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Human Papillomavirus Vaccination Coverage Among Girls Before 13 Years: A Birth Year Cohort Analysis of the National Immunization Survey–Teen, 2008–2013

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Abstract

Routine human papillomavirus (HPV) vaccination is recommended at 11 or 12 years by the Advisory Committee on Immunization Practices. National Immunization Survey–Teen data were analyzed to evaluate, among girls, coverage with one or more doses of HPV vaccination, missed opportunities for HPV vaccination, and potential achievable coverage before 13 years. Results were stratified by birth year cohorts. HPV vaccination coverage before 13 years (≥1 HPV dose) increased from 28.4% for girls born in 1995 to 46.8% for girls born in 2000. Among girls born during 1999–2000 who had not received HPV vaccination before 13 years (57.2%), 80.1% had at least 1 missed opportunity to receive HPV vaccination before 13 years. Opportunities to vaccinate for HPV at age 11 to 12 years are missed. Strategies are needed to decrease these missed opportunities for HPV vaccination. This can be facilitated by the administration of all vaccines recommended for adolescents at the same visit.

Keywords

human papillomavirus; trends in vaccination coverage; missed opportunity; achievable coverage; birth year cohort; adolescent vaccination; vaccination coverage

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Author Contributions

JJ conceptualized and designed the study, carried out data analysis, contributed to the interpretation of findings, drafted the initial and revised manuscripts, and approved the final manuscript as submitted. LDE, PJS, JAS and SS contributed to the study design and interpretation of findings, reveiewed and revised the manuscript, and approved the final manuscript as submitted.]

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Declaration of Conflicting Interests

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Introduction

Human papillomavirus (HPV) is one of the most common sexually transmitted infections and a causal factor for cervical cancer among women.[1–3] Since 2006, vaccines to prevent infection from some types of HPV have been available and recommended for adolescents. Currently, there are 3 HPV vaccines available in the United States: a bivalent vaccine (2vHPV), licensed in 2009 for use in females, protects against HPV types 16 and 18; a quadrivalent vaccine (4vHPV), licensed in 2006 for use in females and 2009 for use in males, protects against HPV types 6, 11, 16, and 18; and a 9-valent vaccine (9vHPV), licensed in 2014 for use in males and females, protects against the 4 types included in 4vHPV plus types 31, 33, 45, 52, and 58.[1,4–6] HPV vaccination is recommended at 11 or 12 years and through 26 years for females who had not been previously vaccinated. This recommendation was based on several considerations, including vaccination safety and immunogenicity at this age, the need to vaccinate prior to HPV exposure, the practicality of administering HPV vaccine with other vaccines that are recommended at this age, and many adolescents have preventive health care visits at this age.[1,7]

While ≥1-dose HPV vaccination coverage among 13-year-old girls has increased each year since 2007, coverage remains low, with only 50.6% initiating the 3-dose HPV vaccine series in 2013 by the Advisory Committee on Immunization Practices (ACIP) recommended age guidelines.[8,9] Additionally, national coverage for HPV vaccination among 13-year-old girls is much lower than the coverage for other adolescent vaccines such as the tetanus toxoid, reduced diphtheria toxoid and acellular pertussis (Tdap), and the meningococcal conjugate (MenACWY) vaccines.

The purpose of this study was to examine HPV vaccination coverage before 13 years (“on-time”) and from 13 to 17 years (“catch-up”) among girls born in 1995–2000. We identify socio-demographic factors associated with receipt of ≥1 dose of HPV vaccination before 13 years and trends across birth cohorts in receipt of ≥1 dose of HPV vaccination before 13 years overall and stratified by sociodemographic characteristics. For the most recent cohorts (the girls who were born in 1999 or 2000), we examined the percentage of girls who had missed opportunities for HPV vaccination before 13 years and the potentially achievable coverage before 13 years if these opportunities had not been missed. We also examine the association of sociodemographic factors with missed vaccination opportunity and achievable coverage. We also examine the cumulative proportion of girls receiving ≥1 dose of HPV vaccination by age, stratified by annual birth cohort.

Methods

Data Source

We used National Immunization Survey (NIS)–Teen data from 2008 to 2013 for our analysis. Data from the NIS–Teen is collected in 2 phases: a random-digit dialed telephone survey that identifies households with adolescents 13–17 years old, followed by a mail survey sent to consenting adolescents’ vaccination providers to obtain the adolescents’ provider-reported vaccination histories.[10] In 2011, NIS–Teen began to sample households with both landline and cellular telephones.[10] From 2008 to 2013, the Council of American

Survey Research Organizations landline response rates ranged from 51.1% to 58.7% and from 2011 to 2013, cell phone response rates ranged from 22.4% to 23.3%.[10] From 2008 to 2013, the provider-phase response rates by landline (the completed interviews for whom we had adequate provider data) ranged from 57.4% to 62% and from 2011 to 2013, the response rate by cellphone ranged from 54.5% to 56.4%.[10]

Definition and Outcome Measures

We combined NIS–Teen data collected from 2008 to 2013 among 13- to 17-year-old girls to determine their HPV vaccination coverage before they reached 13 years of age (up to the day before the 13th birthday) and by birth year cohort. Birth dates and dates of vaccination from all eligible girls were used to determine age at vaccination. The birth year cohorts included in this analysis were adolescents who were born each year from 1995 through 2000. We used receipt of ≥1 dose of HPV vaccine before 13 years as the primary outcome measure (HPV vaccination initiation) and also estimated coverage before 13 years with ≥2 doses and ≥3 doses of HPV vaccination. Our analysis was limited to only girls, since the ACIP recommendation for HPV for boys was not published until 2011.

We also evaluated the percentage of girls who had missed opportunity and achievable coverage for ≥1 dose of HPV vaccine before 13 years in the combined 1999 and 2000 birth year cohorts (born in 1999 or 2000 and 13 years in 2012 or 2013). At least one missed opportunity for HPV vaccination is defined as a provider visit during which a girl received at least 1 vaccine but did not receive the first dose of HPV vaccine, occurring on or after 11 years and before the 13th year birthday, and on or after March 23, 2007 (the publication date of ACIP's 4vHPV recommendation).[11] Achievable coverage is defined as the ≥1-dose HPV vaccination coverage before 13 years that could have been attained if unvaccinated adolescents received the first dose of HPV vaccine during their vaccination visits.

Statistical Analyses

We conducted bivariable analysis of HPV vaccination coverage before 13 years with socio-demographic factors among girls within each of the birth cohorts for 1995–2000 in the United States with SAS-callable SUDAAN version 11.0.1 (Research Triangle Institute, Research Triangle Park, NC) to account for the complex nature of the NIS–Teen sample survey design. All analyses used survey weights designed to increase the representativeness of the weighted sample. NIS–Teen data collection was approved by the National Center for Health Statistics Research Ethics Review Board.

Human papillomavirus vaccination coverage trends within birth year cohorts were assessed with weighted least squares linear regression models.[12] The reciprocal of the estimated variance of vaccination coverage estimates was used for weights. Regression analysis was performed to compute the average percentage increase in HPV vaccination coverage before 13 years across birth year cohorts from 1995–2000. The average birth year cohort percentage increase was defined as the slope of the linear regression line.[12] The cumulative percent receiving ≥1 dose of HPV vaccination was estimated from 13 to 17 years, stratified by annual birth cohort using the Kaplan-Meier method.[13]

Results

A total of 33 707 girls between 13 and 17 years old with adequate provider data from the 2008–2013 NIS–Teen were included in the study. Table 1 shows the demographic characteristics of the 2008–2013 sample.

Figure 1 shows estimated HPV vaccination coverage before 13 years by minimum number of doses received and birth cohort. In general, vaccination coverage significantly increased (test for trend, $P < .05$) from the older cohort (1995) to the younger cohort (2000). For those who received ≥1 dose, the increase was from 28.4% to 46.8%; ≥2 doses, the increase was from 20.0% to 36.2%; and ≥3 doses, the increase was from 11.3% to 26.6%. Coverage for ≥1 dose of HPV and ≥2 doses of HPV vaccination increased with each subsequent cohort, though not all increases were statistically significant. Coverage for ≥3 doses of HPV vaccine increased from 1995 to 2000, although there was a plateau in coverage for the 1996–1999 birth year cohorts.

Table 2 shows coverage for ≥1 dose of HPV vaccine before 13 years by birth year cohorts and the average birth year percentage increase (ABYPI), by selected sociodemographic characteristics. For the most recent cohorts (1999–2000), the characteristics that were significantly associated with a higher level of HPV vaccination series initiation coverage compared with the referent group included Hispanic (54.6% had ≥1 dose of HPV vaccine), those with income <133% (51.7%), whose mothers were ≤34 (50.5%) or 35–44 years old (44.5%), those whose mothers had less than high school (54.9%) or high school education (50.6%), those whose mothers were divorced/widowed/separated/deceased (47.3%) or never married (51.0%), those who had an 11- to 12-year preventive care visit (51.6%), those who received provider recommendation (51.6%), those who had Medicaid insurance (47.6%), those who had other insurance (73.8%), and those living in the West census region (52.6%) ($P < .05$). Those living in suburban areas (39.1%) and those who had military insurance (23.9%) had lower HPV vaccination coverage ($P < .05$). The national ABYPI in HPV vaccination coverage among girls before 13 years was 3.1 percentage points. HPV vaccination series initiation coverage and the ABYPI were consistently highest among Hispanic girls across all cohorts. Subgroups with the highest coverage across the cohorts also tended to have higher ABYPI, including girls in households with income <133%, those whose mother's age was ≤34 years, those whose mothers had less than high school education, and those living in the West census region.

Table 3 shows results of analysis of missed opportunities, potentially achievable coverage with ≥1 dose of HPV vaccination and the gap between potential coverage and actual coverage among the subset of girls born in 1999–2000, overall and by socio-demographic characteristics. For the most recent cohorts (1999–2000), 57.2% of girls were not vaccinated with ≥1 HPV before 13 years. Among the girls who were not vaccinated before age 13, 80.1% had a missed opportunity for the first dose of HPV vaccine before 13 years. That is, 80.1% of unvaccinated girls had a health care encounter where another vaccine was administered but the HPV vaccine was not given. If missed opportunities had been eliminated by administering the first dose of HPV vaccine during a visit when other vaccines were administered for the recent cohorts, HPV vaccination initiation before 13 years among

girls would have reached 88.6%, a 45.8–percentage point difference between actual and potential coverage (Table 3, fifth column). There were only 5 subgroups among those examined with point estimates of potentially achievable coverage below 80%, including girls without a preventive care visit at 11 to 12 years, those who had not received a provider recommendation for HPV vaccination, those who had no health insurance, those who had military insurance, and those who received all vaccinations at public facilities.

Figure 2 shows the cumulative coverage for ≥1 dose of HPV vaccine by age for each birth year cohort. As expected, HPV vaccination coverage increased with age for each cohort. HPV vaccination coverage reached 59% to 62% before 18 years for the oldest cohorts for which information was available, and 60% before 16 years for girls born in 1998. HPV vaccination coverage before 14 years significantly increased from 1995 to 2000 birth year cohort (test for trend, $P < .05$).

Discussion

We found that HPV vaccination coverage before 13 years significantly increased from girls born in 1995 through girls born in 2000. Among girls born in 2000, who reached their 13th birthday in 2013, 47% had received ≥1 HPV vaccine dose, and 27% had received all 3 recommended HPV vaccination doses before 13 years. With “catch-up” vaccination of older girls, ≥1 dose HPV vaccination coverage reached 60% before 18 years for the oldest cohorts and 54% before 14 years for girls born in 2000. Thus, a substantial amount of HPV vaccination initiation is occurring after the 13th birthday, even in the most recent birth cohorts examined (born 2000 who turned 13 in 2013). This may reflect reluctance of providers to make strong HPV vaccination recommendations for younger girls and parent’s hesitancy to consider HPV vaccination until their daughters are older.[14] Delaying vaccination might lower chances of later vaccination, given less frequent preventive visits for older girls[15] and less frequent opportunities for HPV vaccination when other vaccinations (e.g., Tdap, MenACWY) are administered and could increase the likelihood of infection. Vaccination coverage before 13 years increased over time for most socio-demographic subgroups, although increases were larger (>5% ABYPI) for some segments (Hispanic, household income <133% of the federal poverty level, mothers with less than high school education). Racial and ethnic differences in coverage were noted, and the ABYPI for Hispanic girls was 2.7 times that of non-Hispanic White adolescent girls (5.4% vs 2.0%, $P < .05$).

For the 1999–2000 birth year cohort, we identified several subgroups where >50% of the girls had initiated HPV vaccination before 13 years. These subgroups were Hispanic girls, those with household income <133% of the federal poverty level, those whose mothers were ≤34 years old, those whose mothers have less than high school education or high school education, those whose mothers never married, those who had 11- to 12-year preventive care visit, those who received provider recommendation for HPV vaccination, and those living in the West census region. Furthermore, a higher proportion of missed opportunity and lower HPV vaccination coverage were identified among the girls who were White, whose households had higher income, whose mothers were ≥45 years old, whose mothers were college educated, whose mothers were married, and who received all vaccine at private

facilities. Previous research showed that a higher proportion of delay and refusal of HPV vaccine was observed for the above groups.[16,17] A similar pattern was found among 19- to 35-month-old children.[18] Thus, the lower vaccination coverage and the higher missed opportunity among these groups may be related to findings of greater active delay and refusal of HPV vaccine.

Missed vaccination opportunities before 13 years were common in all sociodemographic groups examined. However, several subgroups still were less likely to have vaccination visits and had lower potentially achievable coverage (<80%), including girls who had no health insurance, did not have a preventive care visit at 11–12 years, did not receive provider recommendation, and received all their vaccinations at public facilities. This suggests that for a segment of the population, barriers to health care (lack of health insurance, lack of a medical home, financial and access issues) may be an important contributing factor for lack of HPV vaccination. Although access to vaccine is provided for uninsured girls through the Vaccines for Children (VFC) program, parents of uninsured children may lack a medical home and not be aware of opportunities to receive VFC vaccine from health departments or VFC-qualified providers.[19]

Our study suggests, that 93.3% of those who had an 11- to 12-year preventive care visit and 87.1% of those who received a provider recommendation had a missed opportunity identified. These findings may be related to fewer providers making a strong recommendation to 11- to 12-year-old girls. Since preventive care visits are the visit type most associated with vaccination,[20] and these visits are more common among younger adolescents,[21] vaccination opportunities during preventive visits at 11 to 12 years should not be missed.[22,23] In previous studies, the factors associated with not recommending HPV vaccine strongly to 11- to 12-year-old groups included, uneasiness in communicating to parents the importance of HPV vaccination prior to daughters becoming sexually active, the time it takes to discuss HPV vaccination, and reports of more refusal of HPV vaccine among the parents of younger adolescents than older adolescents.[24]

There are 2 major limitations in this study. First, the NIS–Teen excludes households without any telephone service and response rates were low. Some bias may remain after weighting adjustment designed to minimize nonresponse bias and incomplete representation of the target population by the sampling frame. Second, the potentially achievable coverage that could be obtained if missed opportunities were eliminated assumes that all parents would accept uptake of the missing HPV vaccine for their daughters. Since some parents may not be willing to accept the vaccine even if the provider recommended the vaccine, we may be overestimating potential vaccination coverage.

Conclusion

Despite these limitations, the birth cohort analysis can be used to characterize “on-time” HPV vaccination (vaccination by 13 years) and target socio-demographic groups with lagging “on-time” HPV vaccination. Analysis by birth cohort introduces a new approach to presenting NIS–Teen data that facilitates interpretation of trends in vaccination coverage and timing of vaccination by age, which are difficult to sort out in the usual analysis of the

prevalence of HPV vaccination among adolescents in a given age range (eg, 13–15 or 13–17 years).

In light of recent studies that show providers giving weaker recommendations for HPV vaccination, especially to younger adolescents and their parents,[24,25] it is important that health care providers communicate with parents to understand their personal beliefs and overcome barriers regarding HPV vaccination.[26] Also, providers should modify their counseling practices to provide strong recommendations for HPV vaccination[25] and administration of all vaccines recommended for adolescents at the same visit. Strategies to decrease missed opportunities for HPV vaccination should be implemented in vaccination settings, particularly at 11 to 12 years when these opportunities are most likely to occur. These strategies include use of client reminder and recall systems with educational messages, provider reminders, standing orders, and provider vaccination coverage assessment and feedback to help ensure every provider visit is used to ensure adolescents are fully protected from vaccine-preventable infections and cancers.[27–29]

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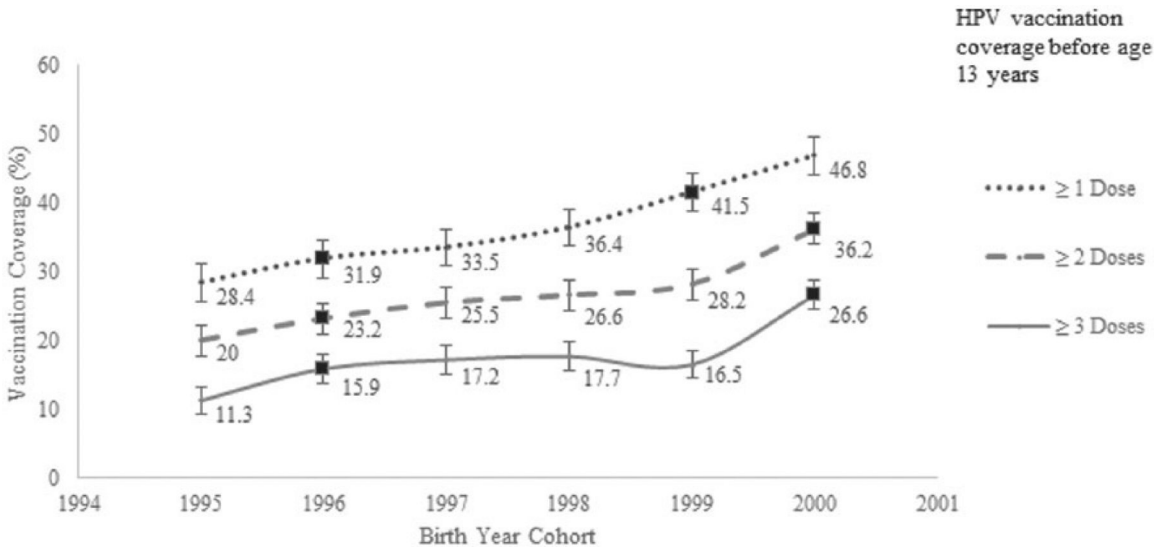

Figure 1.

HPV vaccination coverage before age 13 years among adolescent girls, stratified by birth year cohorts, National Immunization Survey Teen, United States, 2008–2013.

▪Statistically significant difference ($P < 0.05$) compared with previous birth year cohort's estimate.

Note: Statistically significant increase ($P < 0.05$) was observed in ≥1 dose, ≥2 doses, and ≥3 doses of HPV vaccination coverage in 2000 birth year cohort compared with 1995 birth year cohort.

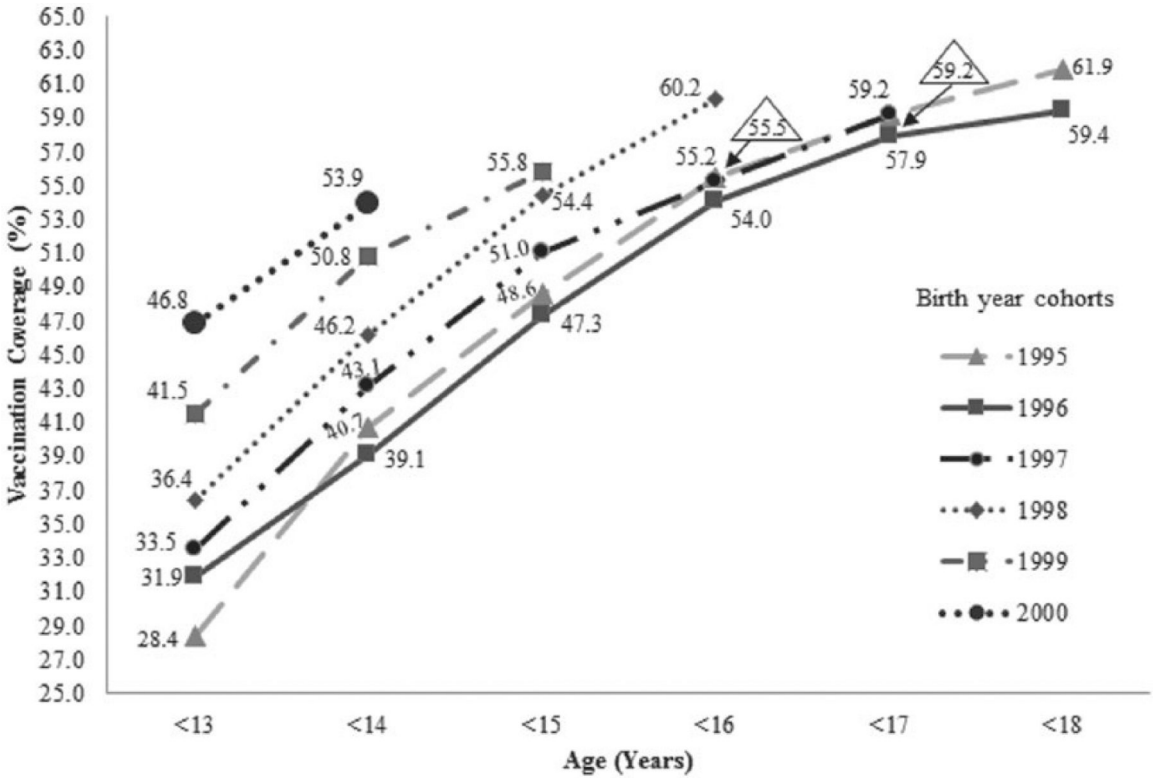

Figure 2.

Cumulative percent with ≥1dose HPV vaccine by age of adolescent girls, stratified by birth year cohorts, National Immunization Survey Teen, United States, 2008–2013.

Table 1.

Demographic Characteristics of Girls 13 Through 17 Years, National Immunization Survey–Teen, United States 2008–2013.

Demographic Characteristics	Sample (n)	Weighted % (95% CI)
Birth year cohort	33 707	100.0 (—)
1995	9277	27.6 (26.8–28.5)
1996	8798	25.9 (25.1–26.8)
1997	6845	19.8 (19.1–20.6)
1998	4895	14.7 (14.0–15.5)
1999	2895	9.1 (8.5–9.6)
2000	997	2.8 (2.6–3.2)
Race/ethnicity[a]	33 707	100.0 (—)
White, non-Hispanic	22 600	56.6 (55.6–57.6)
Black, non-Hispanic	3318	13.8 (13.1–14.5)
Hispanic	4739	21.0 (20.0–21.9)
Other	3050	8.7 (8.1–9.3)
Income to poverty ratio	33 707	100.0 (———)
<133% of federal poverty level	7758	32.3 (31.3–33.3)
133% to <322% of federal poverty level	10 058	29.8 (28.9–30.6)
322% to <503% of federal poverty level	7671	19.0 (18.3–19.7)
≥503% of federal poverty level	8220	19.0 (18.3–19.7)
Mother’s age	33 707	100.0 (—)
≤34 years	3162	11.6 (11.0–12.3)
35–44 years	14 626	45.7 (44.7–46.7)
≥45 years	15 919	42.7 (41.8–43.7)
Mother’s education	33 707	100.0 (—)
< High school	3429	14.5 (13.7–15.3)
High school	6230	24.1 (23.2–25.0)
> High school, some college	9465	26.8 (25.9–27.6)
College graduate	14 583	34.6 (33.8–35.5)
Mother’s marital status	33 707	100.0 (—)
Married	24 867	67.2 (66.2–68.1)

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Demographic Characteristics	Sample (n)	Weighted % (95% CI)
Divorced/widowed/separated/deceased	6115	22.2 (21.4–23.1)
Never married	2725	10.6 (10.0–11.3)
Metropolitan statistical area	33 707	100.0 (—)
Urban area	13 282	39.5 (38.5–40.5)
Suburban area	12 858	45.2 (44.2–46.2)
Rural area	7567	15.3 (14.7–15.9)
Had 11- to 12-year preventive care visit	33 707	100.0 (—)
Yes	15 181	42.4 (41.5–43.4)
No	8952	26.1 (25.2–26.9)
Don’t know	9574	31.5 (30.6–32.5)
Received provider recommendation for HPV vaccine	32 236	100.0 (—)
Yes	20 873	61.9 (60.9–62.9)
No	11 363	38.1 (37.1–39.1)
Insurance status	33 608	100.0 (—)
Private insurance only	21 449	54.9 (53.9–55.9)
Any Medicaid[b]	8200	31.7 (30.7–32.6)
Uninsured	1610	6.2 (5.7–6.7)
CHIP	1077	3.8 (3.4–4.2)
Military	996	2.6 (2.3–3.0)
Other insurance[c]	276	0.8 (0.7–1.0)
Census region	33 707	100.0 (—)
Northeast	6621	17.1 (16.5–17.6)
Midwest	7443	21.9 (21.3–22.6)
South	12 000	37.1 (36.3–37.9)
West	7643	23.9 (23.0–24.8)
Facility types for adolescent’s providers	33 587	100.0 (—)
All private facilities	16 850	52.8 (51.9–53.8)
All public facilities	5198	16.3 (15.5–17.1)
All hospital facilities	2967	7.7 (7.2–8.2)
All STD/school/teen clinics, military, WIC clinics, and pharmacies	1019	3.1 (2.7–3.5)

Demographic Characteristics	Sample (n)	Weighted % (95% CI)
Mixed[d]	7553	20.1 (19.4–20.9)

Abbreviations: WIC, Women, Infant, and Children program; CHIP, Children's Health Insurance Program; HPV, human papillomavirus; STD, sexually transmitted disease.

[a]Reported by parent/guardian respondent. Adolescents of Hispanic ethnicity may be of any race. "Other" indicates that the adolescents identified as American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islanders or multiracial.

[b]Any Medicaid–teen covered by Medicaid with or without any other type of insurance. Teen with any mention of Medicaid coverage will belong in this category of insurance.

[c]Other insurance–teen covered by insurance type other than private, Medicaid, CHIP, IHS (Indian Health Service), or military.

[d]Mixed indicates that the facility is identified to be in more than one of the facility categories such as private, public, hospital, and STD/school/teen clinics.

Table 2.

One or More Doses of HPV Vaccination Coverage Before 13 Years in Birth Year Cohorts, by Demographic Characteristics, National Immunization Survey–Teen, United States, 2008–2013.

Demographic Characteristics	1995–1996 Birth Year Cohort, Weighted % (95% CI)	1997–1998 Birth Year Cohort, Weighted % (95% CI)	1999–2000 Birth Year Cohort, Weighted % (95% CI)	ABYPI Across 1995–2000, % (95% CI)
Total	30.1 (28.9–31.3)	34.7 (33.1–36.4)	42.8 (40.0–45.6)	3.1 (2.2–4.0)
Race/ethnicity[a]				
White, non-Hispanic[b]	28.0 (26.8–29.4)	30.5 (28.8–32.4)	37.3 (34.2–40.5)	2.0 (0.6–3.4)
Black, non-Hispanic	31.2 (27.7–34.9)	35.1 (31.0–39.3)	42.4 (35.1–50.0)	2.9 (1.2–4.5)
Hispanic	34.1 (30.7–37.7)[c]	44.4 (39.8–49.2)[c]	54.6 (47.4–61.6)[c]	5.4 (4.4–6.3)[c]
Other	32.6 (28.2–37.4)	36.6 (31.5–42.0)[c]	45.0 (36.0–54.5)	3.0 (1.6–4.4)
Income to poverty ratio				
<133% of federal poverty level	34.1 (31.5–36.7)[c]	44.7 (41.4–47.9)[c]	51.7 (46.5–56.8)[c]	5.2 (4.0–6.4)[c]
133% to <322% of federal poverty level	27.9 (25.9–30.0)	30.1 (27.4–33.0)	41.2 (36.3–46.3)	2.9 (0.8–5.0)[c]
322% to <503% of federal poverty level	27.2 (25.0–29.6)	29.1 (25.9–32.6)	35.6 (29.9–41.8)	1.6 (0.1–3.2)
≥503% of federal poverty level[b]	29.9 (27.6–32.3)	30.0 (26.8–33.4)	34.4 (29.3–39.8)	0.6 (−0.9–2.2)
Mother's age				
≤34 years	34.6 (30.4–39.1)[c]	44.6 (39.9–49.5)[c]	50.5 (43.2–57.8)[c]	4.5 (2.4–6.7)[c]
35–44 years	30.6 (28.8–32.5)	35.7 (33.3–38.2)[c]	44.5 (40.4–48.6)[c]	3.5 (2.3–4.6)[c]
≥45 years[b]	28.6 (27.0–30.3)	30.4 (28.0–32.8)	36.4 (32.3–40.7)	1.7 (0.6–2.8)
Mother's education				
<High school	36.3 (32.3–40.5)[c]	47.7 (42.2–53.3)[c]	54.9 (45.9–63.6)[c]	5.8 (2.6–9.0)[c]
High school	31.1 (28.6–33.7)[c]	38.0 (34.6–41.6)[c]	50.6 (44.6–56.5)[c]	4.6 (2.2–7.0)[c]
>High school, some college	29.4 (27.2–31.6)	31.9 (29.2–34.8)	34.2 (29.8–39.0)	1.3 (0.0–2.6)
College graduate[b]	27.2 (25.6–28.9)	29.3 (27.0–31.7)	38.6 (34.6–42.8)	2.2 (0.6–3.9)
Mother's marital status				
Married[b]	28.1 (26.7–29.4)	32.7 (30.7–34.7)	39.2 (36.1–42.5)	2.8 (2.1–3.4)

Demographic Characteristics	1995–1996 Birth Year Cohort, Weighted % (95% CI)	1997–1998 Birth Year Cohort, Weighted % (95% CI)	1999–2000 Birth Year Cohort, Weighted % (95% CI)	ABYPI Across 1995–2000, % (95% CI)
Divorced/widowed/separated / deceased	32.5 (29.8–35.4)[c]	37.0 (33.7–40.5)[c]	47.3 (41.1–53.5)[c]	3.7 (1.1–6.3)
Never married	38.9 (34.6–43.5)[c]	42.2 (37.1–47.4)[c]	51.0 (42.4–59.4)[c]	3.3 (0.6–6.1)
Metropolitan statistical area				
Urban area[b]	32.6 (30.6–34.6)	38.6 (36.0–41.3)	46.4 (41.8–50.9)	3.9 (2.2–5.7)
Suburban area	29.4 (27.6–31.3)[c]	32.1 (29.6–34.6)[c]	39.1 (35.0–43.3)[c]	2.0 (0.6–3.3)[c]
Rural area	25.7 (23.4–28.1)[c]	32.7 (29.6–35.9)[c]	44.1 (38.0–50.5)	4.3 (3.2–5.5)
Had 11- to 12-year preventive care visit				
Yes	38.4 (36.4–40.4)[c]	42.6 (40.2–45.2)[c]	51.6 (47.6–55.6)[c]	3.4 (1.8–4.9)
No[b]	18.7 (16.9–20.6)	24.3 (21.8–27.0)	31.0 (26.1–36.4)	3.3 (1.9–4.8)
Don’t know	29.5 (27.2–31.8)[c]	32.2 (29.3–35.1)[c]	37.5 (32.6–42.8)	1.8 (0.5–3.1) [c]
Received provider recommendation for HPV				
Yes	37.0 (35.4–38.5)[c]	40.2 (38.1–42.3)[c]	51.6 (48.2–54.9)[c]	3.3 (1.0–5.6)
No[b]	19.6 (17.7–21.7)	25.0 (22.3–27.9)	28.3 (23.4–33.7)	1.8 (−0.8–4.4)
Insurance status				
Private insurance only[b]	27.5 (26.1–28.9)	29.2 (27.2–31.2)	39.7 (36.1–43.4)	2.2 (0.2–4.3)
Any Medicaid[d]	36.5 (33.9–39.1)[c]	41.8 (38.7–44.9)[c]	47.6 (42.6–52.6)[c]	3.4 (1.3–5.6)
Uninsured	21.4 (17.4–26.1)[c]	33.2 (26.9–40.1)	45.6 (33.6–58.2)[f]	NA[e]
CHIP	34.3 (27.7–41.5)	43.3 (33.8–53.2)[c]	43.5 (31.1–56.7)[f]	2.9 (0.5–5.3)
Military	27.5 (20.8–35.4)	42.2 (33.6–51.3)[c]	23.9 (14.9–36.1)[c,f]	NA[e]
Other insurance[g]	25.0 (15.5–37.6)[f]	50.0 (34.6–65.5)[c,f]	73.8 (48.4–89.4)[c,f]	NA[e]
Census region				
Northeast[b]	31.8 (29.4–34.3)	31.4 (28.5–34.5)	38.1 (32.7–43.8)	1.0 (−0.9–3.0)
Midwest	26.8 (24.8–28.8)[c]	32.1 (29.4–34.8)	42.3 (37.4–47.3)	3.8 (2.1–5.6)[c]
South	28.4 (26.7–30.3)[c]	34.5 (32.2–36.9)	39.7 (35.4–44.1)	3.2 (2.2–4.3)[c]
West	34.3 (31.1–37.6)	39.7 (35.3–44.4)[c]	52.6 (45.4–59.8)[c]	4.3 (1.4–7.2)[c]

Demographic Characteristics	1995–1996 Birth Year Cohort, Weighted % (95% CI)	1997–1998 Birth Year Cohort, Weighted % (95% CI)	1999–2000 Birth Year Cohort, Weighted % (95% CI)	ABYPI Across 1995–2000, % (95% CI)
Facility types for adolescent's providers				
All private facilities[b]	29.5 (28.0–31.2)	34.1 (31.9–36.3)	38.7 (34.8–42.7)	2.3 (0.8–3.7)
All public facilities	25.9 (23.1–29.0)[c]	33.6 (29.3–38.3)	46.2 (38.6–53.9)	4.9 (2.4–7.4)[c]
All hospital facilities	40.5 (35.5–45.6)[c]	42.2 (36.6–47.9)[c]	47.5 (38.7–56.4)	2.1 (0.4–3.7)
All STD/school/teen clinics, military, WIC clinics and pharmacies	26.2 (20.0–33.4)	35.5 (27.2–44.9)	42.3 (25.0–61.8)[f]	NA[e]
Mixed[h]	32.2 (29.6–34.9)	35.0 (31.7–38.4)	47.8 (42.5–53.2)	3.5 (0.8–6.3)

Abbreviations: WIC, Women, Infant, and Children program; CHIP, Children's Health Insurance Program; HPV, human papillomavirus; ABYPI, Average Birth Year Percentage Increase; STD, sexually transmitted disease.

[a]Reported by parent/guardian respondent. Adolescents of Hispanic ethnicity may be of any race. "Other" indicates that the adolescents identified as American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islanders, or multiracial.

[b]Reference group.

[c]Statistically significant difference ($P < .05$) compared with the reference group.

[d]Any Medicaid–teen covered by Medicaid with or without any other type of insurance. Teen with any mention of Medicaid coverage will belong in this category of insurance.

[e]Not available (estimate not reported because unweighted sample size for the denominator was <30 or 95% CI half-width/estimate >0.6).

[f]Estimate might be unreliable because CI half-width is >10.

[g]Other insurance–teen covered by insurance type other than private, Medicaid, CHIP, IHS (Indian Health Service), or military.

[h]Mixed indicates that the facility is identified to be in more than one of the facility categories such as private, public, hospital, and STD/school/teen clinics.

Table 3.

Missed Opportunity and Potentially Achievable Coverage Before 13 Years, for 1999–2000 Birth Year Cohorts, National Immunization Survey–Teen, United States, 2008–2013 (n = 2333).

Demographic Characteristics	Girls Not Receiving HPV Vaccine Before Age 13, Weighted % (95% CI)	Unvaccinated Girls With ≥1 Missed Opportunity for HPV Vaccine, Weighted % (95% CI)	Potential Coverage With ≥1 Dose Of HPV Vaccine If No Missed Opportunity, Weighted % (95% CI)	Difference Between Potential Coverage and Actual Coverage, Weighted % (95% CI)
Total	57.2 (54.4–60.0)	80.1 (77.1–82.7)	88.6 (86.8–90.2)	45.8 (43.1–48.6)
Race/ethnicity[a]				
White, non-Hispanic[b]	62.7 (59.5–65.8)	81.8 (78.5–84.7)	88.6 (86.4–90.5)	51.3 (48.1–54.5)
Black, non-Hispanic	57.6 (50.0–64.9)	72.6 (62.7–80.6)	84.2 (77.7–89.0)	41.8 (34.6–49.5)[c]
Hispanic	45.4 (38.4–52.6)[c]	80.9 (72.7–87.1)	91.3 (87.3–94.2)	36.7 (30.2–43.9)[c]
Other	55.0 (45.5–64.0)	78.7 (65.7–87.7)[d]	88.3 (79.8–93.5)	43.2 (34.8–52.1)
Income to poverty ratio				
<133% of federal poverty level	48.3 (43.2–53.5)[c]	76.5 (70.7–81.5)[c]	88.7 (85.6–91.2)	37.0 (32.2–42.1)[c]
133% to <322% of federal poverty level	58.8 (53.7–63.7)	76.8 (70.7–81.9)[c]	86.3 (82.4–89.5)[c]	45.2 (40.3–50.1)[c]
322% to <503% of federal poverty level	64.4 (58.2–70.1)	83.0 (76.1–88.2)	89.0 (84.3–92.5)	53.4 (47.3–59.5)
>503% of federal poverty level[b]	65.6 (60.2–70.7)	87.5 (82.2–91.3)	91.8 (88.1–94.4)	57.4 (51.9–62.7)
Mother's age				
≤34 years	49.5 (42.2–56.8)[c]	75.8 (67.0–82.8)	88.0 (83.1–91.6)	37.5 (30.8–44.7)[c]
35–44 years	55.5 (51.4–59.6)[c]	78.1 (73.3–82.2)[c]	87.8 (84.9–90.3)	43.3 (39.4–47.3)[c]
≥45 years[b]	63.6 (59.3–67.7)	84.2 (80.3–87.5)	90.0 (87.3–92.1)	53.6 (49.3–57.8)
Mother's education				
<High school	45.1 (36.4–54.1)[c]	72.5 (60.7–81.9)[c,d]	87.6 (81.2–92.0)	32.7 (25.1–41.3)[c]
High school	49.4 (43.5–55.4)[c]	77.1 (70.1–82.8)[c]	88.7 (84.8–91.7)	38.1 (32.7–43.9)[c]
>High school, some college	65.8 (61.0–70.2)	77.3 (71.1–82.5)[c]	85.1 (80.7–88.6)[c]	50.9 (45.8–55.9)
College graduate[b]	61.4 (57.2–65.4)	86.0 (82.4–89.0)	91.4 (89.0–93.3)	52.8 (48.7–56.9)
Mother's marital status				

Demographic Characteristics	Girls Not Receiving HPV Vaccine Before Age 13, Weighted % (95% CI)	Unvaccinated Girls With ≥1 Missed Opportunity for HPV Vaccine, Weighted % (95% CI)	Potential Coverage With ≥1 Dose Of HPV Vaccine If No Missed Opportunity, Weighted % (95% CI)	Difference Between Potential Coverage and Actual Coverage, Weighted % (95% CI)
Married[b]	60.8 (57.5–63.9)	83.3 (80.2–86.0)	89.8 (87.8–91.6)	50.6 (47.4–53.8)
Divorced/widowed/separated/deceased	52.7 (46.5–58.9)[c]	73.3 (65.7–79.7)[c]	85.9 (81.3–89.5)	38.6 (33.0–44.7)[c]
Never married	49.0 (40.6–57.6)[c]	74.9 (63.0–84.0)[d]	87.7 (80.8–92.3)	36.8 (29.0–45.2)[c]
Metropolitan statistical area				
Urban area[b]	53.6 (49.1–58.2)	76.5 (71.0–81.1)	87.4 (84.1–90.0)	41.0 (36.8–45.4)
Suburban area	60.9 (56.7–65.0)[c]	85.3 (81.2–88.6)[c]	91.0 (88.4–93.1)	51.9 (47.8–56.1)[c]
Rural area	55.9 (49.5–62.0)	72.3 (65.6–78.2)	84.5 (80.2–88.1)	40.4 (34.9–46.2)
Had 11- to 12-year preventive care visit				
Yes	48.4 (44.4–52.4)[c]	93.3 (90.6–95.2)[c]	96.7 (95.4–97.7)[c]	45.1 (41.3–49.1)
No[b]	69.0 (63.6–73.9)	63.6 (56.8–69.9)	74.9 (69.7–79.5)	43.9 (38.3–49.6)
Don’t know	62.5 (57.2–67.4)	77.1 (71.4–82.0)[c]	85.7 (81.7–88.9)[c]	48.2 (43.1–53.3)
Received provider recommendation for HPV vaccine				
Yes	48.4 (45.1–51.8)[c]	87.1 (83.7–89.8)[c]	93.7 (92.0–95.1)[c]	42.2 (38.9–45.5)[c]
No[b]	71.7 (66.3–76.6)	70.9 (65.5–75.7)	79.1 (74.8–82.8)	50.8 (45.7–55.9)
Insurance status				
Private insurance only[b]	60.3 (56.6–63.9)	85.2 (82.1–87.9)	91.1 (89.1–92.7)	51.4 (47.8–55.0)
Any Medicaid[b]	52.4 (47.4–57.4)[c]	75.5 (69.5–80.7)[c]	87.2 (83.7–90.0)[c]	39.6 (34.8–44.6)[c]
Uninsured	54.4 (41.8–66.4)[d]	61.4 (45.4–75.3)[c,d]	79.0 (68.1–86.9)[c]	33.4 (22.8–45.9)[c]
CHIP	56.5 (43.3–68.9)[d]	86.0 (74.6–92.8)	92.1 (85.8–95.7)	48.6 (35.4–62.1)
Military	76.1 (63.9–85.1)[c,d]	70.4 (45.8–86.9)[d]	77.4 (55.7–90.4)[d]	53.5 (37.8–68.5)
Other insurance[g]	NA[f]	67.0 (34.7–88.6)[d]	91.4 (73.6–97.6)[d]	NA[f]
Census region				
Northeast[b]	61.9 (56.2–67.3)	84.8 (78.5–89.6)	90.6 (86.4–93.6)	52.5 (46.9–58.1)
Midwest	57.7 (52.7–62.6)	78.5 (73.4–82.9)	87.6 (84.4–90.3)	45.3 (40.6–50.1)

Demographic Characteristics	Girls Not Receiving HPV Vaccine Before Age 13, Weighted % (95% CI)	Unvaccinated Girls With ≥1 Missed Opportunity for HPV Vaccine, Weighted % (95% CI)	Potential Coverage With ≥1 Dose Of HPV Vaccine If No Missed Opportunity, Weighted % (95% CI)	Difference Between Potential Coverage and Actual Coverage, Weighted % (95% CI)
South	60.3 (55.9–64.6)	79.8 (74.5–84.2)	87.8 (84.4–90.5)	48.1 (43.7–52.6)
West	47.4 (40.2–54.6)[c]	77.9 (69.7–84.3)	89.5 (85.1–92.7)	36.9 (30.4–43.8)[c]
Facility types for adolescent's providers				
All private facilities[b]	61.3 (57.3–65.2)	86.0 (82.4–89.0)	91.4 (89.1–93.3)	52.7 (48.8–56.6)
All public facilities	53.8 (46.1–61.4)	60.4 (50.2–69.8)[c]	78.7 (72.0–84.2)[c]	32.5 (25.8–40.1)[c]
All hospital facilities	52.5 (43.6–61.3)	78.7 (69.5–85.7)	88.8 (83.4–92.6)	41.3 (33.2–50.0)[c]
All STD/school/teen clinics, military, WIC clinics and pharmacies	57.7 (38.2–75.0)[d]	69.6 (42.4–87.7)[d]	82.5 (60.3–93.6)[d]	40.1 (25.1–57.3)
Mixed[h]	52.2 (46.8–57.5)[c]	81.3 (75.7–85.8)	90.2 (87.1–92.7)	42.4 (37.3–47.7)[c]

Abbreviations: WIC, Women, Infant, and Children program; CHIP, Children's Health Insurance Program; HPV, human papillomavirus; STD, sexually transmitted disease.

[a]Reported by parents/guardian respondent Adolescents of Hispanic ethnicity may be of any race. "Other" indicates that the adolescents identified as American Indian, Alaska Native, Asian, Native Hawaiian, Pacific Islanders, or multiracial.

[b]Reference group.

[c]Statistically significant difference ($P < .05$) compared with the reference.

[d]Estimate might be unreliable because CI half-width is >10.

[e]Any Medicaid–teen covered by Medicaid with or without any other type of insurance. Teen with any mention of Medicaid coverage will belong in this category of insurance.

[f]Not available (estimate not reported because unweighted sample size for the denominator was <30 or 95% CI half-width/estimate greater than 0.6).

[g]Other insurance–teen covered by insurance type other than private, Medicaid, CHIP, IHS (Indian Health Service), or military.

[h]Mixed indicates that the facility is identified to be in more than one of the facility categories such as private, public, hospital, and STD/school/teen clinics.