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## Adult vaccination disparities among foreign born populations in the United States, 2012

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### Abstract

**Background**—An estimated 13% foreign born persons are living in the United States. Foreign born persons are considered at higher risk of under-vaccination and exposure to several vaccine preventable diseases pre-migration or during return trips to their birth country. Information on vaccination coverage among foreign born populations is limited.

**Purpose**—To assess adult vaccination coverage disparities among foreign born populations in the United States.

**Methods**—Data from the 2012 National Health Interview Survey were analyzed in 2013. For non-influenza vaccines, we calculated the weighted proportion vaccinated. For influenza vaccination, we used the Kaplan-Meier survival analysis to assess coverage among individuals interviewed during September 2011–June 2012 and vaccinated from August 2011–May 2012.

**Results**—Overall, unadjusted vaccination coverage among U.S. born respondents was significantly higher than that of foreign born respondents: influenza, 18 years (40.4% versus 33.8%); PPV, 18–64 years with high-risk conditions (20.8% versus 13.7%); PPV, 65 years (62.6% versus 40.5%); tetanus vaccination, 18 years (65.0% versus 50.6%); Tdap, 18 years (15.5% versus 9.3%); hepatitis B, 18–49 years (37.2% versus 28.4%); shingles, 60 years (21.3% versus 12.0%); and HPV, females 18–26 years (38.7% versus 14.7%). Exceptions were noted for hepatitis A vaccination among travelers and hepatitis B vaccination of persons 18 years with diabetes. Among the foreign born, vaccination coverage was generally lower for non-U.S. citizens, recent immigrants, and those interviewed in a language other than English. Foreign born were less likely than U.S. born to be vaccinated for pneumococcal (< 65 years), tetanus (< 18 years), Tdap (< 18 years), and HPV (women 18–26 years) after adjusting for confounders.

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**Conflict of Interest Statement:**

All authors report no conflicts of interest.

**Conclusions**—Vaccination coverage was lower among foreign born adults than those born in the U.S. Vaccination coverage varied by immigration status, citizenship, language, and demographic characteristics. As the number of foreign born persons residing in the United States increases, it is important to consider foreign birth and immigration status when assessing vaccination disparities and planning interventions.

### Keywords

Adult vaccination; vaccination coverage; foreign born; immigration status; National Health Interview Survey (NHIS)

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### Introduction

Overall, in 2011, an estimated 40 million foreign born persons (13% of the U.S. population) were living in the United States, an increase compared with 1970 (5%).<sup>1–3</sup> The foreign born are individuals born outside of the United States, Puerto Rico, and other U.S. affiliated areas, such as Guam and the Marshall Islands who were not U.S. citizens at birth.<sup>1</sup> While foreign born populations are spread across the United States, in 2011 more than 25% lived in California; an additional 30% lived in New York, Texas, or Florida. The foreign born from Latin America was the largest region-of-birth group, accounting for 53% of all foreign born, followed by 29% from Asia, 12% from Europe, and 7% from other regions. Most (65%) foreign born arrived in the United States before 2000.<sup>1</sup>

Prevalence of most vaccine-preventable diseases (VPD) in the United States is at or near record lows, but VPDs remain endemic in other world regions. Foreign born persons from endemic countries and their family members in the United States are at greater risk of exposure for some VPDs (e.g., hepatitis A and B, congenital rubella) either pre-migration or during return trips to visit friends and family.<sup>4–6</sup> Foreign born individuals, particularly those from Mexico, have been shown to have lower evidence of protective antibodies for some VPDs possibly due to lack of vaccination, lower exposure, and/or waning immunity over time (e.g., tetanus, hepatitis B, and varicella).<sup>5, 7–10</sup> The Advisory Committee on Immunization Practices (ACIP) recommends vaccinations for adults in the United States to prevent VPDs and their sequelae.<sup>11</sup> Influenza vaccination is recommended for adults of all ages each year; other vaccines target different populations based on age, high-risk medical conditions, behavioral risk factors (e.g., injection drug use), occupation, travel, and other indications.<sup>12–13</sup> Most foreign born originate from countries with different vaccination schedules and practices than the United States. Despite great improvements in global vaccination coverage in recent years, coverage remains low in many regions.<sup>14</sup> Even in the United States, adult vaccination coverage remains low for most routinely recommended vaccines and well below *Healthy People 2020* targets.<sup>12, 13, 15</sup>

Analysis of two U.S. national surveys comparing vaccination coverage between foreign born children and children of foreign born mothers versus U.S. born children and children of U.S. born mothers, respectively, found disparities in vaccination levels of the foreign born for some vaccines (e.g., hepatitis B and Haemophilus influenzae type b) and advantages for others (e.g., pneumococcal conjugate vaccine and meningococcal conjugate vaccine).<sup>6–9, 16</sup>

Vaccination coverage disparities for foreign born compared to native populations have been reported from Canada and several countries in Europe, Africa, and Asia.<sup>17–23</sup> A few studies in the United States have reported disparities in some vaccinations among foreign born adults at national, state or local levels.<sup>8, 24–27</sup> However, comprehensive information on vaccination coverage on that population is limited. The purpose of this study is to examine coverage for select routinely-recommended adult vaccinations among the foreign born compared with U.S.-born individuals, by selected demographic characteristics, to help guide development of strategies for improving vaccination coverage among foreign born populations. Coverage for influenza; pneumococcal polysaccharide vaccine [PPV]; 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] vaccines were assessed.

## Methods

Data from the 2012 National Health Interview Survey (NHIS) were analyzed in 2013. The NHIS is an annual household survey conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC), which collects health information on the U.S. civilian, non-institutionalized population.<sup>28</sup> Detailed methods for the NHIS were described in other publications.<sup>14, 28</sup> In 2012, the final response rate for the sample adult core was 61.2%.<sup>28</sup> The NHIS has routinely collected influenza and PPV vaccination information since 1989. Starting from 2004, HepB vaccination information was collected. Starting from 2008, other vaccination information such as HepA, HPV, Shingles, and Td/Tdap was collected.

Vaccination coverage by foreign born status for influenza, PPV, tetanus-toxoid-containing vaccines (Td, Tdap or unknown type) in the past 10 years, HepA, HepB, shingles, and HPV vaccines were assessed from coded survey questions on receipt of these vaccines.

Covariates from coded survey questions to measure associations among vaccination coverage were selected: U.S. born status, time in the United States, language spoken during interview, world region of birth, racial/ethnic status, nativity, and citizenship status. HepA vaccination was assessed among those traveling to countries of high or intermediate endemicity. Persons with high-risk conditions for pneumococcal vaccination were determined by questions in the NHIS and defined as persons with asthma, diabetes, cardiovascular disease, liver diseases, kidney diseases, chronic obstructive pulmonary disease, emphysema, chronic bronchitis, cancer, and 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.<sup>29</sup>

Multivariable logistic regression and predictive marginals were conducted to assess vaccination coverage among U.S. born and foreign born adjusted 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. Adjusted prevalence ratios were calculated comparing U.S. born and foreign born.

SUDAAN statistical software (Research Triangle Institute, Research Triangle Park, NC) was used to calculate point estimates and 95% confidence intervals of vaccination coverage.<sup>30</sup> We used SUDAAN generated asymmetric confidence intervals based on a logit transformation. For the non-influenza adult vaccination coverage estimates, we used weighted percentages. To better assess unadjusted influenza vaccination coverage for the 2011–12 influenza season, the Kaplan-Meier survival analysis procedure was used to assess coverage among individuals interviewed from September 2011 through June 2012 and vaccinated during August 2011 through May 2012.<sup>31</sup> The Kaplan-Meier has advantages for season-specific influenza estimates over other approaches, such as using a full calendar year of data, or restricting estimates based on interviews conducted in the postvaccination period (e.g. March–June) which does not use all relevant data (31). The Kaplan-Meier approach uses all relevant data to maximize precision and to use data collected during the vaccination period that likely has more accurate recall of vaccinations.<sup>31</sup> To assess adjusted vaccination coverage and adjusted prevalence ratios, we used logistic regression and predicted marginal modeling comparing US born and foreign born for each selected vaccination. The NHIS was approved by Research Ethics Review Board (the ERB number is 2009–16) of the National Center for Health Statistics, Centers for Disease Control and Prevention.

## Results

Demographic characteristics of the study population are given in Table 1. Of adults 18 years, 82.6% were born in the United States, and 17.4% were foreign born. Among the foreign born, 49.3% were from Mexico, Central America or Caribbean Islands, 22.7% from Asia, 12.3% from Europe, and 6.0% from South America (Table 1).

Overall, vaccination coverage among U.S.-born respondents was significantly higher than that of foreign born respondents (Table 2): influenza 18 years (40.4% versus 33.8%); PPV 18–64 years with high-risk conditions (20.8% versus 13.7%); PPV 65 years (62.6% versus 40.5%); tetanus vaccination 18 years (65.0% versus 50.6%); Tdap 18 years (15.5% versus 9.3%); hepatitis B 18–49 years (3 doses) (37.2% versus 28.4%); shingles 60 years (21.3% versus 12.0%); and, HPV females 18–26 years (1 doses) (38.7% versus 14.7%) (Table 2). Exceptions were noted for hepatitis A vaccination among travelers and hepatitis B vaccination of persons 18 years with diabetes (Table 2).

Vaccination coverage was significantly higher for foreign born living in the United States <10 years compared with those in the United States 10 years for Tdap vaccination (11.8% versus 8.7%, respectively), HepB vaccination (18–49 years) (33.7% versus 26.3%) and HepB vaccination (18 years with diabetes) (49.8% versus 20.6%) (Table 2). Vaccination coverage was significantly lower for foreign born with <10 years of residence in the United States compared with those with longer residence (10 years) for influenza vaccination (23.8% versus 36.4%, respectively) and PPV, 18–64 years with high-risk conditions (7.4% versus 14.7%) (Table 2). Except for PPV vaccination of adults 65 years, vaccination coverage among foreign born adults who were U.S. citizens was significantly higher than that for foreign born respondents who were not U.S. citizens ( $p < 0.05$ ) (Table 2).

Among U.S. born respondents who preferred to be interviewed in a non-English language, vaccination coverage was significantly lower for influenza, tetanus, and HPV vaccination for females 18–26 years, compared with coverage among those who preferred to be interviewed in English (Table 3). Among foreign born, coverage was significantly lower for all vaccinations among those who preferred to be interviewed in a language other than English compared with those who preferred English for the interview (Table 3).

Among the U.S. born, coverage for most vaccinations was significantly lower for non-Hispanic blacks and Hispanics compared with non-Hispanic whites (Table 4). Among the foreign born, Hispanics had significantly lower coverage for most vaccinations compared with non-Hispanic whites, while non-Hispanic blacks had significantly lower vaccination coverage only for Td (Table 4). Among all race/ethnic-nativity groups, Hispanic foreign born had the lowest coverage for several vaccines, including influenza, Tdap, HepA, HepB (18–49 years old) and shingles (Table 4).

Vaccination coverage by foreign birth region varied across vaccines compared with those born in United States (Table 5). Except for HepB vaccination (18 years with diabetes), adult vaccination coverage was significantly lower among those who were born in Mexico, Central America or Caribbean Islands, compared with those who were born in the United States. Coverage was lower for those born in Europe compared with coverage among those born in the United States for PPV and overall tetanus vaccination, but was higher for HepB vaccination for adults (18 years with diabetes (40.4% versus 20.8%, respectively) and similar for other vaccines. Among those who were born in Asia, coverage was lower for PPV (> 65 years), overall tetanus and Tdap vaccinations, and shingles vaccination, but was higher for HepB vaccination (> 18 years with diabetes) (34.5% versus 20.8%, respectively) (Table 5).

After adjusting for confounders, foreign born adults aged > 65 years were less likely to receive pneumococcal vaccination than U.S. born, and foreign born adults aged > 18 years were less likely to receive tetanus or Tdap vaccination than U.S. born (Table 6). Foreign born women aged 18–26 years were less likely to receive HPV vaccination than U.S. born (Table 6).

## Discussion

This is the first comprehensive assessment of vaccination coverage among foreign born adults in the United States. Overall, vaccination coverage was generally lower among the foreign born compared with U.S. born individuals, even after adjusting for confounders for pneumococcal, tetanus, Tdap, and HPV. Vaccination coverage for foreign born differed by time living in the United States, citizenship status, language used for interview, race/ethnicity, and birth country/region. Among the foreign born, vaccination coverage was generally lower among non U.S. citizens, those interviewed in a language other than English, and non-Hispanic blacks or Hispanics compared with U.S. citizens, those interviewed in English and non-Hispanic whites. The Hispanic foreign born had the lowest coverage for several vaccines. This finding is particularly relevant because the foreign born

from Latin America accounts for more than half of all foreign born adults in the United States.<sup>1-3</sup>

Vaccination coverage among foreign born in the United States depends on the vaccinations received as children or adults pre-migration, during migration, post-migration, or during return visits to their country of origin. Vaccination coverage and immunization schedules vary by country and even by regions within countries.<sup>11, 14, 32</sup> For example, the adult vaccination schedules in Mexico are different compared with the United States (e.g., influenza: persons < 60 years, pregnant women, and persons with risk factors (Mexico) versus universal vaccination (U.S.); PPV: persons < 60 years with high-risk conditions, and persons > 65 years versus persons 18–64 years with high-risk conditions and persons > 65 years; Td: all adults (every 10 years) versus all adults (every 10 years); Tdap: pregnant women versus persons < 18 years; HepA: no adult recommendation versus persons with high-risk behaviors and persons who traveling to a country of high or intermediate endemicity; HepB: no adult recommendation versus persons with high-risk behaviors, persons with diabetes, and Health care personnel; HPV: no adult recommendation versus persons 18–26 years; and Shingles: no adult recommendation versus persons < 60 years<sup>11, 33</sup> The differences between the US and other countries in the schedules of routine vaccinations among adults may contribute to differences in the coverage levels of the vaccines studied. In most countries, immunization programs have historically focused on children.<sup>34-36</sup> Depending on their origin, age at arrival, and year of arrival, adult foreign born may be likely to have differences in vaccination coverage compared with U.S. born populations when they arrive in the United States.<sup>10, 24</sup>

After arrival in the United States, many foreign born adults experience socioeconomic, cultural, linguistic and other barriers to accessing health care and preventive services, including immunizations.<sup>1, 2, 37</sup> The percentage of uninsured was higher among non-U.S. citizens, recent immigrants, and those with poor/fair English proficiency.<sup>3, 38</sup> Our study findings of lower vaccination coverage for non-citizens, recent immigrants, and those interviewed in a language other than English are not unexpected. These characteristics are closely associated with lower access to care.<sup>3</sup> Those populations may also be less aware of U.S. adult immunization recommendations.<sup>39</sup>

Our finding of disparities in vaccination coverage for non-English speakers has also reported previously.<sup>40-45</sup> Limited-English proficiency has been reported to be an impediment to accessing health services and health promotion programs.<sup>40, 44</sup> Disparities in influenza and pneumococcal immunizations among older adults have been reported for those speaking Spanish at home,<sup>40</sup> those with limited English fluency, those who were Hispanic Spanish-speaking versus Hispanic English speakers<sup>41-45</sup> and those not having English as their primary language,<sup>40-45</sup> independent of many demographic, access-to-care, and other factors.<sup>43</sup>

The findings in this report are subject to one limitation. Adult vaccination coverage was self-reported and therefore might be subject to recall bias. However, self-reported influenza, PPV, tetanus, HepA, HepB, shingles and HPV vaccination status among adults have been shown to be sensitive and specific for all except tetanus.<sup>47-51</sup> This study confirms the low



adult vaccination coverage in the United States, and documents significant disparities for foreign born populations. Those disparities are even more relevant because immigration is projected to become the principal driver of U.S. population growth and racial/ethnic diversity.<sup>1, 3, 52</sup> Even when no disparities were identified (e.g., HepB), the low overall vaccination coverage is more worrisome for some foreign born populations because of their higher risk of exposure to certain VPDs.<sup>24</sup>

Any comprehensive adult vaccination strategy, particularly among the foreign born, needs to be tailored to the needs of the target populations and the capacity of public health and health care institutions to address their vaccination needs.<sup>53, 54</sup> Access to care factors play an important role in vaccination uptake.<sup>55–58</sup> Routine assessment of patient vaccination histories, recommendation, and offer of needed vaccinations should be incorporated into routine clinical care of adults.<sup>53, 54, 59</sup> Ensuring standing orders are in place to reduce the number of missed opportunities of individuals who have already accessed health care system and enhancing reminder and recall systems for patients and providers are proven strategies to improve adult vaccination coverage.<sup>54</sup> Increasing health care providers' awareness about foreign born vaccination disparities and best practices for addressing them is particularly important.<sup>54</sup>

Given the high proportion of the foreign born with limited access to health care in the United States, alternative, targeted, outreach strategies have been recommended,<sup>60</sup> including offering vaccinations at non-traditional settings (e.g., ethnic fairs, migrant camps, workplaces). Community leaders, organizations and community health workers serving foreign born adults may be empowered to disseminate linguistic and culturally sensitive vaccination information. Access to low cost or free vaccinations may be especially important for this population because of its limited economic resources<sup>60</sup> and high rate of uninsurance. All foreign born individuals, irrespective of their immigration status are eligible for public health programs providing vaccinations.<sup>61–64</sup> However, other factors such as limited local health department funding for vaccinations or immigrants' lack of awareness of their eligibility for those programs, may in practice restrict their use.

The Immigration and Nationality Act<sup>65</sup> and guidelines from CDC promote vaccinations among certain foreign born populations. All foreign citizens applying for permanent resident visa while overseas (482,000 in 2011) or adjusting status when already in the United States (580,000 in 2011) are required to show proof of having received all required vaccinations or otherwise must receive the first dose for each vaccine series.<sup>66</sup> Immigration-required vaccination, however, does not apply to unauthorized immigrants (11 million in 2011), those admitted with temporary worker visas (3.8 million in 2011), and international students and exchange visitors (2.3 million in 2011).<sup>67</sup> Several provisions of the Affordable Care Act (ACA) might improve access to health care services and ACIP recommended vaccinations for some immigrants who were previously without health insurance.<sup>68</sup> However, unauthorized immigrants are excluded from the ACA and several large categories of foreign born legal residents have restrictions in their eligibility for the federal Medicaid program.<sup>69</sup> Collaboration with immunization programs in countries of origin for targeted outreach and monitoring of migrants would also improve vaccination coverage among the foreign born.

Currently, some national surveys used in vaccination coverage monitoring collect no or limited data related to foreign born persons, limiting assessment disparities in these population. Strategies to increase inclusion of the foreign born in surveys include adding or expanding migration-related variables on surveys, ensuring data collection instruments are available for the main foreign languages spoken in the United States, making translators available, and collaborating with leaders and organizations trusted by foreign born communities.<sup>42, 53–54, 60, 70–71</sup>

As the size and race/ethnic diversity of the foreign born population in the in the United States continues to increase, the findings in this study indicate that this population will be increasingly important to eliminate national adult vaccination disparities.<sup>6</sup> Public policy makers, immunization programs and health care providers should consider foreign born populations in their public health assessment, evaluation and outreach programs that target disadvantaged groups.<sup>6</sup>

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**Table 1**  
 Characteristics of the study population by birth status, United States, National Health Interview Survey 2012

Characteristics	All adults			U.S. born			Foreign born			
	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>
Total	34525	100.0	27956	82.6	6559	17.4				
Age										
18–49 years	18165	56.4	14057	54.7	4102	<b>64.6*</b>				
50–64 years	8978	25.8	7557	26.5	1420	22.7				
65+ years	7382	17.8	6342	18.9	1037	12.7				
Sex										
Male	15273	48.1	12277	48.0	2992	48.8				
Female	19252	51.9	15679	52.0	3567	51.2				
Race/Ethnicity										
Non-Hispanic white	20619	66.5	19705	76.5	913	<b>18.9*</b>				
Non-Hispanic black	5119	11.5	4621	12.4	494	7.3				
Hispanic	5859	14.9	2324	7.4	3532	50.5				
Non-Hispanic Other	2928	7.2	1306	3.8	1620	23.3				
Marital status										
Married	14930	52.9	11497	51.1	3432	<b>61.5*</b>				
Widowed/divorced/separated	9124	17.3	7713	17.9	1406	14.4				
Never married	10393	29.8	8680	31.0	1709	24.0				
Education										
Less than high school	5487	14.0	3433	10.9	2053	<b>28.6*</b>				
High school graduate	8938	26.3	7528	27.1	1409	22.5				
College	19947	59.7	16912	61.9	3032	48.9				
Employment status										
Employed	20038	60.8	15962	60.0	4070	<b>64.5*</b>				
Unemployed	2077	6.3	1642	6.2	435	6.7				
Not in work force	12385	32.9	10332	33.8	2049	28.8				
Poverty level										

Characteristics	All adults			U.S. born			Foreign born		
	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	
At or above poverty	24725	85.3	20481	87.0	4242	<b>77.6*</b>			
Below poverty	6008	14.7	4370	13.0	1637	22.4			
Health insurance									
Yes, Private	19944	62.6	17137	66.0	2802	<b>46.6*</b>			
Yes, Public	8325	20.3	6711	20.2	1613	21.2			
Not insured	6144	17.0	4010	13.8	2131	32.2			
Number of doctor visits in past year									
0	6724	19.7	4734	17.3	1986	<b>30.8*</b>			
1	5860	18.0	4717	17.9	1142	18.2			
2-3	8492	25.8	7013	26.2	1475	23.7			
4-9	8105	23.1	6862	24.1	1242	18.4			
10+	4669	13.4	4076	14.4	593	8.9			
Usual source of care									
Yes	28531	83.9	23789	86.1	4735	<b>73.2*</b>			
No	5642	16.1	3876	13.9	1763	26.8			
Self-reported health status									
Excellent/very good	19602	60.3	15903	60.6	3691	59.3			
Good	9636	26.7	7741	26.4	1893	28.2			
Fair	3999	9.8	3236	9.8	763	9.5			
Poor	1270	3.2	1062	3.2	208	3.0			
Duration of residence									
U.S. born	27956	82.7	27956	100.0	NA	NA			
In U.S. <10 yrs	1339	3.6	NA	NA	1339	20.8			
In U.S. 10 yrs	5167	13.7	NA	NA	5167	79.2			
Citizenship									
U.S. citizen	31269	91.8	27956	100.0	3313	<b>52.5*</b>			
Not U.S. citizen	3214	8.2	NA	NA	3214	47.5			
Language of the interview									
English	31982	93.7	27690	99.0	4284	<b>68.6*</b>			



Characteristics	All adults		U.S. born		Foreign born	
	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>	N <sup>a</sup>	% <sup>b</sup>
Not English	2543	6.3	266	1.0	2275	31.4
Birthplace						
United States	27956	82.6	27956	100.0	NA	NA
Mexico/Central America/Caribbean Islands	3443	8.6	NA	NA	3443	49.3
South America	391	1.0	NA	NA	391	6.0
Europe	604	2.1	NA	NA	604	12.3
Asia	1569	4.0	NA	NA	1569	22.7
Others	543	1.7	NA	NA	543	9.7
Region of U.S. residence						
Northeast	5774	18.2	4461	17.5	1311	<b>21.3</b> *
Midwest	7193	22.7	6466	25.0	725	12.0
South	12536	36.4	10496	37.4	2038	31.9
West	9022	22.6	6533	20.1	2485	34.8

Note: Boldface indicates significance.

Abbreviations: NA=Not applicable.

<sup>a</sup>Unweighted sample size.

<sup>b</sup>Weighted percentage.

\* p < 0.05 by chi-square test (comparing U.S. born and foreign born).

**Table 2**  
Adult vaccination coverage by birth status and years living in the U.S., United States, National Health Interview Survey 2012

	Overall % (95% CI)	Foreign born		Foreign born			
		U.S. born % (95% CI)	Foreign born % (95% CI)	Living in U.S. < 10 years % (95% CI)	Living in U.S. ≥ 10 years % (95% CI)	U.S. citizen % (95% CI)	Non-U.S. citizen % (95% CI)
<b>Influenza vaccination (2011–12 season)<sup>a</sup></b>							
18+	39.2 (38.3–40.2)	40.4 (39.4–41.5)	<b>33.8 (31.9–35.8)*</b>	23.8 (20.1–28.1)	<b>36.4 (34.3–38.7)*</b>	42.6 (39.8–45.6)	<b>24.3 (21.8–27.0)*</b>
<b>Pneumococcal vaccination (ever received)</b>							
18–64 with high-risk conditions	19.9 (18.8–21.0)	20.8 (19.6–22.0)	<b>13.7 (11.6–16.1)*</b>	7.4 (4.4–12.0)	<b>14.7 (12.2–17.6)*</b>	16.3 (13.1–20.1)	<b>10.3 (7.7–13.6)*</b>
65+	59.9 (58.4–61.4)	62.6 (60.9–64.2)	<b>40.5 (36.9–44.2)*</b>	48.8 (29.8–68.1)	40.2 (36.6–43.9)	40.7 (36.6–44.9)	39.1 (30.5–48.4)
<b>Tetanus vaccination (past 10 yrs)</b>							
18+	62.5 (61.8–63.3)	65.0 (64.2–65.8)	<b>50.6 (49.0–52.2)*</b>	53.1 (49.4–56.8)	49.9 (48.1–51.8)	52.4 (50.2–54.6)	<b>48.8 (46.6–51.0)*</b>
<b>Tetanus vaccination including pertussis vaccine (past 7 yrs)</b>							
18+	14.3 (13.7–15.0)	15.5 (14.8–16.2)	<b>9.3 (8.3–10.5)*</b>	11.8 (9.3–15.0)	<b>8.7 (7.6–10.0)*</b>	10.5 (9.0–12.2)	<b>8.1 (6.7–9.6)*</b>
<b>Hepatitis A vaccination ( 2 doses)</b>							
18–49 among travelers	19.1 (17.7–20.6)	19.9 (18.2–21.8)	17.1 (14.8–19.7)	18.7 (14.9–23.2)	16.3 (13.6–19.4)	20.4 (16.9–24.4)	<b>14.1 (11.4–17.3)*</b>
<b>Hepatitis B vaccination ( 3 doses)</b>							
18–49	35.5 (34.5–36.5)	37.2 (36.1–38.3)	<b>28.4 (26.4–30.5)*</b>	33.7 (30.0–37.6)	<b>26.3 (23.9–28.7)*</b>	36.1 (32.5–39.7)	<b>22.9 (20.7–25.3)*</b>
18+ with diabetes	21.2 (19.3–23.1)	20.8 (18.8–22.9)	23.1 (18.8–28.1)	49.8 (32.9–66.8)	<b>20.6 (16.2–25.9)*</b>	26.9 (21.1–33.7)	<b>15.7 (10.5–22.7)*</b>
<b>Shingles vaccination (ever received)</b>							
60+	20.1 (19.1–21.2)	21.3 (20.2–22.5)	<b>12.0 (9.9–14.6)*</b>	--b	12.1 (9.9–14.8)	13.2 (10.6–16.2)	<b>7.3 (4.2–12.3)*</b>
<b>Human papillomavirus vaccination ( 1 dose)</b>							
18–26 Male	3.7 (2.7–5.1)	4.2 (3.0–5.8)	--b	--b	--b	--b	--b
18–26 Female	35.6 (33.0–38.3)	38.7 (35.9–41.6)	<b>14.7 (10.9–19.6)*</b>	10.7 (6.7–16.7)	19.1 (12.8–27.6)	21.2 (13.6–31.5)	<b>10.4 (6.7–15.8)*</b>

Note: Boldface indicates significance.

Abbreviations: CI=Confidence interval.

<sup>a</sup>Influenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

<sup>b</sup>Estimates are not reliable due to sample size < 30 or relative standard error (RSE) > 30%.

\* p < 0.05 by t-test (U.S. born vs. foreign born; living in U.S. < 10 yrs vs. living in U.S. ≥ 10 yrs; U.S. citizen vs. non-U.S. citizen).

**Table 3**  
 Adult vaccination coverage by birth status and language, United States, National Health Interview Survey 2012

	U.S. born		Foreign born	
	English-speaking % (95% CI)	Non-English-speaking % (95% CI)	English-speaking % (95% CI)	Non-English-speaking % (95% CI)
<b>Influenza vaccination (2011–12 season)<sup>a</sup></b>				
18+	40.5 (39.5–41.6)	<b>25.6 (17.6, 36.5) *</b>	37.4 (35.0–39.8)	<b>26.0 (22.8, 29.7) *</b>
<b>Pneumococcal vaccination (ever received)</b>				
18–64 with high-risk conditions	20.8 (19.6–22.0)	21.0 (11.2–35.9)	15.5 (12.9–18.5)	<b>9.9 (6.6–14.5) *</b>
65+	62.7 (61.0–64.3)	-- <i>b</i>	44.6 (40.0–49.1)	<b>30.5 (24.4–37.4) *</b>
<b>Tetanus vaccination (past 10 yrs)</b>				
18+	65.1 (64.3–66.0)	<b>53.2 (45.4–60.9) *</b>	52.7 (50.8–54.6)	<b>46.2 (43.1–49.2) *</b>
<b>Tetanus vaccination including pertussis vaccine (past 7 yrs)</b>				
18+	15.5 (14.8–16.3)	11.8 (6.6–20.2)	11.5 (10.2–13.0)	<b>4.6 (3.3–6.5) *</b>
<b>Hepatitis A vaccination ( 2 doses)</b>				
18–49 among travelers	19.8 (18.1–21.7)	25.2 (14.7–39.6)	19.3 (16.5–22.4)	<b>10.9 (7.7–15.0) *</b>
<b>Hepatitis B vaccination ( 3 doses)</b>				
18–49	37.2 (36.1–38.3)	38.9 (30.6–47.9)	34.6 (31.7–37.6)	<b>16.0 (13.7–18.7) *</b>
18+ with diabetes	20.8 (18.8–22.9)	-- <i>b</i>	29.2 (23.0–36.3)	<b>13.6 (9.0–20.2) *</b>
<b>Shingles vaccination (ever received)</b>				
60+	21.3 (20.2–22.5)	-- <i>b</i>	15.0 (12.1–18.4)	<b>4.9 (2.8–8.5) *</b>
<b>Human papillomavirus vaccination ( 1 dose)</b>				
18–26 Male	4.0 (2.8–5.6)	-- <i>b</i>	-- <i>b</i>	-- <i>b</i>
18–26 Female	39.1 (36.2–42.0)	<b>24.0 (14.1–37.7) *</b>	17.3 (12.1–24.0)	-- <i>b</i>

Note: Boldface indicates significance.

Abbreviations: CI=Confidence interval.

<sup>a</sup> Influenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

<sup>b</sup> Estimates are not reliable due to sample size < 30 or relative standard error (RSE) > 30%.

\* p < 0.05 by t-test (English-speaking vs. non-English-speaking).

**Table 4**  
Adult vaccination coverage by birth status and race/ethnicity, United States, National Health Interview Survey 2012

	U.S. born					Foreign born					
	NH White % (95% CI)	NH Black % (95% CI)	Hispanic % (95% CI)	Other % (95% CI)	NH White % (95% CI)	NH Black % (95% CI)	Hispanic % (95% CI)	Other % (95% CI)	NH White % (95% CI)	Hispanic % (95% CI)	Other % (95% CI)
<b>Influenza vaccination (2011–12 season)<sup>a</sup></b>											
18+	42.6 (41.4, 43.8)	<b>33.5 (31.2, 35.9)*</b>	<b>29.9 (26.2, 33.9)*</b>	37.7 (33.1, 42.8)	39.1 (33.5, 45.1)	39.2 (32.0, 47.4)	<b>27.2 (24.7, 30.0)*</b>				42.0 (38.2, 46.1)
<b>Pneumococcal vaccination (ever received)</b>											
18–64 with high-risk conditions	21.7 (20.3–23.1)	19.8 (17.4–22.3)	<b>15.2 (11.9–19.4)*</b>	17.1 (13.0–22.2)	14.5 (9.6–21.3)	17.8 (10.0–29.8)	12.4 (9.5–16.0)				14.9 (10.3–21.1)
65+	64.9 (63.1–66.6)	<b>47.7 (43.3–52.2)*</b>	<b>52.0 (44.0–59.9)*</b>	<b>48.4 (38.5–58.5)*</b>	47.3 (39.7–55.0)	.. <i>b</i>	38.3 (33.2–43.7)				38.3 (31.5–45.6)
<b>Tetanus vaccination (past 10 yrs)</b>											
18+	67.3 (66.3–68.2)	<b>54.2 (52.1–56.3)*</b>	<b>58.3 (55.7–60.9)*</b>	67.3 (63.7–70.7)	57.1 (52.5–61.5)	<b>49.4 (43.7–55.1)*</b>	<b>49.2 (46.8–51.5)*</b>				<b>48.9 (45.9–51.9)*</b>
<b>Tetanus vaccination including pertussis vaccine (past 7 yrs)</b>											
18+	16.4 (15.5–17.3)	<b>9.7 (8.1–11.4)*</b>	<b>12.9 (11.0–15.1)*</b>	<b>22.1 (18.6–26.0)*</b>	12.2 (9.4–15.8)	11.5 (7.3–17.6)	<b>6.4 (5.1–7.8)*</b>				12.8 (10.4–15.5)
<b>Hepatitis A vaccination ( 2 doses)</b>											
18–49 among travelers	19.3 (17.3–21.4)	17.2 (12.5–23.3)	22.3 (18.3–26.9)	<b>26.6 (20.9–33.3)*</b>	25.8 (19.0–34.1)	16.6 (10.8–24.5)	<b>11.9 (9.3–15.2)*</b>				21.4 (17.6–25.9)
<b>Hepatitis B vaccination ( 3 doses)</b>											
18–49	37.6 (36.3–39.0)	<b>33.7 (30.9–36.5)*</b>	36.6 (33.4–39.9)	<b>43.1 (38.1–48.3)*</b>	40.1 (33.5–47.0)	34.4 (27.7–41.8)	<b>20.9 (18.8–23.2)*</b>				36.7 (32.3–41.4)
18+ with diabetes	20.4 (18.1–23.0)	21.3 (17.3–25.9)	19.5 (13.9–26.8)	27.0 (18.8–37.2)	29.2 (15.9–47.4)	25.4 (13.6–42.2)	16.7 (12.0–22.7)				34.1 (24.9–44.8)
<b>Shingles vaccination (ever received)</b>											
60+	22.9 (21.6–24.2)	<b>8.8 (6.8–11.2)*</b>	<b>16.0 (11.7–21.7)*</b>	22.5 (16.3–30.3)	20.1 (14.6–27.0)	.. <i>b</i>	<b>4.6 (2.9–7.2)*</b>				14.6 (10.7–19.8)
<b>Human papillomavirus vaccination ( 1 dose)</b>											
18–26 Male	3.7 (2.4–5.6)	.. <i>b</i>	.. <i>b</i>	.. <i>b</i>	.. <i>b</i>	.. <i>b</i>	.. <i>b</i>				.. <i>b</i>
18–26 Female	44.1 (40.5–47.8)	<b>29.0 (23.1–35.7)*</b>	<b>25.6 (20.6–31.3)*</b>	38.6 (28.3–50.1)	25.7 (14.3–41.8)	.. <i>b</i>	11.5 (7.1–18.1)				.. <i>b</i>

Note: Boldface indicates significance.

Abbreviations: CI=Confidence interval.

<sup>a</sup>Influenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

<sup>b</sup>Estimates are not reliable due to sample size < 30 or relative standard error (RSE) > 30%.

\* p < 0.05 by t-test (comparing race/ethnicity where non-Hispanic white is the reference group).

**Table 5**  
Adult vaccination coverage by birth country/region, United States, National Health Interview Survey 2012

	Birth Country/Region					
	United States % (95% CI)	Mexico/Central America/Caribbean Islands % (95% CI)	South America % (95% CI)	Europe % (95% CI)	Asia % (95% CI)	Others % (95% CI)
<b>Influenza vaccination (2011–12 season)<sup>a</sup></b>						
18+	40.4 (39.4–41.5)	<b>28.3 (25.6–31.2)*</b>	<b>26.1 (20.2–33.4)*</b>	36.4 (30.3–43.3)	42.0 (38.2–46.0)	43.6 (35.7–52.4)
<b>Pneumococcal vaccination (ever received)</b>						
18–64 with high-risk conditions	20.8 (19.6–22.0)	<b>13.0 (9.9–16.9)*</b>	..b	<b>13.1 (8.0–20.7)*</b>	15.3 (10.6–21.5)	18.4 (10.4–30.3)
65+	62.6 (60.9–64.2)	<b>35.4 (30.5–40.7)*</b>	53.8 (37.0–69.8)	<b>47.7 (38.2–57.4)*</b>	<b>35.4 (28.8–42.7)*</b>	<b>47.9 (34.3–61.7)*</b>
<b>Tetanus vaccination (past 10 yrs)</b>						
18+	65.0 (64.2–65.8)	<b>48.1 (45.7–50.6)*</b>	<b>53.2 (47.4–58.8)*</b>	<b>58.0 (53.0–62.8)*</b>	<b>48.9 (45.8–52.0)*</b>	<b>56.8 (50.4–62.9)*</b>
<b>Tetanus vaccination including pertussis vaccine (past 7 yrs)</b>						
18+	15.5 (14.8–16.2)	<b>6.1 (4.9–7.5)*</b>	<b>9.3 (5.8–14.6)*</b>	12.7 (9.2–17.4)	<b>12.1 (9.8–14.7)*</b>	15.1 (10.7–20.7)
<b>Hepatitis A vaccination ( 2 doses)</b>						
18–49 among travelers	19.9 (18.2–21.8)	<b>11.6 (9.1–14.6)*</b>	..b	22.8 (14.5–34.0)	20.5 (16.6–25.0)	27.3 (19.1–37.4)
<b>Hepatitis B vaccination ( 3 doses)</b>						
18–49	37.2 (36.1–38.3)	<b>20.1 (18.0–22.5)*</b>	32.7 (25.4–40.9)	41.8 (33.6–50.4)	36.1 (31.5–40.9)	41.3 (34.7–48.1)
18+ with diabetes	20.8 (18.8–22.9)	15.9 (11.5–21.5)	..b	<b>40.4 (23.5–59.9)*</b>	<b>34.5 (24.6–45.9)*</b>	..b
<b>Shingles vaccination (ever received)</b>						
60+	21.3 (20.2–22.5)	<b>5.1 (3.2–8.1)*</b>	..b	21.4 (14.3–30.7)	<b>14.6 (10.5–20.0)*</b>	15.3 (9.0–24.7)
<b>Human papillomavirus vaccination ( 1 dose)</b>						
18–26 Male	4.2 (3.0–5.8)	..b	..b	..b	..b	..b
18–26 Female	38.7 (35.9–41.6)	<b>8.8 (5.2–14.4)*</b>	..b	27.9 (15.0–46.0)	..b	..b

Note: Boldface indicates significance.

Abbreviations: CI=Confidence interval.

<sup>a</sup>Influenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

<sup>b</sup>Estimates are not reliable due to sample size < 30 or relative standard error (RSE) > 30%.

\* p < 0.05 by t-test (comparing birth country/region where United States is the reference group).

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**Table 6**  
Adjusted adult vaccination coverage by country of birth, United States, National Health Interview Survey 2012

	U.S. born		Foreign born	
	Adjusted <sup>a</sup> vaccination coverage (95% CI)	Adjusted prevalence ratio (95% CI)	Adjusted vaccination coverage (95% CI)	Adjusted prevalence ratio (95% CI)
<b>Influenza vaccination (2011–12 season)<sup>b</sup></b>				
18+	37.8 (36.8, 38.7)	Reference	36.6 (34.3, 38.9)	1.0 (0.9, 1.0)
<b>Pneumococcal vaccination (ever received)</b>				
18–64 HR	20.5 (19.3, 21.7)	Reference	17.3 (14.2, 21.0)	0.8 (0.7, 1.0)
65+	61.8 (59.9, 63.6)	Reference	48.2 (42.6, 53.9)	<b>0.8 (0.7, 0.9)*</b>
<b>Tetanus vaccination (past 10 yrs)</b>				
18+	64.5 (63.6, 65.4)	Reference	58.1 (55.7, 60.4)	<b>0.9 (0.9, 0.9)*</b>
<b>Tetanus vaccination including pertussis vaccine (past 7 yrs)</b>				
18+	15.6 (14.8, 16.4)	Reference	11.9 (10.3, 13.8)	<b>0.8 (0.7, 0.9)*</b>
<b>Hepatitis A vaccination ( 2 doses)</b>				
18–49 among travelers	19.3 (17.6, 21.2)	Reference	19.1 (15.8, 23.0)	1.0 (0.8, 1.2)
<b>Hepatitis B vaccination ( 3 doses)</b>				
18–49	36.6 (35.5, 37.8)	Reference	33.6 (30.6, 36.7)	0.9 (0.8, 1.0)
18+ with diabetes	21.4 (19.3, 23.7)	Reference	23.7 (17.6, 31.1)	1.1 (0.8, 1.5)
<b>Shingles vaccination (ever received)</b>				
60+	20.6 (19.4, 21.9)	Reference	15.9 (12.0, 20.8)	0.8 (0.6, 1.0)
<b>Human papillomavirus vaccination ( 1 dose)</b>				
18–26 Male	--c	Reference	--c	--c
18–26 Female	37.4 (34.5, 40.4)	Reference	23.0 (16.2, 31.5)	<b>0.6 (0.4, 0.9)*</b>

*Note:* Boldface indicates significance.

Abbreviations: CI=Confidence interval.

<sup>a</sup>Model adjusted for age, gender, race/ethnicity, marital status, education, employment status, poverty level, health insurance, number of doctor visits in the past year, usual source of care, self-reported health status, region of residence

<sup>b</sup>Influenza vaccination coverage estimates are based on interviews conducted during September 2011 through June 2012, and vaccination received during August 2011 through May 2012.

<sup>c</sup>Not enough sample size to run adjusted models.

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