Vaccination Coverage Among U.S. Adolescents Aged 13–17 Years Eligible for the Vaccines for Children Program, 2009

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ABSTRACT

Objectives. We compared (*1*) characteristics of adolescents who are and are not entitled to receive free vaccines from the Vaccines for Children (VFC) program and (*2*) vaccination coverage with meningococcal conjugate (MCV4), quadrivalent human papillomavirus (HPV4), and tetanus-diphtheria-acellular pertussis (Tdap) vaccines among VFC-eligible and non-VFC-eligible adolescents.

Methods. We analyzed data from the 2009 National Immunization Survey-Teen, a nationally representative, random-digit-dialed survey of households with adolescents aged 13–17 years (n=20,066). Differences in sociodemographic characteristics and provider-reported vaccination coverage were evaluated using t-tests.

Results. Overall, 32.1% (±1.2%) of adolescents were VFC-eligible. VFC-eligible adolescents were significantly less likely than non-VFC-eligible adolescents to be white and to live in suburban areas, and more likely to live in poverty and to have younger and less educated mothers. Nationally, coverage among non-VFC-eligible adolescents was 57.1% (±1.5%) for ≥1 dose of Tdap, 55.4% (±1.5%) for ≥1 dose of MCV4, and 43.2% (±2.2%) for ≥1 dose of HPV4. Coverage among VFC-eligible adolescents was 52.5% (±2.4%) for ≥1 dose of Tdap, 50.1% (±2.4%) for ≥1 dose of MCV4, and 46.6% (±3.5%) for ≥1 dose of HPV4. Only 27.5% (±1.8%) of non-VFC-eligible adolescents and 25.0% (±2.9%) of VFC-eligible adolescents received ≥3 doses of HPV4. Vaccination coverage was significantly higher among non-VFC-eligible adolescents for Tdap and MCV4, but not for one-dose or three-dose HPV4.

Conclusions. Coverage with some recommended vaccines is lower among VFC-eligible adolescents compared with non-VFC-eligible adolescents. Continued monitoring of adolescent vaccination rates, particularly among VFC-eligible populations, is needed to ensure that all adolescents receive all routinely recommended vaccines.

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In 2005 and 2006, three new vaccines were routinely recommended for adolescents: meningococcal conjugate vaccine (MCV4), quadrivalent human papillomavirus vaccine (HPV4) for females, and tetanus-diphtheria-acellular pertussis vaccine (Tdap).[1–3] These three were the first vaccination recommendations specifically targeted toward adolescents in many years, underscoring the importance of the comprehensive preventive care visit recommended for all adolescents aged 11–12 years.[4]

Although the majority of adolescents encounter the health-care system annually,[5–8] vaccinations are most often delivered at preventive visits.[6,9] Adolescents access preventive health-care infrequently[5,6,9] and far less often than young children, who are the traditional targets of routine vaccination recommendations. Preventive health-care visits also tend to decline as adolescents become older, being more common among adolescents younger than aged 14 years compared with adolescents aged 14–21 years.[5,9] Health-care providers serving adolescents perceive adolescents' less frequent health-care utilization as a significant barrier to administration of routine vaccinations.[10–12]

Compared with young children, adolescents are more likely to be uninsured or underinsured for vaccines.[13–16] Uninsured adolescents are those not covered by any health insurance that pays for doctor visits and hospital stays; underinsured adolescents are those covered by private health insurance that does not cover the costs of all recommended vaccines. The Vaccines for Children (VFC) program was established in 1993 to eliminate cost as a barrier to routine childhood vaccinations;[17] the development of costly new adolescent vaccines has increased the importance of the program for older children as well. Children ≤18 years of age who are Medicaid-eligible, uninsured, of American Indian or Alaska Native (AI/AN) race/ethnicity, or underinsured and vaccinated in Federally Qualified Health Centers (FQHCs) or Rural Health Clinics (RHCs) are entitled to receive recommended vaccines free of charge through VFC.

VFC has been successful in achieving high rates of coverage with recommended vaccines among children younger than 3 years of age.[18,19] We determined the effect of VFC on adolescent coverage for recommended vaccines.

METHODS

Data for this study were collected using the 2009 National Immunization Survey-Teen (NIS-Teen), a nationally representative survey of households conducted in all 50 states and 11 municipalities that receive Section 317 immunization grant funding directly from the federal government (hereafter, "grantee areas"). NIS-Teen methodology has been described in detail elsewhere.[20] In the NIS-Teen, households are selected using random-digit-dialing, screened for eligibility and willingness to participate, and interviewed to determine vaccination status of a randomly selected adolescent aged 13–17 years for routinely recommended adolescent vaccines. Demographic data on households and respondents (usually mothers) are also collected. If consent is obtained from respondents, all of the adolescent's vaccination providers identified by the respondent are mailed a survey to obtain a provider-documented vaccination history. The NIS is considered nonexempt research involving human subjects, and approval by the Centers for Disease Control and Prevention's Institutional Review Board was obtained.

In 2009, the Council of American Survey Research Organizations response rate for the NIS-Teen telephone interview was 58.0%; among respondents, 57.4% of adolescents had a sufficiently complete provider vaccination history to be included in our final analytic sample (n=20,066).[21] All analyses were limited to provider-verified vaccine doses. Data were weighted to reflect initial selection probability, nonresponse by interviewees and providers, telephone noncoverage, and other factors; complete weighting methods for the NIS-Teen data are described elsewhere.[20,21]

In this analysis, we determined the proportion of adolescents in each VFC eligibility category by grantee area and compared demographic characteristics of adolescents who were and were not entitled to receive VFC vaccines. Methods for determining insurance status and VFC eligibility using data from the Health Insurance Module of the 2009 NIS-Teen[21] are described in detail elsewhere.[18,19] Briefly, adolescents reported as enrolled in a state Medicaid or Medicaid expansion program and adolescents with no reported source of health insurance coverage, as well as adolescents reporting AI/AN race/ethnicity, were considered VFC-eligible in this analysis. In addition, adolescents reporting a source of health insurance that did not fully cover the costs of vaccines received were considered VFC-eligible if they received vaccines at an FQHC or RHC.

We compared vaccination coverage among VFC-eligible and non-VFC-eligible adolescents for the three vaccine recommendations made specifically for adolescents since 2005: one dose of MCV4, one-dose and three-dose coverage with HPV4 (among females only), and one dose of Tdap since age 10. Differences in sociodemographic characteristics and in vaccination coverage were evaluated using t-tests and considered statistically significant at $p<0.05$.

RESULTS

Distribution of VFC eligibility categories for adolescents

Nationally, 32.1% (±1.2%) of adolescents were eligible for VFC; this proportion ranged from 15.1% in New Hampshire (±5.2%) and Utah (±4.7%) to 59.1% (±5.9%) in Chicago (Table 1). The proportion of VFC-eligible adolescents also exceeded 50.0% in Alaska, Oklahoma, the District of Columbia, and El Paso County and Houston in Texas. The majority of VFC-eligible adolescents nationally were enrolled in Medicaid (23.5%, ±1.1% of all adolescents); the next largest group of VFC-eligible adolescents was the uninsured (6.4%, ±0.7% nationally). Among all adolescents, 2.8% (±0.4%) were VFC-eligible due to AI/AN race/ethnicity, and 0.9% (±0.2%) were underinsured adolescents served at FQHCs/RHCs. Distribution of VFC eligibility categories varied widely by grantee area: enrollment in Medicaid ranged from 3.9% (±2.2%) in Utah to 54.8% (±6.0%) in Chicago, while the proportion of AI/AN adolescents ranged from 0.1% (±0.2%) in Houston to 30.7% (±6.6%) in Alaska. The proportion of uninsured adolescents was 0.3% (±0.6%) in Hawaii and 19.3% (±5.8%) in Nevada, while the proportion of underinsured adolescents served in FQHCs/RHCs ranged from 0.0% in several areas up to 10.0% (±3.5%) in Montana. Most VFC-eligible adolescents (93.2%, ±1.1%) received vaccines from providers enrolled in the VFC program; this proportion ranged from 78.7% (±13.3%) in Lake County, Indiana, to 100.0% (±0.0) in Rhode Island and Houston.

Characteristics of VFC-eligible adolescents

VFC-eligible adolescents were significantly more likely than non-VFC-eligible adolescents to be African American, Hispanic, Asian/Pacific Islander, or other race/ethnicity (Table 2). VFC-eligible adolescents were also more likely than non-VFC-eligible adolescents to have received all vaccine doses in public clinics or hospital clinics, and less likely to have received all doses in private provider offices. Mothers of VFC-eligible adolescents were significantly less educated, younger, less likely to be married, and less likely to complete the NIS telephone interview in English than mothers of non-VFC-eligible adolescents. VFC-eligible adolescents were significantly more likely to live in poverty, with 61.3% (±2.3%) of VFC-eligible adolescents living below 133% of the federal poverty level vs. 7.9% (±0.9%) of non-VFC-eligible adolescents. VFC-eligible adolescents were also significantly more likely to live in urban or rural areas and less likely to live in suburban areas than non-VFC-eligible adolescents.

Coverage with recommended adolescent vaccines

Coverage for all three vaccines routinely recommended for adolescents was less than 60.0% among those aged 13–17 years nationally. Overall, 57.1% (±1.5%) of non-VFC-eligible adolescents and 52.5% (±2.4%) of VFC-eligible adolescents had received at least one dose of Tdap (Table 3). Similarly, 55.4% (±1.5%) of non-VFC-eligible adolescents and 50.1% (±2.4%) of VFC-eligible adolescents had received at least one dose of MCV4, and 43.2% (±2.2%) of non-VFC-eligible adolescents and 46.6% (±3.5%) of VFC-eligible adolescents had received at least one dose of HPV4. Completion of the HPV4 series was notably lower, with 27.5% (±1.8%) of non-VFC-eligible adolescents and 25.0% (±2.9%) of VFC-eligible adolescents having received at least three doses of HPV4. Vaccination coverage was significantly higher among non-VFC-eligible adolescents for Tdap and MCV4; coverage for both one-dose and three-dose HPV4 was similar between VFC-eligible and non-VFC-eligible adolescents.

Coverage for all three recommended vaccines varied widely by grantee area among VFC-eligible and non-VFC-eligible adolescents (Table 3). Seven grantee areas surveyed had ≥70.0% MCV4 coverage among non-VFC-eligible adolescents, and seven had ≥70.0% coverage among VFC-eligible adolescents. For Tdap, eight grantee areas had coverage ≥70.0% among non-VFC-eligible adolescents, and eight had coverage ≥70.0% among VFC-eligible adolescents. For one dose of HPV4, one grantee area had coverage ≥70.0% among non-VFC-eligible adolescents, and four had coverage ≥70.0% among VFC-eligible adolescents. No grantee area had coverage ≥70.0% for the three-dose HPV4 series: coverage ranged from 3.7% (±5.2%) in Houston to 54.4% (±17.8%) in Massachusetts for VFC-eligible adolescents and from 6.7% (±4.6%) in Mississippi to 61.7% (±9.9%) in Rhode Island for non-VFC-eligible adolescents.

DISCUSSION

Nationally, vaccination coverage was <60.0% for all three of these recently recommended vaccines among both VFC-eligible and non-VFC-eligible adolescents. Coverage for each vaccine varied widely by geographic area in both groups, with several grantee areas having the majority of adolescents vaccinated with MCV4 or Tdap; only one area surveyed had attained ≥60.0% coverage for the three-dose HPV4 series. National coverage rates for MCV4 and Tdap were significantly lower among VFC-eligible vs. non-VFC-eligible adolescents, a pattern repeated in many grantee areas. Coverage with one or three doses of HPV4 vaccine was similar

Table 1. Proportion of adolescents aged 13–17 years eligible for VFC by eligibility category and geographic area: 2009 National Immunization Survey-Teen

			All VFC-eligible[a]					
Geographic area	*Unweighted sample size* N	*All non-VFC-eligible Percent (95% CI)*	*Total VFC-eligible Percent (95% CI)*	*Medicaid-enrolled Percent (95% CI)*	*American Indian/ Alaska Native Percent (95% CI)*	*Uninsured Percent (95% CI)*	*Underinsured and vaccinated at an FQHC or RHC Percent (95% CI)*	*Vaccinated by VFC-enrolled provider[b] Percent (95% CI)*
Total United States	20,032	67.9 (±1.2)	32.1 (±1.2)	23.5 (±1.1)	2.8 (±0.4)	6.4 (±0.7)	0.9 (±0.2)	93.2 (±1.1)
(range)	(185–446)[c]	(40.9–84.9)	(15.1–59.1)	(3.9–54.8)	(0.1–30.7)	(0.3–19.3)	(0.0–10.0)	(78.7–100.0)
Alabama	337	69.3 (±6.2)	30.7 (±6.2)	25.2 (±5.9)	2.1 (±1.6)	3.5 (±2.9)	0.3 (±0.6)	90.6 (±6.1)
Alaska	273	46.6 (±6.7)	53.4 (±6.7)	29.4 (±6.6)	30.7 (±6.6)	8.5 (±4.1)	3.6 (±2.3)	93.4 (±5.1)
Arizona	349	60.7 (±6.9)	39.3 (±6.9)	20.5 (±5.5)	6.7 (±3.6)	15.6 (±6.3)	0.4 (±0.6)	97.6 (±2.8)
Arkansas	363	63.3 (±6.1)	36.7 (±6.1)	26.1 (±5.6)	3.4 (±2.3)	8.6 (±3.8)	0.5 (±0.7)	85.2 (±7.9)
California	379	66.2 (±6.0)	33.8 (±6.0)	22.7 (±5.2)	3.7 (±2.2)	7.6 (±3.6)	1.5 (±1.5)	91.9 (±5.0)
Los Angeles County	185	62.3 (±8.4)	37.7 (±8.4)	27.2 (±7.7)	2.4 (±2.9)	8.9 (±4.9)	0.0 (±0.0)	91.2 (±7.3)
Rest of state	194	67.7 (±7.7)	32.3 (±7.7)	21.0 (±6.6)	4.2 (±2.8)	7.1 (±4.6)	2.1 (±2.1)	92.2 (±6.4)
Colorado	410	78.9 (±5.6)	21.1 (±5.6)	9.6 (±4.2)	3.0 (±2.1)	8.8 (±4.1)	1.4 (±1.3)	91.8 (±6.8)
Connecticut	351	80.8 (±6.2)	19.2 (±6.2)	15.2 (±5.9)	0.4 (±0.5)	3.8 (±2.5)	0.0 (±0.0)	99.0 (±2.0)
Delaware	371	72.4 (±6.4)	27.6 (±6.4)	23.6 (±6.3)	0.6 (±0.8)	3.4 (±2.5)	0.0 (±0.0)	95.6 (±6.2)
District of Columbia	412	48.2 (±6.0)	51.8 (±6.0)	49.2 (±6.1)	0.9 (±0.8)	2.1 (±1.6)	0.0 (±0.0)	98.4 (±1.7)
Florida	412	58.4 (±6.3)	41.6 (±6.3)	28.4 (±6.1)	0.6 (±0.7)	12.6 (±4.4)	0.1 (±0.2)	93.3 (±4.5)
Georgia	381	66.9 (±6.2)	33.1 (±6.2)	24.2 (±5.9)	0.6 (±0.9)	8.2 (±3.5)	0.6 (±0.9)	90.7 (±5.9)
Hawaii	256	75.6 (±5.9)	24.4 (±5.9)	22.0 (±5.7)	1.7 (±1.7)	0.3 (±0.6)	0.4 (±0.6)	96.2 (±4.4)
Idaho	227	63.6 (±7.7)	36.4 (±7.7)	25.6 (±7.0)	3.4 (±3.1)	7.4 (±4.5)	2.5 (±3.0)	96.9 (±5.4)
Illinois	753	68.9 (±4.6)	31.1 (±4.6)	28.1 (±4.6)	1.1 (±0.8)	2.0 (±1.1)	0.8 (±0.7)	90.4 (±5.9)
Chicago	388	40.9 (±5.9)	59.1 (±5.9)	54.8 (±6.0)	2.0 (±1.5)	3.0 (±1.8)	1.6 (±1.5)	98.2 (±1.7)
Rest of state	365	75.9 (±5.7)	24.1 (±5.7)	21.3 (±5.6)	0.8 (±0.9)	1.8 (±1.3)	0.6 (±0.7)	85.6 (±9.4)
Indiana	873	70.4 (±5.1)	29.6 (±5.1)	22.6 (±4.7)	2.0 (±1.3)	5.4 (±2.2)	0.6 (±0.6)	86.0 (±6.8)
Lake County	268	60.9 (±8.4)	39.1 (±8.4)	35.2 (±8.5)	2.6 (±2.5)	1.8 (±1.6)	0.9 (±1.2)	78.7 (±13.3)
Marion County	327	61.4 (±6.7)	38.6 (±6.7)	31.9 (±6.7)	1.2 (±1.1)	5.8 (±2.4)	0.5 (±0.6)	90.0 (±6.8)
Rest of state	278	73.1 (±6.4)	26.9 (±6.4)	19.5 (±5.9)	2.0 (±1.7)	5.7 (±2.8)	0.6 (±0.8)	86.2 (±9.2)
Iowa	337	80.7 (±5.1)	19.3 (±5.1)	11.7 (±4.1)	0.5 (±1.0)	2.1 (±2.0)	4.9 (±2.8)	85.0 (±10.4)
Kansas	251	81.0 (±5.9)	19.0 (±5.9)	11.9 (±5.2)	3.5 (±2.3)	1.5 (±1.3)	2.7 (±2.3)	81.6 (±12.7)
Kentucky	392	67.9 (±5.7)	32.1 (±5.7)	26.5 (±5.4)	1.7 (±2.4)	4.4 (±2.9)	1.1 (±1.1)	93.3 (±5.2)
Louisiana	281	50.6 (±7.3)	49.4 (±7.3)	45.7 (±7.4)	3.1 (±2.8)	2.4 (±2.1)	0.4 (±0.8)	98.3 (±1.7)
Maine	298	65.0 (±6.9)	35.0 (±6.9)	29.4 (±6.8)	2.2 (±1.8)	2.8 (±2.1)	1.8 (±1.7)	99.0 (±1.9)
Maryland	243	77.2 (±6.6)	22.8 (±6.6)	17.8 (±5.6)	2.7 (±2.3)	4.2 (±4.2)	1.0 (±2.0)	90.3 (±8.4)
Massachusetts	395	73.2 (±5.5)	26.8 (±5.5)	22.4 (±5.2)	3.8 (±2.4)	2.4 (±2.2)	0.0 (±0.0)	98.8 (±2.3)
Michigan	446	69.9 (±5.5)	30.1 (±5.5)	24.1 (±5.4)	2.9 (±2.0)	3.4 (±1.8)	1.0 (±0.8)	96.7 (±3.6)
Minnesota	335	83.7 (±4.8)	16.3 (±4.8)	12.8 (±4.5)	0.9 (±1.1)	2.5 (±1.7)	0.5 (±0.7)	95.1 (±5.6)
Mississippi	438	52.7 (±5.5)	47.3 (±5.5)	34.1 (±5.5)	0.9 (±1.1)	12.1 (±4.0)	1.1 (±1.1)	88.8 (±6.3)
Missouri	374	66.9 (±6.0)	33.1 (±6.0)	22.2 (±5.4)	1.3 (±1.1)	8.5 (±3.9)	1.4 (±1.4)	86.6 (±8.7)
Montana	306	60.3 (±6.3)	39.7 (±6.3)	11.7 (±4.3)	12.7 (±4.9)	8.9 (±3.9)	10.0 (±3.5)	94.0 (±4.6)
Nebraska	286	74.5 (±5.9)	25.5 (±5.9)	17.0 (±5.2)	3.0 (±2.4)	4.8 (±3.0)	2.7 (±1.8)	91.2 (±7.3)
Nevada	336	66.9 (±6.6)	33.1 (±6.6)	11.9 (±4.7)	2.6 (±2.0)	19.3 (±5.8)	0.7 (±1.0)	99.7 (±0.5)
New Hampshire	304	84.9 (±5.2)	15.1 (±5.2)	12.7 (±4.9)	0.9 (±1.0)	2.1 (±2.0)	0.0 (±0.0)	97.8 (±4.4)
New Jersey	427	76.6 (±5.3)	23.4 (±5.3)	20.0 (±5.1)	2.2 (±2.0)	2.4 (±1.8)	0.0 (±0.0)	97.5 (±3.6)

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Table 1 (continued). Proportion of adolescents aged 13–17 years eligible for VFC by eligibility category and geographic area: 2009 National Immunization Survey-Teen

			All VFC-eligible[a]					
Geographic area	*Unweighted sample size* N	*All non-VFC-eligible Percent (95% CI)*	*Total VFC-eligible Percent (95% CI)*	*Medicaid-enrolled Percent (95% CI)*	*American Indian/ Alaska Native Percent (95% CI)*	*Uninsured Percent (95% CI)*	*Underinsured and vaccinated at an FQHC or RHC Percent (95% CI)*	*Vaccinated by VFC-enrolled provider*[b] *Percent (95% CI)*
New Mexico	406	51.7 (±5.7)	48.3 (±5.7)	36.2 (±5.6)	9.7 (±3.6)	6.5 (±3.0)	1.6 (±1.3)	94.7 (±4.0)
New York	537	73.0 (±4.7)	27.0 (±4.7)	24.3 (±4.6)	2.3 (±1.9)	2.0 (±1.4)	0.1 (±0.2)	96.1 (±2.9)
New York City	267	57.5 (±7.9)	42.5 (±7.9)	41.8 (±7.9)	3.5 (±4.0)	0.7 (±0.8)	0.0 (±0.0)	96.1 (±3.8)
Rest of state	270	83.5 (±5.4)	16.5 (±5.4)	12.4 (±5.0)	1.5 (±1.7)	2.9 (±2.2)	0.2 (±0.4)	95.9 (±4.7)
North Carolina	322	64.1 (±6.7)	35.9 (±6.7)	30.0 (±6.7)	1.5 (±1.2)	4.9 (±2.7)	0.5 (±0.6)	93.6 (±5.7)
North Dakota	272	77.8 (±5.8)	22.2 (±5.8)	11.6 (±4.8)	11.1 (±4.4)	2.4 (±2.2)	3.5 (±2.2)	95.4 (±5.2)
Ohio	351	69.9 (±6.2)	30.1 (±6.2)	25.2 (±6.0)	2.2 (±1.8)	3.7 (±2.2)	0.3 (±0.5)	92.1 (±6.0)
Oklahoma	336	47.2 (±6.1)	52.8 (±6.1)	31.1 (±5.8)	18.1 (±4.9)	12.2 (±4.4)	1.0 (±1.1)	93.0 (±4.2)
Oregon	384	74.2 (±5.2)	25.8 (±5.2)	15.3 (±4.3)	5.5 (±2.7)	6.6 (±3.3)	1.4 (±1.3)	97.1 (±4.1)
Pennsylvania	579	72.5 (±5.8)	27.5 (±5.8)	23.8 (±5.6)	2.2 (±1.8)	3.1 (±2.2)	0.3 (±0.4)	93.7 (±5.3)
Philadelphia	324	52.8 (±6.2)	47.2 (±6.2)	41.1 (±6.2)	3.6 (±2.4)	4.5 (±2.5)	0.8 (±1.1)	94.9 (±3.2)
Rest of state	255	75.6 (±6.7)	24.4 (±6.7)	21.1 (±6.5)	1.9 (±2.1)	2.9 (±2.5)	0.2 (±0.4)	93.3 (±6.8)
Rhode Island	409	63.6 (±6.4)	36.4 (±6.4)	28.5 (±6.0)	2.4 (±2.3)	6.9 (±4.1)	0.3 (±0.6)	100.0 (±0.0)
South Carolina	298	54.5 (±6.9)	45.5 (±6.9)	36.8 (±6.9)	1.6 (±1.3)	6.2 (±3.3)	2.1 (±1.6)	94.9 (±4.5)
South Dakota	271	59.6 (±6.9)	40.4 (±6.9)	22.9 (±6.3)	12.2 (±5.0)	4.5 (±3.0)	9.3 (±4.1)	96.7 (±4.0)
Tennessee	397	64.6 (±6.1)	35.4 (±6.1)	29.4 (±6.0)	0.6 (±0.7)	4.9 (±2.8)	0.5 (±0.6)	90.2 (±5.8)
Texas	1,469	59.6 (±5.2)	40.4 (±5.2)	23.0 (±4.6)	3.4 (±1.9)	14.4 (±3.8)	0.4 (±0.5)	94.9 (±3.3)
Bexar County	305	57.2 (±7.4)	42.8 (±7.4)	27.9 (±6.9)	2.5 (±2.5)	12.0 (±5.6)	0.5 (±0.9)	93.2 (±8.4)
Dallas County	296	51.9 (±7.3)	48.1 (±7.3)	28.8 (±6.9)	2.4 (±2.2)	17.2 (±6.4)	1.7 (±2.4)	95.1 (±4.3)
El Paso County	325	49.8 (±5.9)	50.2 (±5.9)	35.4 (±5.7)	2.7 (±1.7)	13.9 (±4.0)	0.0 (±0.0)	99.5 (±0.9)
Houston	239	48.8 (±8.6)	51.2 (±8.6)	34.7 (±8.5)	0.1 (±0.2)	16.4 (±6.7)	0.0 (±0.0)	100.0 (±0.0)
Rest of state	304	62.5 (±7.1)	37.5 (±7.1)	19.9 (±6.3)	4.0 (±2.5)	14.0 (±5.2)	0.3 (±0.6)	94.0 (±4.8)
Utah	337	84.9 (±4.7)	15.1 (±4.7)	3.9 (±2.2)	0.2 (±0.4)	8.8 (±4.1)	2.2 (±1.6)	93.4 (±7.7)
Vermont	426	65.8 (±5.5)	34.2 (±5.5)	29.7 (±5.4)	0.9 (±1.6)	2.4 (±1.5)	1.2 (±1.3)	99.5 (±1.0)
Virginia	355	75.6 (±6.2)	24.4 (±6.2)	19.6 (±5.9)	1.1 (±1.2)	3.8 (±2.8)	0.3 (±0.4)	86.5 (±10.7)
Washington	321	72.7 (±5.7)	27.3 (±5.7)	23.6 (±5.4)	4.4 (±2.3)	1.3 (±1.5)	0.5 (±0.7)	96.2 (±4.5)
West Virginia	249	64.3 (±7.1)	35.7 (±7.1)	29.8 (±6.9)	2.9 (±2.5)	2.1 (±1.8)	2.3 (±1.7)	89.2 (±9.8)
Wisconsin	345	76.6 (±5.7)	23.4 (±5.7)	18.2 (±5.4)	2.4 (±2.0)	2.3 (±1.7)	1.6 (±1.4)	93.5 (±5.7)
Wyoming	372	72.8 (±5.4)	27.2 (±5.4)	16.1 (±4.7)	3.2 (±1.8)	5.1 (±2.6)	3.9 (±2.0)	98.5 (±2.2)

[a]Percentages represent the proportion of all adolescents in each category, rather than all VFC-eligible adolescents (e.g., 25.2% of all adolescents in Alabama are eligible for the VFC program due to Medicaid enrollment).

[b]Analysis was restricted to VFC-eligible adolescents.

[c]Range includes sample size in each grantee area, but not for multiple areas in the same state (e.g., the range includes sample sizes for Lake County, for Marion County, and for the rest of Indiana, but not for the sum of the sample sizes for all areas surveyed in Indiana).

VFC = Vaccines for Children program

CI = confidence interval

FQHC = Federally Qualified Health Center

RHC = Rural Health Clinic

Table 2. Comparison of VFC-eligible and non-VFC-eligible adolescents aged 13–17 years by selected demographic characteristics: 2009 National Immunization Survey-Teen

Characteristic	*Unweighted sample size* N	*VFC-eligible* *Percent (95% CI)*	*Non-VFC-eligible* *Percent (95% CI)*
Race/ethnicity of adolescent			
Non-Hispanic white	14,107	34.7 (±2.1)[a]	71.8 (±1.5)
Non-Hispanic black/African American	2,047	24.1 (±2.0)[a]	9.6 (±0.9)
Hispanic	2,479	30.2 (±2.4)[a]	13.2 (±1.3)
Non-Hispanic Asian/Pacific Islander	778	5.5 (±1.1)[a]	3.5 (±0.7)
Non-Hispanic other	655	5.5 (±1.1)[a]	1.9 (±0.5)
Gender of adolescent			
Male	10,445	52.3 (±2.4)	50.7 (±1.5)
Female	9,621	47.7 (±2.4)	49.3 (±1.5)
Facility type where vaccines were administered[b]			
Public provider	3,717	32.3 (±2.2)[a]	11.8 (±0.9)
Private provider	11,094	42.1 (±2.4)[a]	66.8 (±1.3)
Hospital	1,711	8.8 (±1.3)[a]	6.8 (±0.7)
Other clinic	664	3.3 (±0.9)	3.2 (±0.5)
Mixed	2,809	13.5 (±1.6)[a]	11.4 (±0.8)
Mother's education level			
<High school	1,870	29.9 (±2.4)[a]	6.2 (±0.9)
High school or equivalent	4,060	35.4 (±2.3)[a]	23.6 (±1.4)
Some college	5,852	23.8 (±1.9)[a]	26.1 (±1.2)
≥College degree	8,284	10.9 (±1.3)[a]	44.1 (±1.5)
Mother's age (in years)			
≤34	1,479	15.5 (±1.7)[a]	4.4 (±0.6)
35–44	8,611	53.5 (±2.4)[a]	42.4 (±1.5)
≥45	9,976	31.0 (±2.2)[a]	53.2 (±1.5)
Mother's marital status			
Married/partnered	15,240	52.0 (±2.4)[a]	84.1 (±1.2)
Divorced, separated, or widowed	3,361	28.4 (±2.2)[a]	12.5 (±1.1)
Single, never married	1,291	17.9 (±1.8)[a]	2.9 (±0.5)
Deceased	174	1.8 (±0.6)[a]	0.5 (±0.2)
Mother's preferred language			
English	19,009	78.4 (±2.3)[a]	95.8 (±0.8)
Spanish	909	18.2 (±2.2)[a]	3.4 (±0.8)
Other	148	3.4 (±1.1)[a]	0.7 (±0.3)
Poverty status			
<133% of FPL	3,829	61.3 (±2.3)[a]	7.9 (±0.9)
133%–399% of FPL	8,699	32.3 (±2.1)[a]	47.6 (±1.5)
≥400% of FPL	7,538	6.4 (±1.0)[a]	44.5 (±1.5)
Number of children aged ≤18 years in household			
1	7,730	39.0 (±2.4)	37.9 (±1.4)
2–3	10,400	51.9 (±2.4)	52.4 (±1.5)
≥4	1,936	9.1 (±1.3)	9.8 (±1.0)
Household location			
Urban (MSA, central city)	7,883	43.3 (±2.4)[a]	34.8 (±1.4)
Suburban (MSA, non-central city)	7,660	37.4 (±2.4)[a]	51.1 (±1.5)
Rural (non-MSA)	4,523	19.4 (±1.5)[a]	14.1 (±0.8)

[a]Significantly different between VFC-eligible children and non-VFC-eligible children ($p<0.05$)

[b]Other clinics included sexually transmitted infection clinics, adolescent health clinics, and school-based clinics. Respondents not in the "mixed" category received all vaccine doses at the specified type of provider.

VFC = Vaccines for Children program

CI = confidence interval

FPL = federal poverty level

MSA = metropolitan statistical area

among VFC-eligible and non-VFC-eligible adolescents nationally, but significantly lower among VFC-eligible vs. non-VFC-eligible adolescents in several grantee areas. Although coverage for recommended adolescent vaccines is progressing steadily,[22] underserved adolescents are lagging behind.

There are several potential reasons for coverage variations at the state or local level. During the period of increasing coverage that follows a new vaccine recommendation, differences in the pace of implementation are easily seen in variation of coverage levels. Immunization resources vary by state, and implementation of new vaccine recommendations in the public and private sectors may be delayed while funds are sought to cover the high cost of vaccine purchase.[23–25] A recent study showed state- and county-level poverty rates are associated with geographic variation in HPV4 coverage, although associations differed in direction.[26] Reimbursements for vaccines and vaccine administration also vary widely by state in both the public and private sectors;[13,27] previous research suggests that provider reimbursement levels may help explain some state-level variation in vaccination coverage.[28] Finally, state and local policies—for example, laws requiring adolescent vaccines for school entry—may affect vaccination coverage. For the 2009–2010 school year, 27 states required Tdap vaccination for middle-school entry, seven required MCV4, and two required HPV4 (but allowed students to opt out of this requirement).[22]

Coverage among VFC-eligible adolescents was lower than coverage for non-VFC-eligible adolescents in our sample for MCV4 and Tdap. Although VFC provides vaccines free of charge to eligible adolescents, costs associated with office visits are not covered by the program. The association of poverty level with adolescent vaccination coverage is inconsistent;[22,29] however, studies have shown significantly lower rates of well-child visits[8] and vaccination coverage[29,30] among uninsured adolescents, independent of poverty status. In our sample, 61% of VFC-eligible adolescents lived below 133% of the federal poverty level, and 20% were uninsured. Nonfinancial barriers to vaccination may also deter poor or uninsured adolescents from making the preventive visits where vaccines are administered. These barriers may vary by location: adolescents in upstate New York did not report distance- or transportation-related barriers to accessing health care,[7] but transportation was a substantial barrier to vaccination for poor mothers of young children in urban and rural North Carolina.[31] It is also possible that VFC-eligible adolescents are unaware of their eligibility for free vaccines through VFC and are, therefore, less likely to seek vaccination services.

Finally, it should be noted that VFC-eligible adolescents differ from non-VFC-eligible adolescents on demographic characteristics that may be associated with vaccination coverage, including race/ethnicity, maternal age, and maternal education level. VFC eligibility is a marker not only for economic differences, but also for a constellation of factors that may contribute to limited use of preventive services, including vaccines.

Overall, 93% of VFC-eligible adolescents received vaccinations from a provider enrolled in the VFC program, suggesting that VFC is effectively reaching the financially vulnerable adolescents the program was designed to serve. However, access to VFC benefits varies widely by state, primarily due to differences in state income requirements for Medicaid eligibility. The proportion of Medicaid-enrolled adolescents in each grantee area ranges from less than 5% to more than 50%. Because Medicaid eligibility is the most common way for an adolescent to become VFC-eligible, this variation has a significant effect on the number of underserved adolescents who are able to access free vaccination services in different areas of the country. Interestingly, VFC-eligible adolescents were less likely than non-VFC-eligible adolescents to have received all vaccine doses in a private provider office, despite the fact that private providers comprise more than 70% of all VFC providers.[32]

In our sample, HPV4 coverage was similar among VFC- and non-VFC- eligible adolescents. Eight months after HPV4 vaccine was recommended for routine vaccination of adolescent females, nearly 90% of immunization programs were providing HPV4 vaccine to VFC providers.[33] Conversely, it is known that many private providers delayed purchase of HPV4 vaccine due to financial concerns.[24] A 2007 survey in North Carolina found practices participating in VFC were more likely than those not participating to have HPV4 vaccine available for their patients.[34]

Despite the success of VFC in making HPV4 vaccine available to vulnerable populations, limited access to care among underserved adolescents could impede completion of the three-dose series required for full protection. A recent study showed the majority of adolescent females would need multiple additional health-care visits to complete the HPV4 vaccination series.[35] Such additional visits may represent a substantial financial burden for VFC-eligible adolescents, as uninsured adolescents pay a much greater proportion of their health-care expenses out of pocket than publicly or privately insured adolescents.[36] However, in our sample, three-dose HPV4 coverage did not differ by VFC eligibility status, although series completion rates were low for all adolescent females. Further research is

Table 3. Vaccination coverage for recommended adolescent vaccines—HPV4, MCV4, and Tdap—by VFC eligibility and geographic area: 2009 National Immunization Survey-Teen

	≥1 dose HPV4 vaccine		≥3 doses HPV4 vaccine		≥1 dose MCV4 vaccine		≥1 dose Tdap vaccine	
Geographic area	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*
Total United States	46.6 (±3.5)	43.2 (±2.2)	25.0 (±2.9)	27.5 (±1.8)	50.1 (±2.4)[a]	55.4 (±1.5)	52.5 (±2.4)[a]	57.1 (±1.5)
(range)	(15.3–83.2)	(15.9–73.7)	(3.7–54.4)	(6.7–61.7)	(22.7–81.0)	(16.2–80.2)	(24.6–77.5)	(20.7–76.4)
Alabama	62.7 (±15.2)[b]	41.7 (±9.9)	27.1 (±13.7)[b]	24.2 (±8.4)	46.9 (±12.7)[b]	42.2 (±6.9)	59.3 (±12.5)[b]	57.1 (±6.9)
Alaska	46.0 (±13.9)[b]	34.0 (±12.7)[b]	23.1 (±11.6)[b]	14.3 (±9.5)	40.0 (±9.6)	40.7 (±8.9)	57.3 (±9.9)	54.4 (±9.0)
Arizona	55.0 (±17.2)[b]	51.5 (±10.5)[b]	33.1 (±16.6)[b]	30.1 (±10.4)[b]	70.3 (±11.1)[b]	69.3 (±6.8)	64.6 (±12.1)[b]	68.0 (±6.9)
Arkansas	47.5 (±15.1)[b]	25.8 (±8.9)	13.8 (±11.4)[b]	13.7 (±6.7)	25.4 (±9.7)	19.8 (±5.4)	44.3 (±11.0)[b]	28.9 (±6.4)
California	50.4 (±15.6)[b]	48.6 (±11.9)[b]	23.1 (±11.9)[b]	21.2 (±8.3)	56.6 (±10.7)[b]	59.4 (±7.8)	48.2 (±10.8)[b]	55.7 (±8.0)
Los Angeles County	67.1 (±17.1)[b]	61.0 (±15.2)[b]	37.8 (±18.4)[b]	25.8 (±12.4)[b]	59.5 (±13.9)[b]	57.6 (±11.2)[b]	45.5 (±14.1)[a,b]	60.8 (±10.8)[b]
Rest of state	41.1 (±21.2)[b]	44.6 (±15.0)[b]	14.9 (±14.0)[b]	19.7 (±10.2)[b]	55.3 (±14.3)[b]	60.0 (±9.8)	49.4 (±14.3)[b]	53.8 (±10.2)[b]
Colorado	61.5 (±19.3)[b]	50.1 (±10.0)[b]	38.2 (±20.9)[b]	30.8 (±9.6)	48.1 (±15.6)[b]	55.3 (±6.7)	77.5 (±12.5)[b]	76.4 (±5.9)
Connecticut	60.1 (±31.4)[b]	61.4 (±8.4)	16.4 (±17.8)[a,b]	48.7 (±8.7)	74.8 (±16.2)[b]	66.6 (±6.4)	74.7 (±14.3)[b]	66.7 (±6.2)
Delaware	61.6 (±24.2)[b]	48.5 (±9.5)	31.7 (±22.5)[b]	32.9 (±9.1)	47.9 (±14.5)[a,b]	62.4 (±6.8)	47.0 (±14.4)[b]	55.8 (±6.8)
District of Columbia	63.1 (±12.0)[b]	56.2 (±11.2)[b]	24.6 (±10.1)[b]	20.7 (±8.2)	81.0 (±7.5)	75.3 (±7.3)	40.7 (±8.7)[a]	52.0 (±8.0)
Florida	44.1 (±16.1)[b]	36.1 (±8.9)	26.3 (±14.1)[b]	23.4 (±7.4)	51.3 (±10.8)[b]	53.7 (±7.1)	46.8 (±10.7)[b]	47.5 (±7.1)
Georgia	41.1 (±17.4)[b]	37.7 (±9.2)	18.1 (±13.2)[b]	23.2 (±7.6)	47.1 (±12.1)[b]	57.3 (±6.9)	48.6 (±12.1)[b]	52.8 (±6.9)
Hawaii	83.2 (±12.5)[b]	58.5 (±11.4)[b]	50.9 (±19.2)[b]	34.6 (±10.9)[b]	40.0 (±13.2)[a,b]	54.5 (±7.8)	54.6 (±13.5)[b]	43.3 (±7.8)
Idaho	40.1 (±17.7)[b]	21.6 (±10.3)[b]	25.4 (±15.9)[b]	9.4 (±6.7)	36.0 (±13.4)[b]	33.1 (±8.6)	39.0 (±13.3)[b]	38.4 (±9.0)
Illinois	22.0 (±9.0)[a]	40.4 (±8.3)	12.4 (±7.2)[a]	28.7 (±7.8)	50.3 (±9.3)	54.9 (±5.8)	55.4 (±9.2)	61.3 (±5.8)
Chicago	33.4 (±10.8)[b]	40.3 (±10.8)[b]	13.1 (±6.6)	19.1 (±8.0)	57.0 (±8.4)	60.5 (±8.8)	57.2 (±8.3)	61.1 (±8.9)
Rest of state	15.3 (±11.7)[a,b]	40.4 (±9.4)	12.0 (±10.7)[a,b]	30.1 (±8.9)	46.1 (±14.0)[b]	54.2 (±6.5)	54.3 (±14.0)[b]	61.4 (±6.5)
Indiana	45.4 (±13.1)[b]	33.6 (±8.6)	20.5 (±10.9)[b]	23.0 (±7.3)	39.1 (±9.9)	42.8 (±6.4)	48.5 (±10.3)[b]	42.7 (±6.4)
Lake County	38.8 (±21.8)[b]	25.7 (±11.6)[b]	10.2 (±11.8)[b]	8.7 (±6.5)	29.0 (±13.3)[b]	33.3 (±8.1)	35.8 (±13.9)[b]	40.5 (±9.0)
Marion County	57.0 (±15.8)[b]	48.9 (±11.8)[b]	20.7 (±11.5)[a,b]	34.0 (±10.3)[b]	53.4 (±11.6)[b]	53.3 (±8.0)	50.6 (±11.6)[b]	49.1 (±7.9)
Rest of state	43.4 (±17.8)[b]	32.0 (±10.5)[b]	22.2 (±15.1)[b]	22.6 (±9.0)	37.0 (±13.6)[b]	42.1 (±7.8)	50.0 (±14.0)[b]	41.9 (±7.8)
Iowa	38.0 (±18.8)[b]	43.4 (±9.5)	23.8 (±15.8)[b]	34.6 (±9.1)	36.9 (±14.2)[b]	48.8 (±6.7)	57.7 (±14.8)[b]	62.1 (±6.7)
Kansas	41.8 (±26.5)[b]	44.6 (±11.6)[b]	19.4 (±21.2)[b]	29.4 (±11.6)[b]	35.9 (±16.9)[b]	39.3 (±7.6)	60.7 (±17.5)[b]	63.9 (±7.3)
Kentucky	36.4 (±14.9)[b]	28.2 (±8.8)	18.8 (±12.4)[b]	19.9 (±7.6)	27.8 (±9.6)[a]	40.4 (±6.2)	38.7 (±11.1)[b]	36.9 (±6.2)
Louisiana	61.5 (±16.9)[b]	35.4 (±12.7)[b]	39.5 (±17.6)[b]	19.8 (±10.0)[b]	70.8 (±10.3)[b]	60.9 (±9.3)	47.5 (±11.4)[b]	47.2 (±9.1)
Maine	39.7 (±19.6)[b]	46.1 (±10.6)[b]	17.0 (±13.0)[a,b]	31.7 (±9.9)	42.4 (±12.6)[b]	50.1 (±7.8)	56.1 (±12.6)[b]	52.9 (±7.8)
Maryland	42.8 (±22.2)[b]	38.9 (±13.4)[b]	27.4 (±20.5)[b]	30.0 (±12.8)[b]	53.2 (±16.5)[b]	61.1 (±9.1)	46.3 (±16.3)[b]	53.5 (±9.1)
Massachusetts	81.4 (±13.5)[b]	63.5 (±9.7)	54.4 (±17.8)[b]	47.2 (±9.8)	66.1 (±11.8)[b]	76.9 (±5.5)	56.2 (±12.4)[b]	65.1 (±6.3)
Michigan	50.1 (±16.1)[b]	33.5 (±8.0)	23.7 (±15.7)[b]	22.5 (±7.0)	51.3 (±11.5)[b]	53.1 (±6.2)	43.9 (±11.5)[b]	47.3 (±6.2)
Minnesota	49.7 (±24.8)[b]	44.1 (±9.1)	28.6 (±19.8)[b]	26.7 (±7.9)	27.2 (±12.7)[a,b]	47.1 (±6.5)	42.2 (±15.9)[b]	54.0 (±6.5)
Mississippi	29.7 (±11.7)[b]	15.9 (±8.0)	9.4 (±6.3)	6.7 (±4.6)	22.7 (±7.1)	16.2 (±4.4)	24.6 (±7.3)	20.7 (±5.3)
Missouri	31.0 (±14.7)[b]	33.4 (±9.0)	17.1 (±11.2)[b]	21.2 (±7.7)	47.1 (±11.9)[b]	44.7 (±6.6)	60.0 (±11.2)[b]	60.2 (±6.5)
Montana	37.7 (±14.3)[b]	32.5 (±10.5)[b]	19.9 (±11.6)[b]	23.7 (±9.4)	31.3 (±10.3)[b]	24.1 (±6.3)	66.7 (±10.1)[b]	61.9 (±7.5)
Nebraska	45.3 (±19.5)[b]	50.7 (±10.5)[b]	29.0 (±17.8)[b]	35.4 (±10.3)[b]	50.1 (±13.7)[b]	54.3 (±7.3)	57.3 (±13.2)[b]	49.6 (±7.3)
Nevada	47.6 (±18.7)[b]	34.9 (±9.9)	16.4 (±14.4)[b]	17.9 (±8.0)	41.1 (±12.3)[b]	38.7 (±7.2)	65.6 (±12.6)[b]	63.2 (±7.2)
New Hampshire	65.8 (±27.7)[b]	59.9 (±8.9)	35.3 (±32.1)[b]	40.7 (±9.2)	72.8 (±14.7)[b]	66.9 (±6.5)	67.2 (±18.9)[b]	72.9 (±5.8)

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Table 3 (continued). Vaccination coverage for recommended adolescent vaccines—HPV4, MCV4, and Tdap—by VFC eligibility and geographic area: 2009 National Immunization Survey-Teen

	≥1 dose HPV4 vaccine		≥3 doses HPV4 vaccine		≥1 dose MCV4 vaccine		≥1 dose Tdap vaccine	
Geographic area	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*	*VFC-eligible Percent (95% CI)*	*Non-VFC-eligible Percent (95% CI)*
New Jersey	43.3 (±19.5)[b]	41.9 (±8.7)	20.0 (±14.7)[b]	30.2 (±7.9)	58.6 (±13.4)[a,b]	75.3 (±5.7)	43.0 (±13.4)[a,b]	66.6 (±5.8)
New Mexico	51.3 (±12.8)[b]	54.6 (±10.1)[b]	38.6 (±12.3)[b]	32.7 (±9.3)	55.2 (±8.7)	47.4 (±7.2)	63.4 (±8.5)	63.6 (±7.0)
New York	51.3 (±15.6)[b]	47.8 (±8.3)	33.0 (±14.5)[b]	34.2 (±7.7)	51.0 (±10.9)[a,b]	67.4 (±5.4)	71.1 (±9.2)	68.6 (±5.4)
New York City	45.0 (±20.1)[b]	42.1 (±12.7)[b]	27.0 (±16.2)[b]	27.8 (±10.6)[b]	52.4 (±13.6)[a,b]	67.6 (±8.4)	72.1 (±11.3)[b]	72.5 (±8.1)
Rest of state	59.5 (±23.0)[b]	50.6 (±10.6)[b]	40.9 (±24.3)[b]	37.4 (±10.1)[b]	48.5 (±18.3)[a,b]	67.2 (±6.9)	69.3 (±15.8)[b]	66.7 (±7.0)
North Carolina	47.5 (±18.6)[b]	52.0 (±10.4)[b]	26.1 (±16.3)[b]	33.2 (±9.4)	48.2 (±12.6)[b]	46.1 (±7.2)	51.0 (±12.6)[b]	56.9 (±7.2)
North Dakota	54.6 (±21.2)[b]	42.5 (±10.4)[b]	33.5 (±20.6)[b]	31.2 (±9.7)	75.6 (±13.2)[b]	63.3 (±7.1)	73.8 (±12.4)[b]	71.0 (±6.7)
Ohio	42.2 (±18.2)[b]	39.8 (±10.3)[b]	25.3 (±17.9)[b]	24.9 (±8.3)	46.8 (±12.8)[b]	56.7 (±6.9)	51.9 (±12.8)[b]	49.4 (±7.0)
Oklahoma	45.2 (±11.8)[b]	33.3 (±12.3)[b]	17.2 (±9.1)	14.8 (±8.0)	27.9 (±7.6)	31.2 (±7.7)	40.5 (±8.6)	29.1 (±7.4)
Oregon	63.0 (±16.6)[b]	50.1 (±8.7)	38.9 (±17.5)[b]	30.2 (±8.3)	43.4 (±12.1)[b]	41.1 (±6.2)	46.9 (±12.1)[a,b]	58.5 (±6.3)
Pennsylvania	70.0 (±14.9)[b]	49.1 (±10.6)[b]	32.3 (±17.7)[b]	38.7 (±10.4)[b]	58.1 (±12.9)[a,b]	77.1 (±5.9)	60.9 (±12.7)[b]	70.5 (±6.5)
Philadelphia	61.1 (±13.5)[b]	55.4 (±11.6)[b]	28.2 (±12.6)[b]	26.7 (±10.4)[b]	74.3 (±8.4)	76.2 (±6.4)	62.5 (±9.1)	67.6 (±7.4)
Rest of state	74.9 (±20.3)[b]	48.5 (±11.5)[b]	34.5 (±26.7)[b]	39.9 (±11.3)[b]	53.2 (±16.3)[a,b]	77.2 (±6.5)	60.4 (±16.3)[b]	70.9 (±7.2)
Rhode Island	58.6 (±18.0)[b]	73.7 (±9.1)	33.8 (±17.3)[a,b]	61.7 (±9.9)	67.8 (±10.7)[a,b]	80.2 (±5.2)	66.5 (±11.3)[b]	56.5 (±6.8)
South Carolina	29.3 (±13.5)[b]	27.8 (±10.0)[b]	17.2 (±10.2)[b]	16.0 (±8.2)	24.8 (±8.9)[a]	42.3 (±8.2)	27.4 (±9.1)[a]	46.0 (±8.4)
South Dakota	66.2 (±15.1)[b]	59.7 (±10.6)[b]	42.7 (±16.2)[b]	46.7 (±10.9)[b]	31.6 (±10.5)[b]	20.4 (±6.5)	39.6 (±11.6)[b]	39.7 (±7.9)
Tennessee	52.4 (±15.2)[b]	39.1 (±9.8)	28.9 (±14.5)[b]	25.3 (±8.0)	46.4 (±11.3)[b]	55.2 (±6.8)	44.2 (±11.3)[b]	50.0 (±6.9)
Texas	38.6 (±11.8)[b]	37.3 (±8.1)	19.5 (±10.7)[b]	25.5 (±7.2)	53.6 (±8.6)	49.4 (±6.6)	55.6 (±8.5)	58.4 (±6.5)
Bexar County	53.2 (±19.1)[b]	44.9 (±11.6)[b]	16.2 (±16.7)[b]	22.8 (±8.8)	55.3 (±12.5)[b]	54.5 (±8.5)	63.0 (±11.9)[b]	51.5 (±8.4)
Dallas County	42.1 (±16.8)[b]	51.6 (±13.2)[b]	13.5 (±10.9)[a,b]	27.8 (±11.8)[b]	46.9 (±11.8)[b]	57.6 (±8.5)	45.9 (±11.7)[a,b]	62.3 (±8.7)
El Paso County	62.2 (±11.9)[b]	53.4 (±12.4)[b]	27.8 (±10.5)[b]	29.0 (±11.0)[b]	67.5 (±8.0)	67.3 (±8.1)	61.2 (±8.2)	67.9 (±7.6)
Houston	30.6 (±17.5)[a,b]	52.7 (±16.4)[b]	3.7 (±5.2)[a]	31.3 (±13.4)[b]	61.3 (±12.7)[b]	68.6 (±11.1)[b]	55.5 (±12.7)[b]	49.6 (±11.6)[b]
Rest of state	35.6 (±18.2)[b]	33.5 (±10.2)[b]	23.6 (±16.8)[b]	25.0 (±9.1)	52.5 (±12.5)[b]	45.7 (±8.5)	56.2 (±12.3)[b]	58.9 (±8.4)
Utah	31.8 (±23.3)[b]	32.8 (±9.1)	12.3 (±14.4)[b]	20.7 (±8.4)	39.8 (±16.6)[b]	42.7 (±6.7)	77.1 (±13.6)[b]	62.2 (±6.7)
Vermont	59.9 (±14.6)[b]	61.2 (±9.4)	31.3 (±14.1)[b]	43.4 (±9.5)	41.0 (±10.3)[b]	45.4 (±6.5)	70.6 (±9.4)	70.8 (±6.1)
Virginia	32.6 (±19.2)[b]	38.5 (±9.4)	20.5 (±18.2)[b]	26.3 (±7.9)	40.1 (±15.3)[b]	50.7 (±6.7)	55.9 (±15.2)[b]	56.3 (±6.8)
Washington	57.0 (±18.1)[b]	61.0 (±10.1)[b]	43.0 (±17.6)[b]	32.9 (±9.3)	55.0 (±12.0)[b]	56.1 (±7.4)	64.5 (±11.4)[b]	58.5 (±7.4)
West Virginia	40.5 (±17.4)[b]	37.5 (±11.5)[b]	16.6 (±11.8)[a,b]	31.8 (±11.1)[b]	33.2 (±11.2)[b]	42.2 (±8.3)	31.1 (±10.8)[a,b]	45.6 (±8.5)
Wisconsin	46.7 (±18.7)[b]	49.9 (±9.6)	25.4 (±15.7)[b]	30.0 (±8.8)	53.3 (±14.4)[b]	56.5 (±6.8)	72.3 (±11.8)[b]	72.3 (±6.4)
Wyoming	55.9 (±15.9)[b]	38.2 (±8.8)	42.9 (±15.8)[b]	25.5 (±7.7)	51.7 (±11.7)[b]	45.9 (±6.6)	52.2 (±11.7)[b]	46.3 (±6.6)

[a]The coverage estimate for VFC-eligible adolescents is significantly lower than the coverage estimate for non-VFC-eligible adolescents ($p<0.05$).

[b]Estimate has a 95% CI half-width >10% and may be imprecise.

HPV4 = quadrivalent human papillomavirus

MCV4 = meningococcal conjugate

Tdap = tetanus-diphtheria-acellular pertussis

VFC = Vaccines for Children program

CI = confidence interval

needed to determine what policies, practices, or public health messages contributed to this equality in coverage and whether these interventions might be applied to reduce coverage differences for other recommended adolescent vaccines.

Limitations

Our results were subject to certain limitations. First, statistical adjustments made to these telephone survey data may not fully account for bias due to nonresponse or lack of landline telephone coverage. Limitations of the NIS methodology have been described previously.[20] Second, vaccine receipt was determined solely by provider records; incomplete records may have resulted in underestimations of coverage. Third, VFC eligibility was determined using self-reported, point-in-time insurance status, although insurance status may vary from year to year or even month to month. Fourth, we were not able to measure some factors that may have affected vaccination coverage, such as vaccine availability or provider recommendations for vaccination. Finally, small sample sizes at the grantee area level resulted in potentially imprecise estimates of vaccination coverage with wide confidence intervals. This imprecision limited our ability to compare vaccination rates between VFC- and non-VFC-eligible adolescents at the grantee area level, particularly for HPV4, which is measured only among females. Grantee-level results should be interpreted with caution.

CONCLUSIONS

Despite the success of the VFC program in making expensive new vaccines available to underserved children, coverage rates for some recommended vaccines among VFC-eligible adolescents lag behind those of fully, privately insured adolescents. Limited preventive services utilization by adolescents, coupled with barriers in access to care for poor and uninsured adolescents, diminish opportunities for underserved adolescents to obtain potentially lifesaving vaccines. In addition to continued support for VFC, health practitioners—indeed, all stakeholders—should pursue interventions to address barriers to vaccination beyond the cost of recommended vaccines. Leveraging opportunities to vaccinate at nonpreventive visits,[6,35] particularly at sites offering free or low-cost care to the underserved, is likely to increase protection against vaccine-preventable diseases among all adolescents. Further research is needed to determine what factors contribute to the parity of HPV4 vaccine coverage between VFC-eligible and non-VFC-eligible adolescent females. In the meantime, continued monitoring of adolescent vaccination rates, particularly among VFC-eligible populations, will be needed.

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

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