

Impact of Health Insurance Status on Vaccination Coverage Among Adult Populations



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Introduction: Underinsurance is a barrier to vaccination among children. Information on vaccination among adults aged ≥ 18 years by insurance status is limited. This study assesses vaccination coverage among adults aged ≥ 18 years in the U.S. in 2012 by health insurance status and access to care characteristics.

Methods: The 2012 National Health Interview Survey data were analyzed in 2014 to estimate vaccination coverage among adults aged ≥ 18 years by health insurance status for seven routinely recommended vaccines.

Results: Influenza vaccination coverage among adults aged ≥ 18 years without or with health insurance was 14.4% versus 44.3%, respectively; pneumococcal vaccination coverage among adults aged 18–64 years with high-risk conditions was 9.8% versus 23.0%; tetanus and diphtheria toxoid (Td) coverage (age ≥ 18 years) was 53.2% versus 64.5%; tetanus, diphtheria, and acellular pertussis (Tdap) coverage (age ≥ 18 years) was 8.4% versus 15.7%; hepatitis A (HepA) coverage (age 18–49 years) was 16.6% versus 19.8%; hepatitis B (HepB) coverage (age 18–49 years) was 27.5% versus 38.0%; shingles coverage (age ≥ 60 years) was 6.1% versus 20.8%; and human papillomavirus (HPV) coverage (women aged 18–26 years) was 20.9% versus 39.8%. In addition, vaccination coverage differed by insurance type, whether respondents had a regular physician, and number of physician contacts.

Conclusions: Overall, vaccination coverage among adults aged ≥ 18 years is lower among uninsured populations. Implementation of effective strategies is needed to help improve vaccination coverage among adults aged ≥ 18 years, especially those without health insurance.

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Introduction

In 2011, the overall percentage of people without health insurance in the U.S. was 15.7% (48.6 million) and that among adult populations was 17.8% (41.0 million).¹ Among non-Hispanic whites, 11.1% (21.7 million) were uninsured in 2011, whereas 19.5% (7.7 million) of non-Hispanic blacks and 30.1% (5.8 million) of Hispanics were uninsured.¹ The relationship between health insurance and vaccination coverage among child and adolescent populations has been well studied,^{2–5} and

cost is a recognized barrier to receiving timely preventive medical care. Information regarding some adult vaccinations by health insurance status is documented.^{6–11}

Vaccination is the most effective strategy for preventing vaccine-preventable diseases and their complications. Adult vaccination coverage, however, remains low for most routinely recommended vaccines and well below Healthy People 2020 targets.^{12–15} The adult immunization schedule,¹⁶ updated annually by the Advisory Committee on Immunization Practices (ACIP), provides current recommendations for vaccinating adults. Influenza vaccination is recommended for all adults each year; other vaccinations recommended for adults target different populations based on age, health conditions, behavioral risk factors, occupation, travel, and other indications.^{16,17}

This study uses data from the 2012 National Health Interview Survey (NHIS) to examine associations of

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routinely recommended adult vaccinations (influenza; pneumococcal [PPSV]; tetanus toxoid-containing vaccines, including tetanus and diphtheria toxoid [Td] and tetanus, diphtheria, and acellular pertussis [Tdap]; hepatitis A [HepA]; hepatitis B [HepB]; herpes zoster [shingles]; and human papillomavirus [HPV]) with insurance status, having a primary physician, seeing a provider during the previous year, and select demographic characteristics.

Methods

Study Sample

The 2012 NHIS data were analyzed in 2014 (2013 data became available after the manuscript was submitted). The NHIS is a multistage sampling survey, which collects health information on the U.S. civilian, non-institutionalized population.¹⁸ In the sample adult core, questions about receipt of recommended vaccinations for adults were asked of one randomly selected adult within each family in the household. In 2012, the final response rate for the sample adult core was 61.2%.¹⁸

Measures

Vaccination coverage for influenza, PPSV, Td, HepA, HepB, shingles, and HPV vaccines were assessed from coded survey questions on receipt of these vaccines (respondents were asked whether they have ever received specific vaccinations or not except for influenza vaccination, for which seasonal vaccination were asked and assessed).¹⁸ To determine Tdap vaccination status, respondents were asked, *Have you received a tetanus shot in the past 10 years?* Respondents who answered *yes* were asked, *Was your most recent tetanus shot given in 2005 or later?* An affirmative answer to this question prompted another question: *Did the doctor tell you the vaccine included the pertussis or whooping cough vaccine?* Respondents without *yes* or *no* responses for these three questions were excluded from the assessment of Tdap vaccination.

Covariates from coded survey questions were selected to measure associations between vaccination coverage and health insurance status (yes, no); health insurance type (public only, private [including some people with both private and public insurances], none); regular physician status (yes, no); number of provider visits during the prior year (zero, one to three, four to nine, ten or more); and race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic Asian, other races including American Indian/Alaska Native and people reporting multiple races). Demographic (e.g., marital status) and access to care variables (e.g., health insurance) reflect the status as of the time of survey. HepA vaccination was assessed among those traveling to countries of high or intermediate endemicity. PPSV vaccination was assessed among all respondents aged ≥ 65 years and adults aged 18–64 years with high-risk conditions. Respondents were considered at high risk for PPSV disease if they had ever been told by a doctor or other health professional that they had diabetes, emphysema, chronic obstructive pulmonary disease, coronary heart disease, angina, heart attack, or another heart condition; had a diagnosis of cancer during the previous 12 months (excluding non-melanoma skin cancer); had ever been told by a doctor or other health

professional that they had lymphoma, leukemia, or blood cancer; had been told by a doctor or other health professional that they had chronic bronchitis or weak or failing kidneys during the preceding 12 months; had an asthma episode or attack during the preceding 12 months; or were current smokers. Poverty status was defined using 2012 poverty thresholds published by the U.S. Census Bureau, with below poverty defined as a total family income of $< \$23,492$ for a family of four.¹⁹

Statistical Analysis

SUDAAN, version 11.0.1, was used to calculate point estimates and 95% CIs of vaccination coverage.²⁰ For the non-influenza adult vaccination coverage estimates, regular descriptive analysis was used. To better assess influenza vaccination coverage for the 2011–2012 influenza season, coverage was reported by restricting to individuals interviewed September 2011 through June 2012 and vaccinated August 2011 through May 2012 using Kaplan–Meier survival analysis. Vaccination month was used to define the “event” variable and interview date to define the “censoring” variable of the Kaplan–Meier procedure. This analysis has advantages for season-specific influenza estimates over other approaches, such as using a full calendar year of data, which provides annual estimates representing incomplete estimates for up to three influenza seasons, or restricting estimates based on interviews conducted in the post-vaccination period (e.g., March–June), which does not use all relevant data.²¹ The Kaplan–Meier approach allows us to use all relevant data to maximize precision and to use data collected during the vaccination period that likely have more accurate recall of vaccinations.²¹ Estimates were weighted to the adult civilian population of the U.S. Chi-square tests were used to test coverage differences within or between assessed variables. Statistical significance was defined as $p < 0.05$. Influenza, PPSV, and HepB coverage differences by health insurance status between 2001 and 2012 were assessed (information regarding other vaccines were not collected in the 2001 NHIS). Wide differences by insurance status (with versus without insurance) may indicate more strength of association between insurance status. To assess adjusted vaccination coverage and adjusted prevalence ratios for each selected vaccination, we used logistic regression and predicted marginal modeling comparing respondents with health insurance and those without health insurance, controlling for age, gender, race/ethnicity, marital status, education, employment status, poverty level, health insurance, number of doctor visits in the past year, whether the respondent had a usual place of health care, self-reported health status, and region of residence. The NHIS was approved by the Research Ethics Review Board (ERB number, 2009-16) of the National Center for Health Statistics, CDC.

Results

Characteristics of the study population are shown in [Table 1](#). Overall, vaccination coverage was significantly lower ($p < 0.05$) among adults without health insurance compared with those with health insurance, except for overall HepA vaccination and HepB vaccination of people aged ≥ 18 years with diabetes ([Table 2](#)): influenza coverage, adults aged ≥ 18 years (14.4% vs 44.3%); PPSV,

Table 1. Characteristics of the Study Population by Access to Care Factors, National Health Interview Survey, 2012

Characteristics	All adults	With health insurance			Without health insurance	Regular physician		Physician contacts in the past 12 months				
	<i>n</i>	Overall %	Public %	Private %		%	Yes %	No %	None %	1-3 %	4-9 %	≥10 %
Total	34,525	83.0	24.5	75.5	17.0	83.9	16.1	19.7	43.8	23.1	13.4	
Age (years)												
≥ 18	34,525	83.0	24.5	75.5	17.0	83.9	16.1	19.7	43.8	23.1	13.4	
18-26	4,558	74.0	23.5	76.5	26.0	72.1	27.9	29.6	45.5	15.5	9.4	
18-49	18,165	76.4	18.4	81.6	23.6	77.3	22.7	26.2	45.3	17.6	10.9	
18-64 HR	9,799	76.6	28.2	71.8	23.4	81.2	18.8	19.5	37.8	24.9	17.8	
≥ 60	10,269	95.7	40.2	59.8	4.3	95.0	5.0	8.0	39.2	34.1	18.7	
≥ 65	7,382	99.3	48.0	52.0	0.7	96.7	3.3	6.8	37.0	36.0	20.1	
Gender												
Male ^a	15,273	80.7	22.3	77.7*	19.3*	79.3	20.7*	26.7	44.4	18.7	10.3*	
Female	19,252	85.1**	26.5**	73.5**	14.9**	88.1**	11.9**	13.2**	43.2	27.3**	16.3**	
Race/ethnicity												
Non-Hispanic white ^a	20,619	88.4	20.7	79.3*	11.6*	87.3	12.7*	16.0	44.0	25.0	14.9*	
Non-Hispanic black	5,119	79.4**	36.8**	63.2**	20.6**	84.0**	16.0**	20.4**	45.4	22.6**	11.6**	
Hispanic	5,859	61.6**	37.2**	62.8**	38.4**	69.6**	30.4**	33.4**	40.3**	16.9**	9.4**	
Non-Hispanic Asian	2,108	83.3**	19.8	80.2	16.7**	81.8**	18.2**	25.6**	47.7**	18.2**	8.4**	
Other	820	83.6**	33.4**	66.6**	16.4**	81.8**	18.2**	19.2	41.3	21.9	17.6	
Marital status												
Married ^a	14,930	87.7	18.5	81.5*	12.3*	87.8	12.2*	16.5	45.8	24.7	13.1*	
Widowed/divorced/separated	9,124	85.1**	41.4**	58.6**	14.9**	87.8	12.2	14.8**	38.3**	28.4**	18.5**	
Never married	10,393	73.3**	26.0**	74.0**	26.7**	74.6**	25.4**	28.3**	43.3**	17.3**	11.1**	
Education												
Less than high school ^a	5,487	68.8	55.3	44.7*	31.2*	76.5	23.5*	28.3	35.9	22.1	13.8*	
High school graduate	8,938	78.4**	29.8**	70.2**	21.6**	82.0**	18.0**	22.5**	41.5**	22.4	13.6	

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Table 1. Characteristics of the Study Population by Access to Care Factors, National Health Interview Survey, 2012 (continued)

Characteristics	All adults <i>n</i>	With health insurance			Without health insurance %	Regular physician		Physician contacts in the past 12 months			
		Overall %	Public %	Private %		Yes %	No %	None %	1-3 %	4-9 %	≥10 %
Some college/college graduate	16,577	86.9**	17.9**	82.1**	13.1**	85.6**	14.4**	17.4**	46.5**	23.0	13.1
Higher than college graduate	3,370	96.3**	11.6**	88.4**	3.7**	90.9**	9.1**	11.3**	47.1**	27.4**	14.2
Employment status											
Employed	20,038	82.7**	10.5**	89.5***	17.3***	81.7**	18.3***	22.5**	48.4**	19.9**	9.2*
Unemployed ^a	2,077	53.6	45.0	55.0	46.4	66.6	33.4	34.6	39.2	16.8	9.4
Not in work force	12,385	89.1**	46.3	53.7	10.9**	91.3**	8.7**	11.6**	36.1**	30.4**	22.0**
Poverty level											
At or above poverty	24,725	85.9**	18.1**	81.9***	14.1***	85.4**	14.6***	18.1**	45.6**	23.4**	12.9***
Below poverty ^a	6,008	64.9	67.6	32.4	35.1	73.5	26.5	29.1	33.5	20.5	16.9
Self-reported health status											
Excellent/very good ^a	19,602	84.1	16.3	83.7*	15.9*	82.6	17.4*	21.9	49.5	19.8	8.8*
Good	9,636	81.2**	28.4**	71.6**	18.8**	84.6**	15.4**	18.2**	40.3**	26.8**	14.7**
Fair	3,999	80.8**	52.1**	47.9**	19.2**	87.3**	12.7**	14.1**	26.0**	31.9**	27.9**
Poor	1,270	84.6	67.0**	33.0**	15.4	92.6**	7.4**	6.6**	16.7**	29.3**	47.4**
U.S.-born status											
U.S.-born ^a	27,956	86.2	23.4	76.6*	13.8*	86.1	13.9*	17.3	44.1	24.1	14.4*
Born outside U.S.—in U.S. ≤10 years	1,339	52.1**	25.5	74.5	47.9**	55.7**	44.3**	42.1**	39.4**	12.9**	5.6**
Born outside U.S.—in U.S. >10 years	5,167	72.1**	32.5**	67.5**	27.9**	77.9**	22.1**	27.6**	42.7	19.9**	9.8**
Region of residence											
Northeast ^a	5,774	88.3	23.6	76.4*	11.7*	89.7	10.3*	16.3	44.9	24.9	13.9*
Midwest	7,193	86.2**	19.2**	80.8**	13.8**	85.8**	14.2**	17.8	45.3	22.9**	14.0
South	12,536	79.8**	26.8**	73.2**	20.2**	81.8**	18.2**	20.5**	42.8**	23.7	13.0
West	9,022	80.7**	27.4**	72.6**	19.3**	80.6**	19.4**	23.0**	42.8	21.0**	13.1

Note: Boldface indicates statistical significance.

^aReference level.

* $p < 0.05$ by χ^2 test (comparing health insurance [yes/no], private versus public insurance, regular physician [yes/no], and physician contacts in the past 12 months by each demographic variable).

** $p < 0.05$ by χ^2 test (comparing within each demographic variable with the indicated reference level).

HR, high risk.

Table 2. Adult Vaccination Coverage by Health Insurance Status in the U.S., National Health Interview Survey, 2012

Vaccination	All adults % (95% CI)	With health insurance			Without health insurance % (95% CI)
		Overall % (95% CI)	Public % (95% CI)	Private % (95% CI)	
Influenza vaccination (2011–2012 season) ^a					
≥ 18	39.2 (38.3, 40.2)	44.3 (43.3, 45.4)*	50.8 (48.8, 52.8)*,**	42.3 (41.1, 43.5)*	14.4 (12.8, 16.1)
18–64	32.6 (31.6, 33.6)	37.3 (36.2, 38.5)*	39.4 (36.7, 42.2)*	36.9 (35.6, 38.1)*	14.3 (12.8, 16.0)
≥ 65	70.1 (68.2, 72.0)***	70.5 (68.6, 72.4)*,***	66.6 (63.9, 69.3)*,**,***	74.0 (71.5, 76.5)*,**,***	23.4 (12.9, 40.1)
Pneumococcal vaccination (ever received)					
18–64 HR	19.9 (18.8, 21.0)	23.0 (21.7, 24.4)*	29.8 (27.1, 32.8)*,**	20.4 (18.9, 21.9)*	9.8 (8.4, 11.4)
≥ 65	59.9 (58.4, 61.4)*,***	60.2 (58.7, 61.7)*,***	56.4 (53.9, 58.7)*,**,***	63.7 (61.8, 65.5)*,**,***	— ^b
Tetanus vaccination (past 10 years)					
≥ 18	62.5 (61.8, 63.3)	64.5 (63.6, 65.3)*	59.2 (57.6, 60.8)*,**	66.2 (65.2, 67.1)*	53.2 (51.5, 54.9)
18–64	64.1 (63.3, 64.9)	66.9 (66.0, 67.8)*	63.8 (61.8, 65.8)*,**	67.6 (66.6, 68.5)*	53.4 (51.7, 55.1)
≥ 65	55.1 (53.6, 56.7)*,***	55.4 (53.8, 56.9)*,**,*	52.6 (50.4, 54.8)*,**,**,*	57.9 (55.8, 60.0)*,**,***	26.2 (14.1, 43.4)*,***
Tetanus vaccination including pertussis vaccine (past 7 years)					
≥ 18	14.3 (13.7, 15.0)	15.7 (15.0, 16.4)*	10.7 (9.5, 12.0)*,**	17.3 (16.5, 18.1)*	8.4 (7.2, 9.6)
18–64	15.7 (15.0, 16.5)	17.8 (17.0, 18.7)*	13.4 (11.7, 15.3)*,**	18.8 (17.9, 19.7)*	8.4 (7.3, 9.7)
≥ 65	8.0 (7.0, 9.1)*,**	8.1 (7.1, 9.2)*,**,*	7.2 (5.9, 8.8)*,**,*	8.9 (7.5, 10.5)*,**,*	0.0 (—)*,***
Hepatitis A vaccination (≥ 2 doses)					
18–49 among travelers	19.1 (17.7, 20.6)	19.8 (18.2, 21.4)	24.6 (20.0, 29.9)*,**	19.2 (17.5, 21.0)	16.6 (13.8, 19.9)
Hepatitis B vaccination (≥ 3 doses)					
18–49	35.5 (34.5, 36.5)	38.0 (36.9, 39.2)*	34.4 (31.9, 37.0)*,**	38.8 (37.5, 40.1)*	27.5 (25.7, 29.3)
≥ 18 with diabetes	21.2 (19.3, 23.1)	21.3 (19.4, 23.3)	16.9 (14.4, 19.8)**	24.3 (21.6, 27.3)	20.2 (15.0, 26.5)
18–64 with diabetes	27.1 (24.4, 30.1)	28.5 (25.5, 31.6)*	25.5 (20.3, 31.4)	30.0 (26.3, 34.0)*	20.2 (15.0, 26.7)
≥ 65 with diabetes	12.0 (9.9, 14.5)*,***	12.0 (9.9, 14.5)*,***	9.7 (7.3, 12.7)*,**,**,*	14.4 (11.1, 18.4)*,**,*	— ^b
Shingles vaccination (ever received)					
≥ 60	20.1 (19.1, 21.2)	20.8 (19.8, 21.9)*	17.7 (16.3, 19.2)*,**	22.9 (21.4, 24.5)*	6.1 (3.9, 9.5)

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Table 2. Adult Vaccination Coverage by Health Insurance Status in the U.S., National Health Interview Survey, 2012 (continued)

Vaccination	All adults % (95% CI)	With health insurance			Without health insurance % (95% CI)
		Overall % (95% CI)	Public % (95% CI)	Private % (95% CI)	
60–64	14.0 (12.4, 15.7)	15.1 (13.4, 17.1)*	8.4 (6.1, 11.4)**	16.8 (14.7, 19.1)*	6.5 (4.0, 10.2)
≥ 65	22.9 (21.6, 24.2)***	23.0 (21.8, 24.4)***	19.2 (17.6, 20.9)***	26.6 (24.6, 28.6)***	— ^b
Human papillomavirus vaccination (≥ 1 dose)					
18–26 male	3.7 (2.7, 5.1)	4.2 (2.9, 6.0)	— ^b	3.5 (2.3, 5.3)	— ^b
18–26 female	35.6 (33.0, 38.3)	39.8 (36.7, 42.9)*	30.4 (25.2, 36.2)**	43.4 (39.7, 47.2)*	20.9 (16.8, 25.7)

Note: Boldface indicates statistical significance.

^aInfluenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

^bEstimates may not be reliable because of sample size < 30 or relative standard error > 30%.

* $p < 0.05$ by χ^2 test (comparing health insurance types with “without health insurance” as the reference group).

** $p < 0.05$ by χ^2 test (private health insurance versus public health insurance).

*** $p < 0.05$ by χ^2 test (comparing persons 18–64 years with ≥ 65 years for influenza, tetanus, and Tdap; persons 18–64 years with high-risk conditions to persons ≥ 65 years for pneumococcal; persons 18–64 years with diabetes with ≥ 65 years with diabetes for hepatitis B; persons 60–64 years with ≥ 65 years for shingles).

HR, high risk.

adults aged 18–64 years with high-risk conditions (9.8% vs 23.0%); Td, adults aged ≥ 18 years (53.2% vs 64.5%); Tdap, adults aged ≥ 18 years (8.4% vs 15.7%); HepA (two or more doses), adults aged 18–49 years traveling to countries of high or intermediate endemicity (16.6% vs 19.8%); HepB (three or more doses), adults aged 18–49 years (27.5% vs 38.0%); shingles, adults aged ≥ 60 years (6.1% vs 20.8%); and HPV, women aged 18–26 years (20.9% vs 39.8%). Coverage was lower for these vaccinations among those with no insurance compared with those who reported either public or private health insurance. For influenza, PPSV, shingles, and HPV vaccination, coverage was two to three times higher among those with health insurance versus those without insurance (Table 2).

Adult vaccination coverage differed by type of health insurance. Vaccination coverage was significantly higher among adults with private health insurance compared with those reporting public health insurance for PPSV vaccination among adults aged ≥ 65 years, tetanus vaccination among adults aged ≥ 18 years, Tdap vaccination among adults aged ≥ 18 years, HepB vaccination among adults aged 18–49 years and adults aged ≥ 18 years with diabetes, shingles vaccination among adults aged ≥ 60 years, and HPV vaccination among women aged 18–26 years ($p < 0.05$), but lower for influenza vaccination among adults aged ≥ 18 years, PPSV vaccination among adults aged 18–64 years with high-risk conditions, and HepA vaccination among adults aged 18–49 years ($p < 0.05$) (Table 2).

Generally, those with a regular physician were more likely to report having received recommended vaccinations than those who did not have a regular physician, regardless of whether they had health insurance. Among adults with health insurance, coverage was significantly higher among those who reported having a regular physician compared with those who did not have a regular physician, except for HepA vaccination among travelers. Among adults without health insurance, except for HepA vaccination among travelers and HPV vaccination among women aged 18–26 years, coverage was significantly higher among adults who had a regular physician compared with those who did not (Table 3).

With a few exceptions (HepA vaccination among travelers, HepB vaccination among adults with diabetes, and HPV vaccination among women aged 18–26 years), vaccination coverage was significantly higher among those reporting one or more physician contacts in the past year compared with those who had not visited a physician in the past year, regardless of whether they had health insurance (Table 4). Additionally, vaccination coverage increased as the number of physician contacts increased (Table 4). Among adults who had health insurance and ten or more physician contacts within

Table 3. Adult Vaccination Coverage by Health Insurance and Regular Physician Status, National Health Interview Survey, 2012

Vaccination	With health insurance				Without health insurance			
	With a regular physician		Without a regular physician		With a regular physician		Without a regular physician	
	<i>n</i> ^a	% (95% CI)	<i>n</i>	% (95% CI)	<i>n</i>	% (95% CI)	<i>n</i>	% (95% CI)
Influenza vaccination (2011–2012 season) ^b								
≥ 18	145.0	47.0 (45.9, 48.1)	14.0	18.0 (15.5, 20.9)*	16.1	21.7 (19.1, 24.7)	17.1	7.6 (6.2, 9.2)*
18–64	112.6	39.7 (38.5, 41.0)	13.0	17.4 (14.8, 20.4)*	16.0	21.6 (18.9, 24.5)	17.0	7.6 (6.2, 9.2)*
≥ 65	32.4	71.8 (69.9, 73.7)**	0.9	26.9 (19.8, 35.9)***	0.1	— ^c	0.1	— ^c
Pneumococcal vaccination (ever received)								
18–64 HR	45.4	24.5 (23.1, 26.0)	4.8	8.5 (6.3, 11.4)*	7.8	12.8 (10.7, 15.2)	7.5	6.8 (5.0, 9.0)*
≥ 65	39.7	61.4 (59.8, 62.9)**	1.2	20.7 (15.1, 27.7)***	0.1	— ^c	0.1	— ^c
Tetanus vaccination (past 10 years)								
≥ 18	175.3	65.2 (64.4, 66.0)	17.0	57.0 (54.3, 59.7)*	19.0	58.6 (56.3, 60.9)	20.3	48.1 (45.7, 50.5)*
18–64	135.6	67.9 (67.0, 68.8)	15.8	58.3 (55.5, 61.1)*	18.9	58.8 (56.5, 61.1)	20.1	48.3 (45.9, 50.7)*
≥ 65	39.7	55.8 (54.3, 57.4)**	1.2	40.1 (31.4, 49.6)***	0.1	— ^c	0.1	— ^c
Tetanus vaccination including pertussis vaccine (past 7 years)								
≥ 18	175.3	16.2 (15.4, 17.0)	17.0	11.0 (9.1, 13.3)*	19.0	11.0 (9.2, 13.2)	20.3	6.0 (4.8, 7.6)*
18–64	135.6	18.6 (17.7, 19.5)	15.8	11.8 (9.7, 14.2)*	18.9	11.1 (9.2, 13.3)	20.1	6.1 (4.8, 7.6)*
≥ 65	39.7	8.3 (7.3, 9.5)**	1.2	— ^c	0.1	— ^c	0.1	— ^c
Hepatitis A vaccination (≥ 2 doses)								
18–49 among travelers	32.6	19.9 (18.2, 21.7)	5.1	18.9 (15.4, 23.0)	3.9	17.7 (13.5, 22.8)	5.1	15.8 (12.4, 20.0)
Hepatitis B vaccination (≥ 3 doses)								
18–49	87.0	38.6 (37.3, 39.8)	12.8	34.3 (31.4, 37.3)*	13.9	29.5 (26.9, 32.3)	16.8	25.8 (23.4, 28.3)*
≥ 18 with diabetes	18.8	21.3 (19.4, 23.4)	0.3	— ^c	1.5	21.8 (15.8, 29.2)	0.5	— ^c
18–64 with diabetes	10.6	28.6 (25.6, 31.8)	0.2	— ^c	1.5	21.9 (15.9, 29.3)	0.5	— ^c
≥ 65 with diabetes	8.2	12.1 (9.9, 14.6)**	0.1	— ^c	0.0	— ^c	0.0	— ^c
Shingles vaccination (ever received)								
≥ 60	55.0	21.2 (20.1, 22.4)	2.0	8.9 (5.8, 13.5)*	1.6	7.6 (4.6, 12.5)	1.0	— ^c

(continued on next page)

Table 3. Adult Vaccination Coverage by Health Insurance and Regular Physician Status, National Health Interview Survey, 2012 (continued)

Vaccination	With health insurance			Without health insurance		
	With a regular physician	Without a regular physician		With a regular physician	Without a regular physician	
	n ^a	% (95% CI)	n	n	% (95% CI)	n
60–64	15.2	15.6 (13.8, 17.6)	0.7	1.4	7.8 (4.6, 13.1)	0.9
≥65	39.7	23.4 (22.0, 24.8)**	1.2	0.1	— ^c	0.1
Human papillomavirus vaccination (≥1 dose)						
18–26 male	10.4	5.1 (3.5, 7.4)	2.8	2.0	— ^c	3.6
18–26 female	12.6	42.0 (38.7, 45.4)	2.1	2.2	24.6 (17.7, 33.2)*	2.0

Note: Boldface indicates significance.

^aWeighted sample size in millions.

^bInfluenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

^cEstimates may not be reliable because of sample size < 30 or relative standard error > 30%.

* $p < 0.05$ by χ^2 test (with regular physician versus without regular physician).

** $p < 0.05$ by χ^2 test (comparing persons 18–64 years with ≥65 years for influenza, tetanus, and Tdap; persons 18–64 years with high-risk conditions to persons ≥65 years for pneumococcal; persons 18–64 years with diabetes with ≥65 years with diabetes for Hepatitis B; persons 60–64 years with ≥65 years for shingles).

HR, high risk.

the past year, 28.4%–80.4% reported not receiving recommended vaccinations (not receiving Td vaccination, 28.4%; PPSV [age ≥65 years], 30.2%; influenza, 41.1%; PPSV [high-risk, age 18–64 years], 61.0%; HPV [women aged 18–26 years], 61.4%; HepA [travelers aged 18–49 years], 72%; HepB [diabetics aged ≥18 years], 76.5%; shingles, 76.9%; and Tdap, 80.4% (Table 4).

Influenza and PPSV vaccination coverage among adults aged ≥65 years was usually higher compared with coverage among adults aged 18–64 years; however, Td, Tdap, and HepB coverage among adults aged ≥65 years was usually lower compared with coverage among adults aged 18–64 years (Tables 2–4). Shingles vaccination coverage among adults aged ≥65 years was usually higher compared with coverage among adults aged 60–64 years (Tables 2–4). Additionally, for influenza, PPSV, and HepB vaccinations, the majority of coverage differences by health insurance status (with versus without insurance) were smaller in 2001 compared with those in 2012 (Table 5).

Adults without health insurance were significantly less likely than those with health insurance to be vaccinated for influenza (age ≥18 years); pneumococcal (aged 18–64 years with high-risk conditions); tetanus (age ≥18 years); and Tdap (age ≥18 years) after adjusting for confounders (Table 6). The difference in adjusted vaccination coverage between respondents with and without health insurance ranged from –0.2% (HepA vaccination among travelers aged 18–49 years) to 10.9% (influenza vaccination among adults aged ≥18 years) (Table 6).

Discussion

This is the first comprehensive assessment of vaccination coverage by health insurance status among U.S. adult populations. Such information is important for understanding factors that contribute to disparities in vaccination coverage and implementing strategies to improve vaccination coverage.^{2–5,22–28} Most respondents (83%) in this study indicated having some type of health insurance. Having health insurance was associated with a greater likelihood of having received recommended vaccinations, even after adjusting for confounders for influenza, PPSV, Td, and Tdap. For influenza, PPSV, shingles, and HPV vaccination, coverage was two to three times higher among those with health insurance versus those without. Wider coverage differences by insurance status (with versus without insurance) in 2012 compared with 2001 may indicate a greater strength of association between health insurance and vaccination in 2012 compared with 2001. Additionally, after controlling demographic and access to care variables based on our

Table 4. Adult Vaccination Coverage by Health Insurance and Physician Contacts, National Health Interview Survey, 2012

Vaccination	With health insurance Physician contacts in the past 12 months								Without health insurance Physician contacts in the past 12 months							
	n ^a	None	1-3	4-9	≥ 10	n	None	1-3	4-9	≥ 10	n	None	1-3	4-9	≥ 10	
		% (95% CI)	n	% (95% CI)	n		% (95% CI)	n	% (95% CI)	n		% (95% CI)	n	% (95% CI)	n	% (95% CI)
Influenza vaccination (2011-2012 season) ^b																
≥ 18	20.5	20.7 (18.6, 23.1)	71.7	39.9 (38.4, 41.5)*	42.2	55.8 (53.7, 57.9)*	23.1	58.1 (55.3, 60.9)*	15.8	8.0 (6.4, 9.9)	11.6	14.8 (12.5, 17.6)*	3.5	28.7 (22.2, 36.7)*	2.0	39.3 (29.8, 50.5)*
18-64	18.5	19.1 (16.8, 21.6)	59.8	34.7 (33.0, 36.4)*	29.7	47.0 (44.6, 49.4)*	16.7	50.3 (46.9, 53.7)*	15.7	7.9 (6.3, 9.8)	11.5	14.8 (12.4, 17.6)*	3.5	28.7 (22.2, 36.7)*	1.9	39.1 (29.6, 50.3)*
≥ 65	2.0	35.7 (29.3, 43.0)**	12.0	66.1 (63.0, 69.2)***	12.5	76.0 (72.9, 78.9)***	6.5	78.3 (74.3, 82.0)***	0.1	— ^c	0.1	— ^c	0.0	— ^c	0.0	— ^c
Pneumococcal vaccination (ever received)																
18-64 HR	6.0	8.9 (6.7, 11.8)	19.2	17.8 (15.9, 19.9)*	14.1	24.3 (22.0, 26.8)*	10.3	39.0 (35.6, 42.5)*	6.6	6.1 (4.4, 8.3)	5.3	10.4 (8.2, 13.1)*	2.1	17.8 (13.1, 23.8)*	1.2	14.8 (10.1, 21.2)*
≥ 65	2.6	31.3 (26.2, 36.9)**	15.0	55.7 (53.2, 58.1)***	14.7	64.8 (62.3, 67.2)***	8.2	69.8 (66.5, 72.9)***	0.2	— ^c	0.1	— ^c	0.0	— ^c	0.0	— ^c
Tetanus vaccination (past 10 years)																
≥ 18	26.0	55.4 (53.4, 57.5)	86.9	64.3 (63.1, 65.5)*	49.2	65.5 (64.0, 67.0)*	28.5	71.6 (69.9, 73.4)*	19.2	46.7 (44.2, 49.2)	13.5	56.9 (54.1, 59.7)*	4.0	61.2 (55.8, 66.2)*	2.3	71.5 (65.0, 77.3)*
18-64	23.4	57.4 (55.2, 59.6)	71.9	66.3 (65.0, 67.6)*	34.5	69.7 (68.0, 71.4)*	20.3	75.0 (73.0, 77.0)*	19.0	46.9 (44.4, 49.4)	13.4	57.0 (54.2, 59.8)*	3.9	61.5 (56.2, 66.6)*	2.3	71.5 (64.9, 77.2)*
≥ 65	2.6	37.6 (32.6, 42.9)**	15.0	54.3 (51.7, 56.9)***	14.7	55.4 (52.9, 57.9)***	8.2	63.1 (59.9, 66.3)***	0.2	— ^c	0.1	— ^c	0.0	— ^c	0.0	— ^c
Tetanus vaccination including pertussis vaccine (past 7 years)																
≥ 18	26.0	9.5 (8.1, 11.2)	86.9	16.2 (15.2, 17.3)*	49.2	16.3 (14.9, 17.7)*	28.5	19.6 (17.6, 21.8)*	19.2	5.4 (4.3, 6.7)	13.5	9.5 (7.6, 11.9)*	4.0	13.5 (9.8, 18.2)*	2.3	19.8 (12.6, 29.7)*
18-64	23.4	10.0 (8.5, 11.8)	71.9	18.1 (16.9, 19.3)*	34.5	19.6 (17.9, 21.5)*	20.3	24.0 (21.4, 26.8)*	19.0	5.4 (4.4, 6.7)	13.4	9.6 (7.7, 12.0)*	3.9	13.6 (9.9, 18.4)*	2.3	19.8 (12.6, 29.7)*
≥ 65	2.6	— ^c	15.0	7.6 (6.1, 9.3)**	14.7	8.6 (7.0, 10.5)**	8.2	9.4 (7.2, 12.2)**	0.2	0.0 (—)**	0.1	— ^c	0.0	— ^c	0.0	— ^c
Hepatitis A vaccination (≥ 2 doses)																

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Table 4. Adult Vaccination Coverage by Health Insurance and Physician Contacts, National Health Interview Survey, 2012 (continued)

Vaccination	With health insurance Physician contacts in the past 12 months								Without health insurance Physician contacts in the past 12 months									
	n ^a	None		1-3		4-9		≥10		n	None		1-3		4-9		≥10	
		% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n		% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	
18-49 among travelers	6.2	17.3 (14.2, 21.0)	18.8	18.2 (16.2, 20.4)	8.1	20.7 (17.5, 24.4)	4.6	28.0 (23.3, 33.3)*	4.4	15.2 (11.4, 19.8)	3.3	17.7 (13.2, 23.4)	0.8	17.9 (11.2, 27.6)	0.5	21.2 (12.0, 34.6)		
Hepatitis B vaccination (≥ 3doses)																		
18-49	18.1	32.4 (30.0, 35.0)	48.2	36.3 (34.6, 38.0)*	20.4	41.8 (39.4, 44.4)*	12.4	47.5 (44.0, 51.0)*	15.8	22.4 (20.1, 24.9)	10.3	32.1 (29.1, 35.2)*	2.5	36.6 (30.2, 43.5)*	1.8	31.2 (23.9, 39.7)*		
≥ 18 with diabetes	0.6	22.1 (12.6, 35.8)	5.2	21.2 (17.7, 25.1)	7.6	19.8 (17.1, 22.9)	5.3	23.5 (19.9, 27.5)	0.4	— ^c	0.7	21.5 (12.8, 33.9)	0.7	20.9 (12.0, 33.8)	0.3	27.3 (14.4, 45.7)		
18-64 with diabetes	0.4	29.2 (15.8, 47.4)	3.3	26.8 (21.9, 32.3)	4.1	28.5 (24.0, 33.4)	2.9	30.9 (25.2, 37.2)	0.3	— ^c	0.7	21.7 (12.9, 34.2)	0.7	20.5 (11.6, 33.6)	0.3	28.0 (14.7, 46.7)		
≥ 65 with diabetes	0.2	— ^c	1.9	11.7 (8.0, 16.8)**	3.5	9.7 (7.2, 13.0)**	2.4	15.1 (10.8, 20.9)**	0.0	— ^c	0.0	— ^c	0.0	— ^c	0.0	— ^c		
Shingles vaccination (ever received)																		
≥ 60	3.8	7.9 (5.7, 10.7)	22.0	21.3 (19.7, 23.0)*	19.5	21.6 (19.7, 23.5)*	10.8	23.1 (20.6, 25.9)*	0.9	— ^c	1.0	— ^c	0.5	— ^c	0.1	— ^c		
60-64	1.2	— ^c	7.0	16.8 (14.1, 19.8)	4.9	14.8 (11.5, 18.9)	2.6	15.8 (11.9, 20.7)	0.7	— ^c	0.9	— ^c	0.5	— ^c	0.1	— ^c		
≥ 65	2.6	8.9 (6.5, 12.1)	15.0	23.4 (21.5, 25.4)***	14.7	23.8 (21.7, 26.1)***	8.2	25.5 (22.6, 28.7)***	0.2	— ^c	0.1	— ^c	0.0	— ^c	0.0	— ^c		
Human papillomavirus vaccination (≥ 1 dose)																		
18-26 male	4.1	— ^c	6.8	5.1 (3.2, 7.9)	1.4	— ^c	0.7	— ^c	3.6	— ^c	1.6	— ^c	0.2	— ^c	0.2	— ^c		
18-26 female	1.7	28.6 (19.7, 39.5)	6.9	41.2 (36.5, 46.1)*	3.7	43.0 (37.5, 48.7)*	2.3	38.6 (31.3, 46.5)	1.6	17.3 (11.6, 24.9)	1.6	21.0 (14.7, 29.2)	0.5	30.3 (17.5, 47.2)	0.4	26.2 (15.2, 41.2)		

Note: Boldface indicates statistical significance.

^aWeighted sample size in millions.

^bInfluenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

^cEstimates may not be reliable because of sample size < 30 or relative standard error > 30%.

* $p < 0.05$ by t test (comparing physician contacts where “none” is the reference group).

** $p < 0.05$ by t test (comparing persons 18-64 years with ≥ 65 years for influenza, tetanus, and Tdap; persons 18-64 years with high-risk conditions to persons ≥ 65 years for pneumococcal; persons 18-64 years with diabetes with ≥ 65 with diabetes for Hepatitis B; persons 60-64 years with ≥ 65 years for shingles).

HR, high risk.

Table 5. Adult Vaccination Coverage by Health Insurance Status in the U.S., National Health Interview Survey, 2001 and 2012

Vaccination	2012			2001		
	With health insurance % (95% CI)	Without health insurance % (95% CI)	Difference ^a	With health insurance % (95% CI)	Without health insurance % (95% CI)	Difference
Influenza vaccination (past 12 months) ^b						
≥ 18	44.3 (43.3, 45.4)	14.4 (12.8, 16.1)	29.9*	29.1 (28.5, 29.8)	9.9 (9.1, 10.9)	19.2*
18–64	37.3 (36.2, 38.5)	14.3 (12.8, 16.0)	23.0*	21.3 (20.7, 22.0)	9.6 (8.8, 10.5)	11.7*
≥ 65	70.5 (68.6, 72.4)	23.4 (12.9, 40.1)	47.1*	63.3 (61.9, 64.7)	38.1 (24.3, 54.1)	25.1*
Pneumococcal vaccination (ever received)						
18–64 HR	23.0 (21.7, 24.4)	9.8 (8.4, 11.4)	13.2*	18.3 (16.9, 19.7)	11.3 (8.7, 14.4)	7.0*
≥ 65	60.2 (58.7, 61.7)	— ^c	— ^c	54.2 (52.6, 55.7)	23.5 (12.9, 38.9)	30.6*
Hepatitis B vaccination (≥ 3 doses)						
18–49	38.0 (36.9, 39.2)	27.5 (25.7, 29.3)	10.6*	26.1 (25.2, 27.1)	19.3 (17.8, 20.8)	6.8*
≥ 18 with diabetes	21.3 (19.4, 23.3)	20.2 (15.0, 26.5)	1.1	12.7 (11.1, 14.5)	17.6 (12.3, 24.4)	–4.9
18–64 with diabetes	28.5 (25.5, 31.6)	20.2 (15.0, 26.7)	8.2*	18.7 (16.2, 21.6)	16.6 (11.5, 23.3)	2.1
≥ 65 with diabetes	12.0 (9.9, 14.5)	— ^c	— ^c	4.2 (2.9, 6.1)	— ^c	— ^c

Note: Boldface indicates statistical significance.

^aVaccination coverage estimate among those with health insurance minus vaccination coverage estimate among those without health insurance.

^bInfluenza vaccination coverage estimates are based on proportion of respondents who answered that they had received a flu shot in the past 12 months.

^cEstimates may not be reliable because of sample size < 30 or relative standard error > 30%.

* $p < 0.05$ by χ^2 test (comparing with health insurance to without health insurance).

HR, high risk.

multivariable analysis, coverage might increase up to 11 percentage points if uninsured respondents had health insurance.

The type of health insurance indicated by respondents had a significant association with vaccination coverage. In this study, vaccination coverage was generally higher among adults with private health insurance compared with those reporting public health insurance. Studies^{23,29,30} on insurance status and vaccination in children have reported similar findings. The factors contributing to vaccination levels by type of health insurance are not well understood. In one study,¹ the percentage of people with private health insurance declined from 1999 through 2011, ranging from 67% to 74% in 1999–2008 and 64% in 2009–2011. This downward shift in private insurance coverage might have a negative impact on

most adult vaccination coverage. A better understanding of factors influencing vaccination by type of health insurance is needed.

For those aged ≥ 65 years, Medicare covers some vaccinations. Medicare Part B covers influenza, PPSV, and HepB (if people are at high risk). Part B also covers other vaccinations only if people have been exposed to a dangerous virus or disease (e.g., if people step on a rusty nail [acute wound], Medicare will cover a Td vaccine). All vaccines other than influenza, PPSV, and HepB are covered under Medicare Part D, including shingles. Medicare Part D pays for the vaccination itself and for doctor or other healthcare providers who administer the vaccine. These Medicare benefits may remove financial barriers to some vaccinations for those aged ≥ 65 years and help improve vaccination coverage among seniors.³¹

Table 6. Adjusted Adult Vaccination Coverage by Health Insurance Status, United States, National Health Interview Survey, 2012

Vaccination	With health insurance		Without health insurance		Difference ^b
	Adjusted ^a vaccination coverage (95% CI)	Adjusted prevalence ratio (95% CI)	Adjusted vaccination coverage(95% CI)	Adjusted prevalence ratio (95% CI)	
Influenza vaccination (2011-2012 season) ^c					
≥ 18	30.9 (29.8, 32.0)	ref	20.0 (17.8, 22.4)	0.6 (0.6, 0.7)*	10.9
Pneumococcal vaccination (ever received)					
18-64 HR	14.6 (13.0, 16.4)	ref	10.1 (8.3, 12.2)	0.7 (0.5, 0.9)*	4.5
≥ 65	51.9 (49.4, 54.3)	ref	41.6 (21.5, 65.0)	0.8 (0.5, 1.4)	10.3
Tetanus vaccination (past 10 years)					
≥ 18	61.3 (60.1, 62.4)	ref	57.5 (55.3, 59.7)	0.9 (0.9, 1.0)*	3.8
Tetanus vaccination including pertussis vaccine (past 7 years)					
≥ 18	13.9 (13.1, 14.8)	ref	10.6 (8.9, 12.5)	0.8 (0.6, 0.9)*	3.4
Hepatitis A vaccination (≥ 2 doses)					
18-49 among travelers	17.7 (15.9, 19.6)	ref	17.9 (14.1, 22.4)	1.0 (0.8, 1.3)	-0.2
Hepatitis B vaccination (≥ 3 doses)					
18-49	33.6 (32.1, 35.1)	ref	32.1 (29.6, 34.7)	1.0 (0.9, 1.0)	1.5
≥ 18 with diabetes	22.3 (18.6, 26.6)	ref	19.4 (12.1, 29.6)	0.9 (0.5, 1.4)	2.9
Shingles vaccination (ever received)					
≥ 60	18.7 (17.1, 20.4)	ref	15.5 (9.2, 25.1)	0.8 (0.5, 1.4)	3.1
Human papillomavirus vaccination (≥ 1 dose)					
18-26 male	— ^d	ref	— ^d	— ^d	— ^d
18-26 female	34.9 (30.9, 39.2)	ref	29.5 (22.6, 37.5)	0.8 (0.6, 1.1)	5.4

Note: Boldface indicates statistical significance.

^aMultivariable logistic model was conducted to get adjusted vaccination coverage (adjusted for age, gender, race/ethnicity, marital status, education, employment status, poverty level, number of physician contacts in the past year, usual source of care, self-reported health status, U.S.-born status, region of residence).

^bAdjusted vaccination coverage among those with health insurance minus adjusted vaccination coverage among those without health insurance.

^cInfluenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during the past 12 months.

^dNot enough sample size to run adjusted models.

*p < 0.05.

HR, high risk.

Vaccination coverage for three vaccines in this report that are included in *Healthy People 2020* (influenza, PPSV, and shingles) were well below the respective target levels of 70% for influenza vaccination among adults aged ≥ 18 years, 60% for PPSV vaccination among adults aged 18-64 years with high-risk conditions, 90% for PPSV vaccination among adults aged ≥ 65 years, and 30% for shingles vaccination among adults aged ≥ 60

years, even among those with health insurance.^{14,15} Substantial improvement in vaccination coverage among adult populations, especially among those without health insurance, will be needed to achieve *Healthy People 2020* targets.

Removing cost barriers to adult vaccination might improve coverage.²³⁻²⁵ The federal Immunization Grant Program supports the immunization infrastructure to

deliver vaccines to underinsured children and, as funding permits, to uninsured and underinsured adults.³² The vaccine manufacturer of HepA, HepB, shingles, and HPV vaccines has implemented the Merck Vaccine Patient Assistance Program, which provides free vaccines to all adults who are uninsured and poor (household income <\$44,680 for individuals, \$60,520 for couples, or \$92,200 for a family of four).³³ Additionally, this manufacturer sometimes makes exceptions based on special circumstances of financial or medical hardship.³³ Programs like this might help improve vaccination coverage among uninsured and poor adult populations. Federal, state, and local partners should continue to build support for adult vaccination and identify other strategies to remove cost barriers for uninsured populations.

Generally, those with a regular physician were more likely to report having received recommended vaccinations than those who did not have a regular physician, regardless of whether they had health insurance, and vaccination coverage generally increased as the number of physician contacts increased. This observation suggests that an increased number of physician contacts might have facilitated opportunities to be reminded of the need for vaccinations, discussions about indicated vaccinations, and a recommendation and decision to vaccinate. These findings are also consistent with previous reports indicating that people who have a usual place for health care or medical home and who seek medical care one or more times during the year are more likely to be vaccinated and receive other preventive services than those without a usual place for health care.^{30,34} Studies^{35–38} have shown that healthcare provider recommendations for vaccination are strongly associated with adult vaccination coverage. Having a regular physician and routine physician contact can provide important opportunities for providers to educate their patients about vaccine-preventable diseases, as well as recommend and offer vaccination.^{23,35–37} Routine patient reminder and recall, expanded access in healthcare settings, reduced patient out-of-pocket costs, provider reminder, standing orders, and provider assessment and feedback should be incorporated into routine adult clinical care.^{39–41}

Limitations

The findings in this report are subject to limitations. First, adult vaccination coverage was self-reported and therefore might be subject to recall bias. Self-reported influenza and PPSV vaccination status among adults, however, has been shown to be fairly sensitive and specific.^{42–46} Adult self-reported vaccination status also has been shown to be sensitive for tetanus, HepA, HepB,

HPV, and shingles vaccination and specific for vaccination with all these vaccines, except for tetanus vaccination.⁴⁶ Second, NHIS response rates were 60%–70%, and it is possible that nonresponse bias may have remained after weighting adjustments. Third, self-reported vaccination might be subject to social desirability bias. Fourth, statistical tests for estimates were conducted with one ref group and we did not perform multiple comparisons. Finally, other factors like cultural, religious, vaccine safety concerns, state immunization intervention programs, and numerous other factors also may affect vaccination coverage; however, the NHIS did not collect this information.

Conclusions

Adult vaccination coverage is low overall and especially low for those without health insurance. Any comprehensive strategy needs to be tailored to the needs of the healthcare institution to improve coverage among adults overall and those without health insurance.^{39,40} The Patient Protection and Affordable Care Act (ACA) requires that certain clinical preventive services, including all ACIP-recommended vaccines, be provided without cost sharing in Medicare Part B benefits and by newly qualified private and public health plans. The ACA also encourages state Medicaid programs to provide selected clinical preventive services with no cost sharing.⁴⁷ Beginning in 2013, state Medicaid programs that eliminate cost sharing for these preventive services may receive enhanced federal matching funds for them.^{47,48} The expanded enrollment in public and private insurance programs expected from provisions of the ACA might improve access to healthcare services (including vaccination) for previously uninsured individuals. Other provisions of the ACA that create incentives for primary care, including increased payments for primary care services provided by primary care doctors, and coverage without cost sharing⁴⁹ for vaccines recommended by the ACIP, also should help to improve adult vaccination coverage. Additionally, to improve vaccination coverage, routine patient reminder and recall, expanded access in healthcare settings, reduced patient out-of-pocket costs, provider reminder, standing orders, and provider assessment and feedback should be incorporated into routine adult clinical care.^{39–41}

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References

1. U.S. Census Bureau. Income, poverty, and health insurance coverage in the United States: 2011. www.census.gov/prod/2012pubs/p60-243.pdf.
2. Zhao Z, Mokdad AH, Barker L. Impact of health insurance status on vaccination coverage in children 19–35 months old, United States, 1993–1996. *Public Health Rep.* 2004;119(2):156–162.
3. Smith PJ, Stevenson J, Chu SY. Associations between childhood vaccination coverage, insurance type, and breaks in health insurance coverage. *Pediatrics.* 2006;117(6):1972–1978. <http://dx.doi.org/10.1542/peds.2005-2414>.
4. Hunsaker J, Veselovskiy G, Gazmararian JA. Health insurance plans and immunization: assessment of practices and policies, 2005–2008. *Pediatrics.* 2009;124(suppl 5):S532–S539. <http://dx.doi.org/10.1542/peds.2009-1542M>.
5. Smith PJ, Lindley MC, Shefer A, Rodewald LE. Underinsurance and adolescent immunization delivery in the United States. *Pediatrics.* 2009;124(suppl 5):S515–S521. <http://dx.doi.org/10.1542/peds.2009-1542K>.
6. Kharbanda EO, Parker E, Nordin JD, Hedblom B, Rolnick SJ. Receipt of human papillomavirus vaccine among privately insured adult women in a U.S. Midwestern Health Maintenance Organization. *Prev Med.* 2013;57(5):712–714. <http://dx.doi.org/10.1016/j.ypmed.2013.07.011>.
7. Hurley LP, Bridges CB, Harpaz R, et al. U.S. physicians' perspective of adult vaccine delivery. *Ann Intern Med.* 2014;160(3):161. <http://dx.doi.org/10.7326/M13-2332>.
8. Ayanian JZ, Weissman JS, Schneider EC, Ginsburg JA, Zaslavsky AM. Unmet health needs of uninsured adults in the United States. *JAMA.* 2000;284(16):2061–2069. <http://dx.doi.org/10.1001/jama.284.16.2061>.
9. Jain N, Yusuf H, Wortley PM, Euler GL, Walton S, Stokley S. Factors associated with receiving hepatitis B vaccination among high-risk adults in the United States: an analysis of the National Health Interview Survey, 2000. *Fam Med.* 2004;36:480–486.
10. Ross JS, Bradley EH, Busch SH. Use of health care services by lower-income and higher-income uninsured adults. *JAMA.* 2006;295:2027–2036. <http://dx.doi.org/10.1001/jama.295.17.2027>.
11. Hinman AR, Orenstein WA. Adult immunization: what can we learn from the childhood immunization program? *Clin Infect Dis.* 2007;44(12):1532–1535. <http://dx.doi.org/10.1086/519543>.
12. CDC. Non-influenza vaccination coverage among adults. *MMWR.* 2013;62(4):66–72.
13. CDC. Non-influenza vaccination coverage among adults. *MMWR.* 2014;63(5):95–102.
14. Healthy People 2020. Topics & objectives—immunization and infectious diseases. www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives.
15. Healthy People 2020. Explore the latest data from the immunization and infectious diseases and global health progress review. www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives.
16. CDC. Advisory Committee on Immunization Practices Recommended Immunization Schedule for Adults Aged 19 Years or Older—United States, 2014. *MMWR.* 2014;63(5):110–112.
17. CDC. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices—United States, 2013–2014. *MMWR.* 2013;66(RR07):1–43.
18. CDC. National Health Interview Survey. ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2012/srvydesc.pdf.
19. U.S. Census Bureau. Poverty thresholds. www.census.gov/hhes/www/poverty/data/threshld/.
20. Shah B, Barnwell B, Bieger G. *SUDAAN User's Manual, Release 10.1*. Research Triangle Park, NC: Research Triangle Institute; 2010.
21. Lu PJ, Santibanez TA, Williams WW, et al. Surveillance of influenza vaccination coverage—United States, 2007–08 through 2011–12 influenza seasons. *MMWR Surveill Summ.* 2013;62(suppl 4):1–29.
22. Lu PJ, Jain N, Cohn AC. Meningococcal conjugate vaccination among adolescents aged 13–17 years, United States, 2007. *Vaccine.* 2010;28:2350–2355. <http://dx.doi.org/10.1016/j.vaccine.2009.12.032>.
23. Lu PJ, Euler GL, Harpaz R. Herpes zoster vaccination among adults aged 60 years and over in the United States, 2008. *Am J Prev Med.* 2011;40(2):e1–e6. [10.1016/j.amepre.2010.10.012](http://dx.doi.org/10.1016/j.amepre.2010.10.012).
24. Lu PJ, Byrd KK, Murphy TV, Weinbaum CM. Hepatitis B vaccination coverage among high-risk adults 18–49 years, U.S., 2009. *Vaccine.* 2011;29(40):7049–7057. <http://dx.doi.org/10.1016/j.vaccine.2011.07.030>.
25. Williams WW, Lu PJ, Saraiya M, et al. Factors associated with human papillomavirus vaccination among young adult women in the United States. *Vaccine.* 2013;31(28):2937–2946. <http://dx.doi.org/10.1016/j.vaccine.2013.04.041>.
26. CDC. Influenza vaccination coverage among adults—National Health Interview Survey, United States, 2008–09 Influenza Season. *MMWR.* 2012;61(suppl):65–72.
27. CDC. Vaccination coverage by race/ethnicity and poverty level among children aged 19–35 months—United States, 1997. *MMWR.* 1998;47:956–959.
28. Egede LE, Zheng D. Racial/ethnic differences in adult vaccination among individuals with diabetes. *Am J Public Health.* 2003;93(2):324–329. <http://dx.doi.org/10.2105/AJPH.93.2.324>.
29. Santoli JM, Huet NJ, Smith PJ, et al. Insurance status and vaccination coverage among U.S. preschool children. *Pediatrics.* 2004;113(suppl 6):1959–1964.
30. Sudano JJ, Baker DW. Intermittent lack of health insurance coverage and use of preventive services. *Am J Public Health.* 2003;93:130–137. <http://dx.doi.org/10.2105/AJPH.93.1.130>.
31. Medicare coverage of vaccines and immunizations. www.medicareinteractive.org/page2.php?topic=counselor&page=script&script_id=1519.
32. CDC. Immunization Grant Program (Section 317). www.cdc.gov/vaccines/imz-managers/guides-pubs/index.html.
33. Merck Vaccine Patient Assistance Program. www.merckhelps.com/VPAP/.
34. Beal AC, Doty MM, Hernandez SE, Shea KK, Davis K. *Closing the divide: how medical homes promote equity in health care—Results from the Commonwealth Fund 2006 Health Care Quality Survey*. New York, NY: The Commonwealth Fund; 2007.
35. Lu PJ, Euler GL, Jumaan AO, Harpaz R. Herpes zoster vaccination among adults aged 60 years or older in the United States, 2007: uptake of the first new vaccine to target seniors. *Vaccine.* 2009;27:882–887. <http://dx.doi.org/10.1016/j.vaccine.2008.11.077>.
36. CDC. Influenza vaccination among pregnant women, the 2011–12 season. *MMWR.* 2012;61(38):758–763.
37. CDC. Influenza vaccination coverage among health-care personnel—the 2011–12 season. *MMWR.* 2012;61(38):753–757.
38. Winston CA, Wortley PM, Lees KA. Factors associated with vaccination of Medicare beneficiaries in five U.S. communities: results from the Racial and Ethnic Adult Disparities Immunization Initiative survey, 2003. *J Am Geriatr Soc.* 2006;54:303–310. <http://dx.doi.org/10.1111/j.1532-5415.2005.00585.x>.
39. Poland GA, Shefer AM, McCauley M, et al. Standards for adult immunization practice. *Am J Prev Med.* 2003;25(2):144–150. [http://dx.doi.org/10.1016/S0749-3797\(03\)00120-X](http://dx.doi.org/10.1016/S0749-3797(03)00120-X).
40. Guide to Community Preventive Services. www.thecommunityguide.org/vaccines/healthsysteminterventions.html.
41. Recommendations from the National Vaccine Advisory Committee: standards for adult immunization practice. *Public Health Rep.* 2014;129:115–123.
42. Donald RM, Baken L, Nelson A, Nichol KL. Validation of self-report of influenza and pneumococcal vaccination status in elderly outpatients. *Am J Prev Med.* 1999;16(3):173–177. [http://dx.doi.org/10.1016/S0749-3797\(98\)00159-7](http://dx.doi.org/10.1016/S0749-3797(98)00159-7).
43. Zimmerman RK, Raymund M, Janosky JE, Nowalk MP, Fine MJ. Sensitivity and specificity of patient self-report of influenza and pneumococcal polysaccharide vaccinations among elderly out-

- patients in diverse patient care strata. *Vaccine*. 2003;21:1486–1491. [http://dx.doi.org/10.1016/S0264-410X\(02\)00700-4](http://dx.doi.org/10.1016/S0264-410X(02)00700-4).
44. Mangtani P, Shah A, Roberts JA. Validation of influenza and pneumococcal vaccine status in adults based on self-report. *Epidemiol Infect*. 2007;135(1):139–143. <http://dx.doi.org/10.1017/S0950268806006479>.
45. Shenson D, DiMartino D, Bolen J, Campbell M, Lu PJ, Singleton JA. Validation of self-reported pneumococcal vaccination in behavioral risk factor surveillance surveys: experience from the sickness prevention achieved through regional collaboration (SPARC) program. *Vaccine*. 2005;23:1015–1020. <http://dx.doi.org/10.1016/j.vaccine.2004.07.039>.
46. Rolnick SJ, Parker ED, Nordin JD, et al. Self-report compared to electronic medical record across eight adult vaccines: do results vary by demographic factors? *Vaccine*. 2013;31(37):3928–3935. <http://dx.doi.org/10.1016/j.vaccine.2013.06.041>.
47. Dorrell CG, Jain N, Yankey D. Validity of parent-reported vaccination status for adolescents aged 13–17 years: National Immunization Survey—Teen, 2008. *Public Health Rep*. 2011;126(S2):60–69.
48. 111th Congress. Public Law 111-148 - March. 23, 2010. 124 STAT. 119 (H.R. 3590). An act entitled: the Patient Protection and Affordable Care Act. www.gpo.gov/fdsys/pkg/PLAW-111publ148/pdf/PLAW-111publ148.pdf.
49. Koh HK, Sebelius KG. Promoting prevention through the Affordable Care Act. *N Engl J Med*. 2010;363:1296–1299. <http://dx.doi.org/10.1056/NEJMp1008560>.