPV vaccination coverage with ≥1 dose was 34.6%, and coverage (≥1 dose) was significantly higher among non-Hispanic blacks (42.2%) and Hispanics (49.6%) compared with non-Hispanic whites (26.7%; $P < .05$; Table 2).

In bivariable analyses, among male adolescents, other characteristics that were significantly associated with

TABLE 1 Sample Characteristics of Male Adolescents Aged 13 to 17 Years in the United States, by Demographic and Access-to-Care Variables, NIS-Teen 2013.

Characteristic	Sample	%, (95% CI)[a]
Total	9554	
Age (y)		
13–15	5819	61.0 (59.1–62.8)
16–17	3735	39.0 (37.2–40.9)
Race/ethnicity		
Non-Hispanic white	6300	54.3 (52.4–56.2)
Non-Hispanic black	840	14.1 (12.8–15.6)
Hispanic	1461	22.8 (21.0–24.7)
American Indian/Alaskan Native	147	0.9 (0.7–1.3)
Asian	278	3.1 (2.5–3.8)
Other	528	4.7 (4.1–5.4)
Mother's educational level		
<High school	1054	13.9 (12.5–15.5)
High school	1695	24.3 (22.5–26.1)
Some college or college graduate	2631	25.6 (24.0–27.1)
>College graduate	4174	36.2 (34.5–38.0)
Mother's marital status		
Married	6919	66.7 (64.9–68.5)
Widowed/divorced/separated	1809	22.8 (21.2–24.4)
Never married	750	10.5 (9.3–11.9)
Mother's age, y		
≤34	834	9.6 (8.6–10.7)
35–44	4043	45.2 (43.3–47.1)
≥45	4677	45.2 (43.3–47.0)
Immigration status		
Born in United States	9206	95.3 (94.1–96.2)
Born outside United States	323	4.7 (3.8–5.9)
Income to poverty ratio		
<1.33%	2366	34.0 (32.1–36.0)
1.33% to <3.22%	2856	30.3 (28.6–32.1)
3.22% to <5.03%	2118	17.1 (15.9–18.4)
>5.03%	2214	18.5 (17.3–19.9)
Medical insurance[b]		
Private insurance only	4609	42.0 (40.3–43.9)
VFC eligible, Medicaid/IHS/AIAN (All)	3827	45.3 (43.4–47.2)
VFC eligible, uninsured	469	6.0 (5.1–7.0)
SCHIP (public)	269	2.9 (2.4–3.5)
Military	314	2.9 (2.4–3.5)
Other	66	0.9 (0.5–1.8)
Physician contacts within past year		
None	1468	18.0 (16.5–19.6)
1	2777	28.6 (26.9–30.3)
2–3	3365	34.7 (32.9–36.6)
≥4	1902	18.7 (17.3–20.1)
Well–child visit at age 11–12 y[c]		
Yes	3318	34.3 (32.5–36.1)
No	1829	16.9 (15.7–18.2)
Not licensed[d]	2182	22.7 (21.2–24.3)
Don't know	2225	26.2 (24.4–28.0)
Number of providers		
1	4757	50.7 (48.9–52.6)
2	2842	28.9 (27.2–30.6)
≥3	1943	20.4 (18.8–22.0)
Metropolitan statistical area		
Urban area	3636	38.9 (37.1–40.8)
Suburban area	3743	47.7 (45.8–49.6)
Rural area	2175	13.4 (12.5–14.4)
Region		
Northeast	1975	16.9 (16.0–17.8)
Midwest	2174	21.7 (20.7–22.7)
South	3132	37.5 (36.0–39.0)
West	2273	24.0 (22.3–25.7)

TABLE 1 Continued

Characteristic	Sample	%, (95% CI)[a]
Facility type		
All private facilities	4470	52.2 (50.3–54.1)
All public facilities	1398	14.8 (13.4–16.3)
All hospital facilities	993	9.0 (8.0–10.2)
All STD/school/teen clinics or other facilities	160	1.8 (1.4–2.3)
Mixed[e]	2343	21.0 (19.6–22.5)
Other[f]	141	1.2 (0.9–1.6)

SCHIP, State Children's Health Insurance Program.

[a] Percentages are weighted.

[b] Insurance categories are mutually exclusive.

[c] Status of health-care visit at age 11–12 y based on provider reported data.

[d] This indicated that the adolescents were ≥13 y of age when HPV vaccination was recommended in 2006.

[e] Mixed 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.

[f] Includes military, Women, Infants, and Children program clinics, and pharmacies.

a higher level of HPV vaccination coverage compared with the referent group included mother of adolescent being never married, widowed, divorced, or separated; being born outside the United States; being Vaccines for Children (VFC) eligible but not uninsured or with State Children's Health Insurance Program (the state children's health insurance); having 2 or 3 physician contacts in the past 12 months; having a well-child visit at age 11 to 12 years; having 1 or 2 vaccination providers; and living in urban or suburban areas ($P < .05$). Those whose mothers had high school or more than high school education, those whose mother's age was ≥45 years, those with an income to poverty ratio >133%, those living in the Midwest or South, and those receiving vaccinations from all STD/school/teen clinics or other facilities were characteristics associated with a lower level of HPV vaccination (Table 2).

HPV Vaccination Uptake (≥3 Doses)

Overall, HPV vaccination uptake (≥3 doses) was 13.9%. Coverage (≥3 doses) was significantly higher among non-Hispanic blacks (15.7%) and Hispanics (20.3%) compared with non-Hispanic whites (11.1%; $P < .05$; Table 3).

In bivariable analyses, among male adolescents, other characteristics that were significantly associated with a higher level of HPV vaccination coverage (≥3 doses) compared with the referent group included having a well-child visit at age 11 to 12 years and living in urban or suburban areas ($P < .05$). A mother with a high school or more than high school education, income to poverty ratio between 133% and 503%, and being VFC eligible but not insured were characteristics associated with a lower level of HPV vaccination (≥3 doses; $P < .05$; Table 3).

Factors Associated With HPV Vaccination Based on Multivariable Logistic Regression Models

Multivariable logistic regression showed that characteristics independently associated with a higher likelihood of HPV vaccination (≥1 dose) included being non-Hispanic black race or Hispanic ethnicity; having mothers who were widowed, divorced, or separated; having 1 to 3 physician contacts in the past 12 months; having a well-child visit at age 11 to 12 years; having 1 or 2 vaccination providers; living in urban or suburban areas; and receiving vaccinations from mix of facility types ($P < .05$). Having mothers with some college or college education, those with a higher family income to poverty ratio, those living in South or Midwest, and those receiving vaccinations from all STD/school/teen clinics or other facilities were characteristics independently associated with a lower likelihood of HPV vaccination ($P < .05$; Table 2). Regression diagnosis found that multicollinearity was not identified among all variables assessed in this multivariable logistic model.

Multivariable logistic regression showed that characteristics independently associated with a higher likelihood of HPV vaccination (≥3 dose) included being non-Hispanic black race or Hispanic ethnicity, having a well-child visit at age 11 to 12 years, and living in urban or suburban areas ($P < .05$). Income to poverty ratio between 322% and 503%, and being VFC eligible but not insured were characteristics that were associated with a lower level of HPV vaccination (≥3 doses; $P < .05$; Table 3). Regression diagnosis found that multicollinearity was not identified among all variables assessed in this multivariable logistic model.

Trends of HPV Vaccination Among Male Adolescents

Overall, HPV vaccination coverage among male adolescents significantly increased from 2010 to 2013 (test for trend, $P < .05$). In addition, among each birth cohort, the cumulative percent receiving HPV vaccination among male adolescents increased slowly before June 2011 and increased considerably after June 2011, particularly after December 2011 (Figs 1 and 2).

Parent-Reported Reasons for Nonreceipt of HPV Vaccination Among Male Adolescents

The most common reason reported by parents for having no intent for their boys to receive HPV vaccination among those who have not received any HPV vaccinations was that the respondent thought their provider did not recommend it (24.0%). Other reasons included that it was not needed or not necessary (18.9%),

TABLE 2 HPV Vaccination Coverage (≥1 Dose) Among Male Adolescents Aged 13 to 17 Years in the United States, by Demographic and Access-to-Care Characteristics, NIS-Teen 2013

Characteristic	Unadjusted		Adjusted	
	Vaccination Coverage (≥1 Dose)	Vaccination With ≥1 Dose, PR	Vaccination Coverage (≥1 Dose)	Vaccination With ≥1 Dose, PR
	% (95% CI)	PR (95% CI)	% (95% CI)	PR (95% CI)
Total	34.6 (32.7–36.5)			
Age, y				
13–15[a]	34.9 (32.5–37.5)	Ref	33.2 (30.7–35.8)	Ref
16–17	34.1 (31.3–37.0)	0.98 (0.87–1.09)	37.1 (33.6–40.7)	1.12 (0.98–1.28)
Race/ethnicity				
Non-Hispanic White[a]	26.7 (24.9–28.6)	Ref	29.3 (27.1–31.6)	Ref
Non-Hispanic Black	42.2 (36.8–47.8)[b]	1.58 (1.36–1.83)[b]	41.4 (35.9–47.1)[b]	1.41 (1.21–1.65)[b]
Hispanic	49.6 (44.5–54.8)[b]	1.86 (1.64–2.11)[b]	43.9 (39.2–48.8)[b]	1.50 (1.30–1.72)[b]
American Indian/Alaskan Native	38.6 (25.8–53.2)	1.44 (1.00–2.09)	41.2 (25.7–58.7)	1.41 (0.92–2.15)
Asian	26.3 (18.5–36.1)	0.99 (0.70–1.39)	24.6 (17.0–34.3)	0.84 (0.59–1.20)
Other	34.4 (27.8–41.7)[b]	1.29 (1.04–1.60)[b]	34.1 (27.6–41.3)	1.16 (0.94–1.44)
Mother's educational level				
<High school[a]	47.0 (41.1–53.0)	Ref	36.1 (30.8–41.8)	Ref
High school	36.7 (32.3–41.4)[b]	0.78 (0.65–0.93)[b]	33.9 (30.1–37.9)	0.94 (0.78–1.13)
Some college/college graduate	27.9 (24.7–31.3)[b]	0.59 (0.50–0.71)[b]	29.4 (26.3–32.7)[b]	0.81 (0.67–0.99)[b]
> College graduate	33.1 (30.5–35.8)[b]	0.70 (0.61–0.82)[b]	38.5 (35.2–41.8)	1.06 (0.88–1.29)
Mother's marital status				
Married[a]	31.4 (29.3–33.7)	Ref	33.0 (30.7–35.4)	Ref
Widowed/divorced/separated	38.8 (34.8–43.0)[b]	1.24 (1.09–1.40)[b]	38.7 (34.9–42.7)[b]	1.17 (1.04–1.33)[b]
Never married	44.3 (37.9–51.0)[b]	1.41 (1.20–1.66)[b]	36.1 (30.2–42.4)	1.09 (0.90–1.32)
Mother's age, y				
≤34[a]	40.4 (35.0–46.0)	Ref	38.4 (33.1–44.0)	Ref
35–44	35.3 (32.3–38.3)	0.87 (0.74–1.03)	34.6 (31.9–37.3)	0.90 (0.77–1.06)
≥45	32.7 (30.1–35.5)[b]	0.81 (0.69–0.95)[b]	34.0 (31.3–36.9)	0.89 (0.75–1.05)
Immigration status				
Born in United States	33.9 (32.0–35.8)	Ref	34.2 (32.3–36.2)	Ref
Born outside United States	48.6 (37.5–59.9)[b]	1.43 (1.13–1.82)[b]	43.5 (34.2–53.3)	1.27 (1.01–1.60)
Income to poverty ratio				
<133%[a]	44.2 (40.5–48.0)	Ref	41.5 (37.3–45.7)	Ref
133% to <322%	29.8 (26.4–33.4)[b]	0.67 (0.58–0.78)[b]	31.0 (27.8–34.3)[b]	0.75 (0.64–0.87)[b]
322% to <503%	25.9 (22.8–29.3)[b]	0.59 (0.50–0.68)[b]	28.2 (24.5–32.2)[b]	0.68 (0.56–0.82)[b]
>503%	32.8 (29.4–36.5)[b]	0.74 (0.65–0.85)[b]	33.9 (29.9–38.1)[b]	0.82 (0.68–0.98)[b]
Medical insurance				
Private insurance only[a]	29.6 (27.2–32.2)	Ref	33.9 (30.9–37.1)	Ref
VFC eligible, Medicaid/IHS/AIAN (All)	39.5 (36.4–42.6)[b]	1.33 (1.19–1.50)[b]	35.8 (33.0–38.8)	1.06 (0.93–1.20)
VFC eligible, uninsured	32.8 (25.2–41.4)	1.11 (0.85–1.44)	31.7 (24.5–39.9)	0.94 (0.72–1.22)
SCHIP (Public)	42.0 (32.5–52.1)[b]	1.42 (1.10–1.82)[b]	40.4 (31.3–50.2)	1.19 (0.92–1.53)
Military	28.6 (20.9–37.8)	0.96 (0.71–1.31)	33.4 (25.0–42.9)	0.98 (0.74–1.30)
Other	_[c]	_[c]	_[c]	_[c]
Physician contacts in past year				
None[a]	28.7 (24.3–33.6)	Ref	28.0 (24.0–32.4)	Ref
1	33.9 (30.6–37.4)	1.18 (0.98–1.43)	34.1 (31.0–37.4)[b]	1.22 (1.02–1.45)[b]
2–3	39.6 (36.2–43.0)[b]	1.38 (1.15–1.65)[b]	39.7 (36.7–42.8)[b]	1.42 (1.20–1.68)[b]
≥4	32.5 (29.0–36.2)	1.13 (0.93–1.38)	32.7 (29.1–36.5)	1.17 (0.97–1.41)
Well-child visit at age 11–12 y				
Yes	39.9 (36.6–43.2)[b]	1.55 (1.32–1.83)[b]	39.8 (36.6–43.2)[b]	1.40 (1.20–1.64)[b]
No[a]	25.7 (22.2–29.5)	Ref	28.4 (24.6–32.6)	Ref
Not licensed[d]	32.4 (28.9–36.1)[b]	1.26 (1.05–1.51)[b]	31.4 (27.1–36.0)	1.10 (0.90–1.36)
Don't know	35.4 (31.3–39.7)[b]	1.38 (1.15–1.66)[b]	34.7 (31.0–38.6)[b]	1.22 (1.03–1.45)[b]
Number of providers				
1	35.6 (33.0–38.3)[b]	1.19 (1.01–1.39)[b]	36.4 (33.7–39.2)[b]	1.23 (1.04–1.45)[b]
2	36.2 (32.6–39.8)[b]	1.20 (1.01–1.43)[b]	35.2 (32.1–38.5)[b]	1.18 (1.01–1.39)[b]
≥3[a]	30.0 (26.0–34.4)	Ref	29.7 (25.7–34.1)	Ref
Metropolitan statistical area				
Urban area	40.1 (37.0–43.2)[b]	1.73 (1.49–2.02)[b]	37.9 (35.1–40.8)[b]	1.40 (1.20–1.62)[b]
Suburban area	33.4 (30.5–36.3)[b]	1.44 (1.23–1.69)[b]	33.9 (31.1–36.9)[b]	1.25 (1.08–1.45)[b]
Rural area[a]	23.1 (20.2–26.3)	Ref	27.2 (23.7–30.9)	Ref

TABLE 2 Continued

Characteristic	Unadjusted		Adjusted	
	Vaccination Coverage (≥1 Dose)	Vaccination With ≥1 Dose, PR	Vaccination Coverage (≥1 Dose)	Vaccination With ≥1 Dose, PR
	% (95% CI)	PR (95% CI)	% (95% CI)	PR (95% CI)
Region				
Northeast	42.2 (38.8–45.6)	1.00 (0.86–1.17)	42.2 (38.8–45.8)	1.06 (0.91–1.22)
Midwest	27.8 (25.1–30.6)[b]	0.66 (0.56–0.78)[b]	31.1 (28.2–34.2)[b]	0.78 (0.67–0.90)[b]
South	30.4 (27.8–33.2)[b]	0.72 (0.62–0.85)[b]	29.8 (27.2–32.5)[b]	0.75 (0.64–0.86)[b]
West[a]	42.0 (36.7–47.5)	Ref	40.0 (35.3–44.8)	Ref
Facility type				
All private facilities[a]	34.4 (31.9–37.1)	Ref	33.4 (30.8–36.0)	Ref
All public facilities	33.1 (27.9–38.8)	0.96 (0.80–1.15)	31.5 (26.7–36.7)	0.94 (0.79–1.13)
All hospital facilities	38.5 (32.3–45.1)	1.12 (0.93–1.34)	37.3 (31.6–43.3)	1.12 (0.94–1.32)
All STD/school/teen clinics or other facilities	15.8 (9.6–25.1)[b]	0.46 (0.28–0.75)[b]	13.6 (7.8–22.7)[b]	0.41 (0.24–0.70)[b]
Mixed[e]	36.9 (33.0–41.0)	1.07 (0.94–1.22)	41.3 (37.2–45.5)[b]	1.24 (1.09–1.41)[b]
Other[f]	28.4 (16.6–44.0)	0.82 (0.50–1.35)	43.0 (27.1–60.4)	1.29 (0.86–1.94)

CI, confidence interval; SCHIP, State Children's Health Insurance Program.

[a] Reference level.

[b] $P < 0.05$ by t test for comparisons within each variable with the indicated reference level.

[c] Estimate may not be reliable due to relative SE >30% or sample size <30.

[d] This indicated that the adolescents were ≥13 y of age when HPV vaccination was recommended in 2006.

[e] Mixed indicates that the facility is identified to be in >1 of the facility categories such as private, public, hospital, STD/school/teen clinics.

[f] Includes military, Women, Infants, and Children program clinics, and pharmacies.

lack of knowledge (16.4%), the adolescent was not sexually active (8.1%), and safety concern/side effects (7.3%; Table 4). Percentages reported among male adolescents aged 13 to 15 years were similar with those aged 16 to 17 years (Table 4).

DISCUSSION

Findings from our analysis show that HPV vaccine coverage (≥1 dose) among male adolescents aged 13 to 17 years was 34.6% and ≥3 HPV doses was 13.9%, ~1 to 2 years after the quadrivalent HPV vaccine was routinely recommended by ACIP for male adolescents.[2] Coverage increased steadily after the ACIP recommendation but remained low, and about two-thirds of male adolescents were still unvaccinated with HPV in 2013.

Early uptake of HPV vaccine among male adolescents is similar to early uptake of other vaccines recommended for adolescents. Meningococcal conjugate vaccine (MCV4), tetanus/diphtheria/acellular pertussis vaccine, and HPV vaccine (female), 3 new vaccines recommended for adolescents in 2005, 2005, and 2006 had reported vaccination coverage levels of 10.8%, 11.7%, and 25.1% (~1 year after ACIP's recommendations), respectively, for receipt of ≥1 dose.[17–20] Meningococcal conjugate vaccine, tetanus/diphtheria/acellular pertussis vaccine, and HPV vaccination (female) coverage were 30.4%, 32.4%, and 37.2%, respectively, ~2 years after ACIP's recommendations.[17–20] Although HPV vaccination uptake in boys was similar to uptake in girls 1 to 2 years after ACIP recommendations were made, one might have expected uptake in boys to be higher in the same amount of time because providers already had the vaccine in stock (so there were no delays in obtaining supply) and had experience with administering the vaccine.

Our analysis showed that HPV vaccination coverage among male adolescents significantly increased from 2010 to 2013 (test for trend, $P <$ .05). One previous study also indicated that early uptake of HPV vaccination (≥1 dose) of male adolescents increased from 1.4% in 2010% to 8.3% in 2011.[14] Another study showed that HPV vaccination (≥1 dose) of Hispanic males 13 to 17 years increased from 2.8% in 2010 to 31.7% in 2012,[21] and our study showed that the coverage (≥1 dose) among Hispanic male 13- to 17-year-olds further increased to 49.6% in 2013. The results from previous research and our study reflect the adoption of ACIP recommendations during this period. Studies have found that HPV vaccine awareness was lower among male adolescents and their parents,[22] which may affect uptake of this vaccine. Continued monitoring will determine if HPV vaccination coverage continues to increase or levels off as has been observed for HPV vaccination of females.[15,23]

Racial and ethnic disparities were noted, with non-Hispanic black male adolescents having significantly higher HPV vaccine coverage (≥1 dose) compared with non-Hispanic white males. Disparities were also noted with Hispanics having significantly higher HPV vaccine coverage (both ≥1 dose

TABLE 3 HPV Vaccination Coverage (≥3 Doses) Among Male Adolescents Aged 13 to 17 Years in the United States, by Demographic and Access-to-Care Characteristics, NIS-Teen 2013

Characteristic	Unadjusted		Adjusted	
	Vaccination Coverage (≥3 Dose)	Vaccination With ≥3 Dose, PR	Vaccination Coverage (≥3 Dose)	Vaccination With ≥3 Dose, PR
	% (95% CI)	PR (95% CI)	% (95% CI)	PR (95% CI)
Total	13.9 (12.5–15.3)			
Age, y				
13–15[a]	13.5 (11.8–15.5)	Ref	13.3 (11.5–15.5)	Ref
16–17	14.4 (12.3–16.7)	1.06 (0.86–1.30)	15.1 (12.4–18.2)	1.13 (0.86–1.48)
Race/ethnicity				
Non-Hispanic White[a]	11.1 (9.9–12.6)	Ref	11.9 (10.4–13.5)	Ref
Non-Hispanic Black	15.7 (12.3–19.9)[b]	1.41 (1.08–1.85)[b]	15.9 (12.3–20.4)[b]	1.34 (1.01–1.77)[b]
Hispanic	20.3 (16.2–25.1)[b]	1.82 (1.41–2.34)[b]	18.5 (14.8–22.8)[b]	1.56 (1.19–2.04)[b]
American Indian/Alaskan Native	—[c]	—[c]	—[c]	—[c]
Asian	9.1 (5.5–14.7)	0.82 (0.49–1.36)	7.7 (4.6–12.5)	0.65 (0.39–1.08)
Other	12.2 (8.6–16.8)	1.09 (0.77–1.56)	12.9 (9.2–17.7)	1.08 (0.76–1.55)
Mother's educational level				
<High school[a]	20.9 (16.3–26.2)	Ref	17.6 (13.4–22.8)	Ref
High school	13.8 (10.7–17.5)[b]	0.66 (0.47–0.93)[b]	14.4 (11.3–18.1)	0.81 (0.58–1.15)
Some college/college graduate	11.1 (8.8–14.0)[b]	0.53 (0.38–0.74)[b]	12.3 (9.8–15.4)	0.70 (0.48–1.01)
> College graduate	13.2 (11.5–15.0)[b]	0.63 (0.48–0.83)[b]	13.3 (11.2–15.6)	0.75 (0.53–1.06)
Mother's marital status				
Married[a]	13.3 (11.7–15.1)	Ref	13.8 (12.1–15.7)	Ref
Widowed/divorced/separated	15.5 (12.4–19.2)	1.16 (0.90–1.50)	15.6 (12.5–19.4)	1.13 (0.87–1.47)
Never married	14.2 (10.8–18.4)	1.06 (0.79–1.42)	11.9 (8.8–15.8)	0.86 (0.62–1.20)
Mother's age, y				
≤34[a]	14.2 (10.7–18.7)	Ref	13.7 (10.3–17.9)	Ref
35–44	12.6 (10.7–14.7)	0.88 (0.64–1.22)	12.5 (10.8–14.5)	0.91 (0.67–1.24)
≥45	15.1 (13.0–17.4)	1.06 (0.77–1.46)	15.6 (13.3–18.3)	1.14 (0.83–1.57)
Immigration status				
Born in United States	13.4 (12.1–14.9)	Ref	13.6 (12.3–15.1)	Ref
Born outside United States	22.2 (13.5–34.3)	1.65 (1.02–2.68)	21.7 (13.4–33.3)	1.60 (1.00–2.56)
Income to poverty ratio				
<133%[a]	17.5 (14.7–20.6)	Ref	16.6 (13.1–20.8)	Ref
133% to <322%	11.1 (8.8–13.9)[b]	0.64 (0.48–0.84)[b]	12.1 (9.7–15.0)	0.73 (0.51–1.03)
322% to <503%	10.2 (8.4–12.5)[b]	0.59 (0.45–0.76)[b]	10.7 (8.4–13.5)[b]	0.64 (0.44–0.95)[b]
>503%	15.1 (12.6–18.1)	0.87 (0.68–1.11)	14.9 (11.9–18.7)	0.90 (0.61–1.32)
Medical insurance				
Private insurance only[a]	13.2 (11.3–15.3)	Ref	15.2 (12.4–18.4)	Ref
VFC eligible, Medicaid/IHS/AIAN (All)	15.3 (13.1–17.9)	1.16 (0.94–1.44)	14.0 (11.8–16.5)	0.92 (0.69–1.23)
VFC eligible, uninsured	6.3 (4.0–9.9)[b]	0.48 (0.29–0.77)[b]	5.5 (3.3–9.3)[b]	0.37 (0.20–0.66)[b]
SCHIP (Public)	19.6 (12.6–29.1)	1.49 (0.95–2.32)	19.2 (12.8–27.9)	1.27 (0.82–1.96)
Military	10.4 (6.4–16.4)	0.79 (0.48–1.29)	13.0 (7.8–20.8)	0.85 (0.51–1.42)
Other	_[c]	_[c]	_[c]	_[c]
Physician contacts in past year				
None[a]	10.9 (8.0–14.9)	Ref	11.3 (8.6–14.7)	Ref
1	13.9 (11.4–16.9)	1.27 (0.88–1.84)	14.1 (11.7–16.9)	1.25 (0.90–1.72)
2–3	15.4 (13.0–18.1)	1.40 (0.98–2.01)	15.4 (13.1–18.1)	1.36 (1.00–1.85)
≥4	14.0 (11.8–16.5)	1.28 (0.89–1.83)	13.8 (11.5–16.4)	1.22 (0.88–1.67)
Well-child visit at age 11–12 y				
Yes	16.8 (14.3–19.5)[b]	2.50 (1.82–3.44)[b]	17.0 (14.5–19.8)[b]	2.18 (1.58–3.02)[b]
No[a]	6.7 (5.1–8.8)	Ref	7.8 (5.8–10.3)	Ref
Not licensed[d]	14.3 (11.9–17.1)[b]	2.14 (1.53–2.98)[b]	13.4 (10.4–17.0)[b]	1.72 (1.16–2.54)[b]
Don't know	14.3 (11.3–17.9)[b]	2.13 (1.48–3.06)[b]	14.2 (11.3–17.8)[b]	1.83 (1.28–2.60)[b]
Number of providers				
1	14.5 (12.6–16.7)	1.26 (0.97–1.63)	14.5 (12.5–16.7)	1.17 (0.87–1.57)
2	14.3 (11.8–17.3)	1.24 (0.93–1.66)	14.3 (11.8–17.1)	1.15 (0.86–1.54)
≥3[a]	11.6 (9.3–14.3)	Ref	12.4 (9.7–15.7)	Ref
Metropolitan statistical area				
Urban area	16.9 (14.7–19.4)[b]	2.13 (1.68–2.71)[b]	16.2 (14.2–18.5)[b]	1.62 (1.27–2.08)[b]
Suburban area	13.0 (11.0–15.4)[b]	1.64 (1.26–2.12)[b]	13.1 (11.0–15.5)[b]	1.31 (1.01–1.71)[b]
Rural area[a]	8.0 (6.5–9.6)	Ref	10.0 (8.0–12.4)	Ref

TABLE 3 Continued

Characteristic	Unadjusted		Adjusted	
	Vaccination Coverage (≥3 Dose)	Vaccination With ≥3 Dose, PR	Vaccination Coverage (≥3 Dose)	Vaccination With ≥3 Dose, PR
	% (95% CI)	PR (95% CI)	% (95% CI)	PR (95% CI)
Region				
Northeast	18.5 (15.9–21.3)	1.27 (0.91–1.76)	17.5 (14.9–20.4)	1.29 (0.92–1.81)
Midwest	11.7 (9.8–13.9)	0.80 (0.57–1.13)	13.3 (11.1–15.8)	0.98 (0.71–1.34)
South	12.6 (10.8–14.7)	0.87 (0.62–1.21)	13.0 (11.1–15.0)	0.96 (0.71–1.30)
West[a]	14.6 (10.8–19.4)	Ref	13.6 (10.2–17.8)	Ref
Facility type				
All private facilities[a]	14.6 (12.6–16.8)	Ref	13.6 (11.7–15.8)	Ref
All public facilities	12.2 (8.8–16.8)	0.84 (0.59–1.20)	12.5 (9.2–16.9)	0.92 (0.65–1.31)
All hospital facilities	15.7 (12.0–20.3)	1.08 (0.80–1.46)	15.8 (12.0–20.4)	1.16 (0.86–1.56)
All STD/school/teen clinics or other facilities	_[c]	_[c]	_[c]	_[c]
Mixed[e]	13.6 (11.3–16.2)	0.93 (0.74–1.17)	16.4 (13.2–20.1)	1.20 (0.92–1.56)
Other[f]	_[c]	_[c]	_[c]	_[c]

PR, prevalence ratio; SCHIP, State Children's Health Insurance Program.

[a] Reference level.

[b] $P < .05$ by t test for comparisons within each variable with the indicated reference level.

[c] Estimate may not be reliable due to relative SE >30% or sample size <30.

[d] This indicated that the adolescents were aged ≥13 y of when HPV vaccination was recommended in 2006.

[e] Mixed indicates that the facility is identified to be in >1 of the facility categories such as private, public, hospital, STD/school/teen clinics.

[f] Includes military, Women, Infants, and Children program clinics, and pharmacies.

and ≥3 doses) compared with non-Hispanic white males. This disparity remained after controlling for other factors. Racial and ethnic disparities in HPV vaccination were similar to those among female adolescents.[22] HPV vaccination coverage was generally higher among teens living in poverty, which might reflect the VFC program's[24] effectiveness at reaching these young persons.

Further research is needed to better understand the factors associated with racial/ethnic differences in HPV vaccination coverage among male adolescents.

Several other characteristics, such as having more physician contacts in the past 12 months, and having a well-child visit at age 11 to 12 years were independently associated with HPV vaccination initiation, consistent with other vaccination studies among adolescents.[25–28] Physician recommendations for vaccination are associated with a patient's decision to get vaccinated.[25–28] Persons who have more physician contacts may have more opportunities to discuss their vaccination status and receive vaccination.

Some barriers may hinder vaccine uptake. Our analysis indicated that the most common primary reasons for not receiving HPV vaccination among male adolescents aged 13 to 17 years were that their provider did not recommend HPV vaccination (24.0%), that the vaccine was not needed or not necessary (18.9%), lack of knowledge (16.4%), the adolescent was not sexually active (8.1%), and safety concern/side effects (7.3%). These stated reasons for not receiving HPV vaccine indicate that parents may have limited knowledge regarding HPV vaccine and ACIP recommendations. To help facilitate discussions between clinicians and parents, CDC has

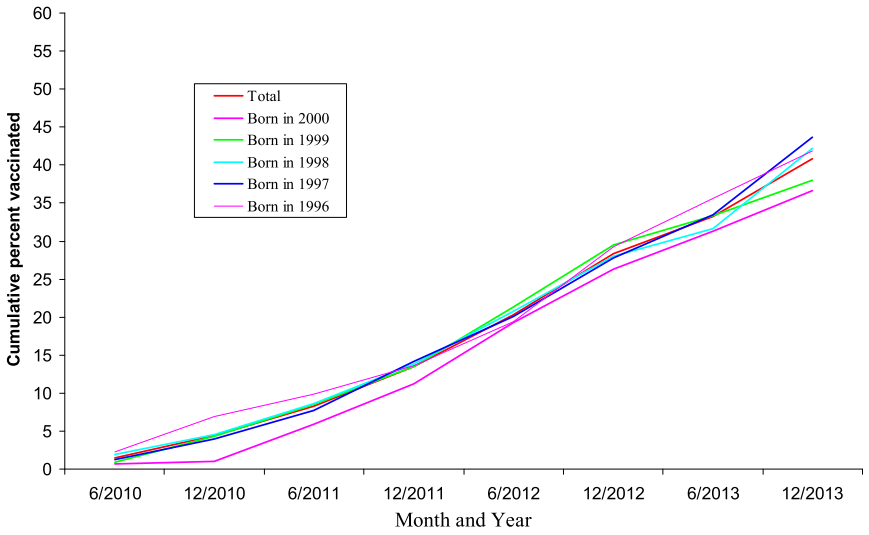

FIGURE 1
Cumulative percent of HPV vaccination (≥1 dose) uptake over time by birth cohort among male adolescents aged 13 to 17 years (NIS-Teen, 2013).

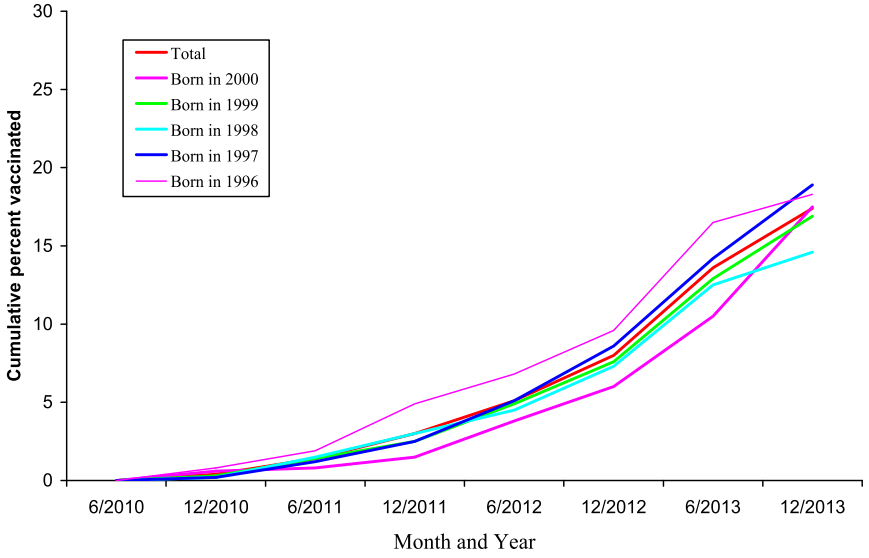

FIGURE 2
Cumulative percent of HPV vaccination (≥3 dose) uptake over time by birth cohort among male adolescents aged 13 to 17 years (NIS-Teen, 2013).

developed several resources, including a tips sheet with suggested language for talking with parents.[29]

The Guide to Community Preventive Services has identified evidence-based strategies to improve vaccination coverage, including standing-order programs, reminder/recall systems to notify clinicians and parents when a vaccine is due, and use of Immunization Information Systems.[30] Although these interventions may be helpful for adolescents who need to receive their second or third dose of HPV vaccine, it is not clear that they will be sufficient for improving initiation of the series. Additional efforts will be needed to improve provider practices and recommendation of this vaccine at age 11 to 12 years to all adolescent boys and girls.

The findings in this study are subject to several limitations. First, household response rates were 51.1% (landline households) and 23.3% (cellular phone households), respectively. Only 59.5% (landline) and 54.5% (cellular telephone) of completed household interviews also had adequate provider-verified vaccination data. Some bias may remain after weighting adjustments designed to mitigate potential bias from incomplete data from the sample frame and nonresponse.[31,32] Second, some provider-confirmed vaccination histories might not include all vaccinations received (eg, vaccinations administered in nontraditional settings such as emergency departments) and might have underestimated vaccination coverage.

One to two years after the vaccine was recommended for male adolescents, only 34.6% had initiated HPV vaccination (≥1 dose) and 13.9% had ≥3 HPV doses. Coverage increased steadily after the ACIP recommendation for routine vaccination of males but remained low: about two-thirds of male adolescents were still unvaccinated with HPV in 2013. To further increase HPV vaccination coverage, comprehensive strategies include the following: (1) providers should routinely assess the HPV vaccination status of their patients, especially when they have

TABLE 4 Main Reasons for Not Receiving HPV Vaccination[a] Among Male Nonvaccinees Aged 13 to 17 Years, NIS-Teen 2013

Main Reason	13–17 y		13–15 y		16–17 y	
	Sample	%, Range	Sample	%, Range	Sample	%, Range
Not recommended	861	24.0 (21.8–26.4)	506	22.9 (20.1–25.9)	355	25.8 (22.2–29.6)
Not needed or not necessary	621	18.9 (16.8–21.2)	385	19.5 (16.8–22.5)	236	18.1 (14.8–21.9)
Lack of knowledge	566	16.4 (14.5–18.5)	329	16.3 (13.8–19.2)	237	16.5 (13.7–19.8)
Not sexually active	309	8.1 (6.8–9.7)	196	8.2 (6.4–10.3)	113	8.0 (6.0–10.6)
Safety concern/side effects	248	7.3 (5.9–9.0)	151	7.7 (5.8–10.0)	97	6.8 (4.9–9.3)
Not appropriate age	135	3.2 (2.5–4.2)	105	3.8 (2.9–5.0)	30	2.3 (1.2–4.4)
Not a school requirement	134	3.5 (2.7–4.5)	80	4.2 (3.0–5.8)	54	2.5 (1.7–3.5)
Child is male	119	4.2 (3.1–5.7)	67	4.6 (3.1–6.8)	52	3.6 (2.2–5.7)
Family/parental decision	113	3.0 (2.2–4.1)	64	2.8 (1.9–4.2)	49	3.2 (1.8–5.6)
Costs/uninsured/insurance does not fully cover shots	68	1.5 (1.0–2.1)	38	1.3 (0.8–2.2)	30	1.8 (1.1–2.8)
Child fearful/shot could be painful	50	1.7 (0.9–3.2)	15	1.4 (0.4–4.7)	35	2.2 (1.5–3.3)
Need more info/new vaccine	41	0.9 (0.5–1.4)	23	0.6 (0.3–1.2)	18	1.2 (0.6–2.4)
Intend to complete but have not yet/already planned	32	1.0 (0.6–1.7)	16	0.7 (0.4–1.4)	16	1.5 (0.7–3.2)
Other reason	73	2.0 (1.4–2.8)	38	2.1 (1.3–3.3)	35	1.9 (1.2–2.9)

[a] Percentage of main reasons for no intent of receiving HPV vaccination in the next 12 mo among male nonvaccinees aged 13–17 y.

a well-child visit, to ensure that the adolescent is fully vaccinated and recommending catch-up vaccination and administering all age-appropriate vaccines during the same clinical encounter; (2) it is important to ensure all vaccine providers are knowledgeable about HPV vaccine recommendations for males and females, with provision for current information on efficacy and safety of vaccines; (3) reducing parental out-of-pocket expenses; (4) using media promotions and educational programs for parents to improve HPV awareness; and (5) efforts should be directed to provide comprehensive, accessible, and appropriate communication messages on HPV and HPV vaccine directed to male adolescents and parents.[29,30,33] Additionally, the Affordable Care Act may help improve vaccination coverage because the expanded enrollment in public and private insurance programs expected from provisions of the Affordable Care Act is likely to improve access to health care services, including vaccination.[34] Continued monitoring of HPV vaccination uptake among male adolescents is useful for evaluating vaccination campaigns and for planning and implementing strategies to increase vaccination coverage. Increased efforts are needed to improve HPV vaccination coverage for all adolescents to reduce HPV infections and related cancers.

ABBREVIATIONS

ACIP: Advisory Committee on Immunization Practices
CDC: Centers for Disease Control and Prevention
HPV: human papillomavirus
HPV2: bivalent human papillomavirus vaccine
HPV4: quadrivalent human papillomavirus vaccine
NIS-Teen: National Immunization Survey-Teen
STD: sexually transmitted diseases
VFC: Vaccines for Children program

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