Place of influenza vaccination among children—United States, 2010–11 through 2013–14 influenza seasons

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Abstract

Background—Studies are published on settings adults receive influenza vaccination but few have reported on settings children are vaccinated and how this might be changing over time or vary by socio-demographics.

Methods—Data from the National Immunization Survey-Flu were analyzed to assess place of influenza vaccination among vaccinated children 6 months–17 years during the 2010–11, 2011–12, 2012–13, and 2013–14 influenza seasons. The percentage of children vaccinated at each place was calculated overall and by age, race/ethnicity, income, and Metropolitan Statistical Area (MSA).

Results—The places children received influenza vaccination varied little over four recent influenza seasons. From the 2010–11 through 2013–14 influenza seasons the percentage of vaccinated children receiving influenza vaccination at a doctor's office was 64.1%, 65.1%, 65.3%, and 65.3%, respectively with no differences from one season to the next. Likewise, for vaccination at clinics or health centers (17.8%, 17.5%, 17.0%. 18.0%), health departments (3.2%, 3.6%, 3.0%, 2.8%), and other non-medical places (1.6%, 1.4%, 1.2%, 1.1%), there were no differences from one season to the next. There were some differences for vaccinations at hospitals, pharmacies, and schools. There was considerable variability in the place of influenza vaccination by age, race/ethnicity, income, and MSA. Fewer Hispanic children were vaccinated at a doctor's office than black, white, and other or multiple race children and fewer black children and children of other or multiple races were vaccinated at a doctor's office than white children. More children at or below the poverty level were vaccinated at a clinic or health center than all of the other income groups.

Conclusion—Most vaccinated children receive their influenza vaccination at a doctor's office. Place of vaccination changed little over four recent influenza seasons. Large variability in place of vaccination exists by age, race/ethnicity, income, and MSA. Monitoring place of vaccination can help shape future immunization programs.

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1. Introduction

Children have higher rates of influenza infection than adults and young children have higher rates of outpatient visits, hospitalizations, and deaths due to influenza compared to older children [1–3]. Influenza vaccination is the single best defense against influenza disease [4]. Beginning in 2004 all children 6–23 months were recommended to receive annual influenza vaccination [5]. In 2006 the influenza recommendations were expanded to include annual vaccination for all children 6–59 months [6]. Finally, the recommendations were further expanded in 2008 to include annual vaccination of all children 6 months through 18 years [7]. Since the 2010–11 influenza season, annual influenza vaccination has been recommended for all persons 6 months and older [8]. Influenza vaccination coverage with at least one dose among children is reported annually, with coverage among children 6 months–17 years being 58.9% in the 2013–14 season [9]. This remains below the Healthy People target of 70% vaccination coverage [10].

Several studies have been published on the places where adults receive influenza vaccination [11–13]. However, few studies have reported on the settings where children receive influenza vaccinations and how this may be changing over time or vary by socio-demographic characteristics [13]. In this descriptive study we report where children 6 months through 17 years received influenza vaccination over four influenza seasons in the United States based on a large national survey. We also examine variation in place of vaccination by several socio-demographic characteristics. Knowing the places where children receive their influenza vaccination can aid in planning of influenza campaigns and can help with pandemic preparedness by providing information on where children routinely receive seasonal influenza vaccination.

2. Methods

Data from the National Immunization Survey-Flu (NIS-Flu), which began in the 2010–11 influenza season, were analyzed to assess place of influenza vaccination among vaccinated children 6 months–17 years during the 2010–11, 2011–12, 2012–13, and 2013–14 influenza seasons. The NIS-Flu is a national list-assisted random-digit-dialed dual frame (land line and cellular telephone) survey of households with children. It includes three components: the NIS for children 19–35 months, the NIS-Teen for children 13–17 years, and the NIS-Child Influenza Module (NIS-CIM) for children 6–18 months and 3–12 years identified during the screening of households for the NIS and NIS-Teen. Data collection for NIS-Flu during the 2010–11 season also included the National Survey of Children with Special Health Care Needs (NS-CSHCN), which used the same sampling frame as the NIS and identified children 6–18 months and/or 3–12 years for a short post-CSHCN influenza module. Interviews were conducted September through June for the 2010–11 and 2011–12 seasons and October through June for the 2012–13 and 2013–14 seasons. All 50 states and the District of Columbia were included in the survey. The Council of American Survey and Research Organizations (CASRO) [14] response rates for the NIS-Flu for the 2011–12 through 2013–14 seasons ranged (over NIS-Flu component and season) from 51.8% to 58.6% for the landline sample and 26.3–32.1% for the cellular telephone sample. The CASRO response rate range was wider for the 2010–11 season because of the NS-CSHCN,

and ranged from 38.1% to 73.6% for landline and 26.4% to 35.8% for cellular telephones. While estimates based on NIS and NIS-Teen typically rely on provider reported vaccination status, influenza vaccination status in the NIS-Flu is based only on parental report. Influenza vaccination coverage estimates from the NIS-Flu are posted annually on FluVaxView [9].

During the NIS-Flu survey, respondents were asked if their child had received an influenza vaccination and, if so, during which month and year. Children were considered vaccinated if they were reported to have received an influenza vaccination August through May for the 2010–11 and 2011–12 season and July through May for the 2012–13 and 2013–14 seasons. National and state level influenza vaccination coverage estimates and methods were published previously; the estimates for children 6 months through 17 years were 51.0%, 51.5%, 56.6%, and 58.9% respectively for the four influenza seasons [9]. For children who received an influenza vaccination, respondents were asked "At what kind of place did [selected child] get his/her most recent seasonal flu vaccination?" Responses were coded by the interviewer into the following categories which appeared on their computer screen during the interview: (1) doctor's office, (2) health department, (3) clinic or health center, (4) hospital, (5) other medically-related place, (6) pharmacy or drug store, (7) workplace, (8) elementary/middle/high school, (9) other non-medically-related place, (10) don't know, or (11) refused. Although some children in the study had received two doses of influenza vaccine in an influenza season, this study focused on place of the most recent dose received. Place of influenza vaccination was grouped into the following categories for analyses: (1) doctor's office, (2) clinic or health center, (3) hospital or other medical place, (4) health department, (5) pharmacy, (6) school, (7) other non-medical place. The percentage of other medical place was very small (0.7%, 0.9%, 0.7%, and 0.6%, for the four influenza seasons respectively) and so was grouped along with hospital. The percentage of participants with don't know or refused for place of influenza vaccination were 0.4%, 0.3%, 0.4%, and 0.5%, respectively for the four influenza seasons. Children for whom place of influenza vaccination was reported as don't know or refused were excluded from study, i.e., they were not included in the denominator.

Information on the following socio-demographic characteristics were included in this study: child's age as of November 1st, child's race/ethnicity, income/poverty level, and Metropolitan Statistical Area (MSA) status. The income/poverty level variable was defined based on total family income in the past calendar year, and the U.S. Census poverty thresholds for that year specified for the applicable family size and number of children <18 years. Poverty thresholds are available at http://www.census.gov/hhes/www/poverty/data/threshld/index.html.

The NIS-Flu sample included a total of 116,799, 96,254, 100,829, and 126,860 children for the 2010–11, 2011–12, and 2012–13, 2013–14 seasons, respectively who were at least 6 months as of November 1st of the respective influenza season and were not missing influenza vaccination status [9]. The analyses for this study was limited to subsets of this data ($n = 44,736$, $n = 41,621$, $n = 51,826$, and $n = 67,843$ for the four influenza seasons, respectively) that included children who had received at least one dose of influenza vaccine, and had information about place of influenza vaccination. For all four influenza seasons, we calculated the percentage of children receiving their most recent influenza vaccination at

each place. Additionally, these percentages were stratified by the socio-demographic variables. Differences between socio-demographic groupings in the percentages of children visiting a particular place for vaccination were tested using pair-wise comparison *t*-tests. Multivariable logistic regression analyses were used to determine variables independently associated with receipt of vaccination at each type of place. Adjusted prevalence ratios (APR) based on predicted marginals from the logistic regression models were computed [15]. A two-sided significance level of 0.05 was adopted for all statistical tests. Comparisons reported as being increases or decreases were statistically significant, while comparisons that were not statistically significant are reported as not being different. Reported percentages and corresponding 95% confidence intervals (95% CI) were weighted, while reported sample sizes were unweighted. All analyses were weighted to population totals and to adjust for households having multiple telephone lines, unit non-response, and non-coverage of non-telephone households. Analyses were conducted using SAS release 9.3 (SAS Inc., Cary, NC) and SUDAAN release 11.0.0 (Research Triangle Institute, Research Triangle Park, NC) statistical software to take into account the complex survey design.

3. Results

Place of vaccination varied very little over the four influenza seasons studied. From the 2010–11 through the 2013–14 influenza seasons the percentage of vaccinated children who received influenza vaccination at a doctor's office was 64.1%, 65.1%, 65.3%, and 65.3%, respectively with no differences from one season to the next (Fig. 1). Likewise, for vaccination at clinics or health centers (17.8%, 17.5%, 17.0%. 18.0%), health departments (3.2%, 3.6%, 3.0%, 2.8%), and other non-medical places (1.6%, 1.4%, 1.2%, 1.1%), there were no differences from one season to the next. There was an increase in the percentage of children receiving vaccination at a hospital or other medical place from the 2010–11 season to the 2011–12 season (4.2–5.0%); however, from the 2012–13 to the 2013–14 season there was a similar decrease (4.9% to 4.2%). From the 2011–12 to the 2012–13 season there was an increase in the percentage of children receiving vaccinations at a pharmacy (2.9–3.8%). The percentage of children receiving influenza vaccination at schools decreased from the 2010–11 season to the 2011–12 season (6.5–4.4%) and then did not change for subsequent seasons (Fig. 1).

There was considerable variability in the place of influenza vaccination by age, race/ethnicity, income, and MSA (Table 1, Fig. 2). By age groups, the percentage of vaccinated children receiving vaccination at a doctor's office decreased with increasing age for all four influenza seasons studied. During the 2013–14 season, this ranged from 76.7% for 6–23 month olds down to 58.2% for 13–17 year olds (Table 1 and Fig. 2 [red bars]). The percentage receiving vaccination at a clinic or health center did not differ by age group for any season. The percentage receiving vaccination at a hospital or other medical place also did not differ by age group with the exception of the 2012–13 season in which more 6–23 year olds than 5–12 year olds received vaccination at this type of place. The percentage receiving vaccination at a health department was lower for 6–23 month olds than the older age groups in all seasons except the 2010–11 season in which there were no age differences. The percentage of vaccinated children receiving vaccination at a pharmacy increased with increasing age for all four influenza seasons studied; however, the 6–23 year olds and the 2–

4 year olds did not differ. In the 2013–14 season, the percentage ranged from 0.5% for 6–23 year olds to 8.8% of 13–17 year olds (Table 1, Fig. 2). In all seasons studied, more of the vaccinated children 5–12 years and 13–17 years received vaccination in a school than younger children. Vaccination at an other non-medical place increased with increasing age (Table 1).

The examination of place of influenza by racial/ethnic groups showed that in all four seasons studied, among those vaccinated, a lower percentage of Hispanic children were vaccinated at a doctor's office than black, white, and other or multiple race children. During the 2013–14 season these percentages were 46.9%, 66.7%, 74.2%, and 65.4% respectively (Table 1 and Fig. 2 [blue bars]). In all four seasons studied, a lower percentage of black children and children of other or multiple races were vaccinated at a doctor's office than white children. Conversely, in all four seasons, a higher percentage of Hispanic children were vaccinated at a clinic or health center than all other racial/ethnic groups, while a lower percentage of white children were vaccinated at this type of place. In the 2013–14 season, the percentages were 37.2% Hispanic, 16.7% black, 9.0% white, and 15.8% other or multiple race. A lower percentage of white children than children of other race/ethnicity groups received influenza vaccination at a hospital or other medical place for all seasons studied. In the 2010–11 and 2011–12 seasons, a lower percentage of Hispanic children than black children received vaccination at a health department, while in the 2012–13 and 2013–14 seasons there were no racial/ethnic group differences in receiving influenza vaccination at a health department. In all four seasons studied, a higher percentage of white children received influenza vaccination at a pharmacy than both Hispanic children and black children. There were no differences in any of the four seasons between Hispanic, black, and white children in the percentage receiving vaccination at school. The differences for other non-medical place are depicted in Table 1.

By income/poverty level, among those vaccinated, a lower percentage of vaccinated children at or below the poverty level were vaccinated at a doctor's office than those of higher income or unknown income for all seasons studied (Table 1, Fig. 2 [green bars]). A higher percentage of children at or below the poverty level were vaccinated at a clinic or health center than all of the other income groups. A lower percentage of vaccinated children in households with income >$75K/year received vaccinations at a health department or a hospital or other medical place compared with the other income groups. A lower percentage of children at or below poverty received vaccination at a pharmacy compared with all other income groups for all seasons studied. Differences for other groups and places are denoted in Table 1.

By MSA status, a lower percentage of children in non-MSAs received vaccination at a doctor's office than children residing in an MSA (Table 1, Fig. 2 [purple bars]). A lower percentage of children in MSA non-central city were vaccinated at a clinic or health center than children residing in an MSA central city or non-MSA. A higher percentage of children residing in a non-MSA received vaccination at a health department or school than those residing in an MSA.

The results of the multivariable logistic regression analyses were not very different from the bivariate results, with most of the results remaining significant while controlling for other variables in the models (Table 2).

4. Discussion

This study provides national estimates of place of influenza vaccination for children over four influenza seasons. Almost two out of every three vaccinated children received influenza vaccination at a doctor's office with the next most frequent setting being a clinic or health center, where nearly one in five vaccinated children received vaccination. All other settings for vaccination had a frequency of 5% or lower. There was stability over the four influenza seasons studied in the distribution of reported settings for influenza vaccination for children.

Comparing the estimates in this study to the places adults receive influenza vaccination showed marked differences. In the 2011–12 season 38.4% of vaccinated adults received vaccination at a doctor's office and 8.4% at a clinic or health center, much lower than the percentage for children (65.1% and 17.5%, respectively) [12]. Adults were far more likely to be vaccinated at pharmacies than were children (adults: 20.1%; children: 2.9%) [12]. These results are not surprising because use of a medical home for vaccination of children has been encouraged as this helps to maintain continuity of care and increases the likelihood that other preventive health services will be delivered [16, 17]. Additionally, state laws vary on the minimum age for which pharmacists are permitted to administer influenza vaccination with many states allowing only the vaccination of adults [18]. However, vaccination provided in non-traditional settings, such as schools or pharmacies, can provide parents with more convenience and options for vaccinating their child [19, 20]. These settings can also play roles in increasing influenza vaccination coverage during routine influenza seasons and during influenza pandemics [19, 21].

Differences in estimates of place of influenza vaccination were observed by age, with older children more commonly vaccinated in non-medical settings relative to younger children. This is likely explained by a combination of factors including: the recommendation for young children to visit their health care provider frequently for well-child visits and to receive other vaccines recommended for young children; state pharmacy laws prohibiting vaccination of very young children; and availability of influenza vaccination at some schools for school-aged children [18]. Differences in place of influenza vaccination by MSA status revealed that schools and health departments play a larger role in delivering influenza vaccination in non-MSA areas than in MSA areas. This was not surprising given the larger distances between places in rural areas that may limit convenient access to medical facilities [22].

The differences in the distribution of settings for influenza vaccination by race/ethnicity and by income are less understood. Hispanic and black children (compared with white children) and children at or below poverty (compared with those above poverty) were much less commonly vaccinated at a doctor's office while more commonly vaccinated at clinics or health centers. This might in part be attributable to racial/ethnic differences in vaccination-seeking behavior; however, it is also likely due in part to barriers some parents have in

bringing their child to a doctor's office during the influenza season such as lack of health insurance or a primary care doctor for the child, reduced ability to take off of work for a provider visit, and transportation issues. While pharmacies offer an option for some parents to have their child vaccinated, this appeared to be less so for children at or below poverty, who were vaccinated at pharmacies less frequently than other children. We speculate on these reasons but could not examine them with our available survey data.

This study is subject to at least five limitations. First, the NIS-Flu is a telephone survey with a moderate to low response rate especially for the cellular telephone sample, thus selection and non-response bias is possible and may remain even after weighting adjustments designed to reduce this bias. Second, estimates of place of influenza vaccination are based upon parental report and may be subject to some recall bias. Third, the survey question asked about place of the most recent influenza vaccination and some children in the study received more than one influenza dose. It is conceivable that some parents may take their child to different vaccination settings for their first versus second dose within the same influenza season; however, such a change in place within season is likely rare, but could not be evaluated with data available in this study. Fourth, some people's interpretation of doctor's office could include clinic, health center, or hospital; the categorization of vaccination setting for this study depended only on what the parent/guardian verbalized during the telephone survey. Lastly, we did not ask about reasons for choosing a particular setting for the child's vaccination thus we could not assess whether where the children were vaccinated was driven by personal preference versus availability and access issues.

In conclusion, this study demonstrates that most vaccinated children receive their influenza vaccination at a doctor's office, place of vaccination has changed very little over four influenza seasons, and large variability in place of vaccination exists by age, race/ethnicity, income, and MSA. Monitoring place of vaccination can help shape future immunization programs targeted at specific groups.

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

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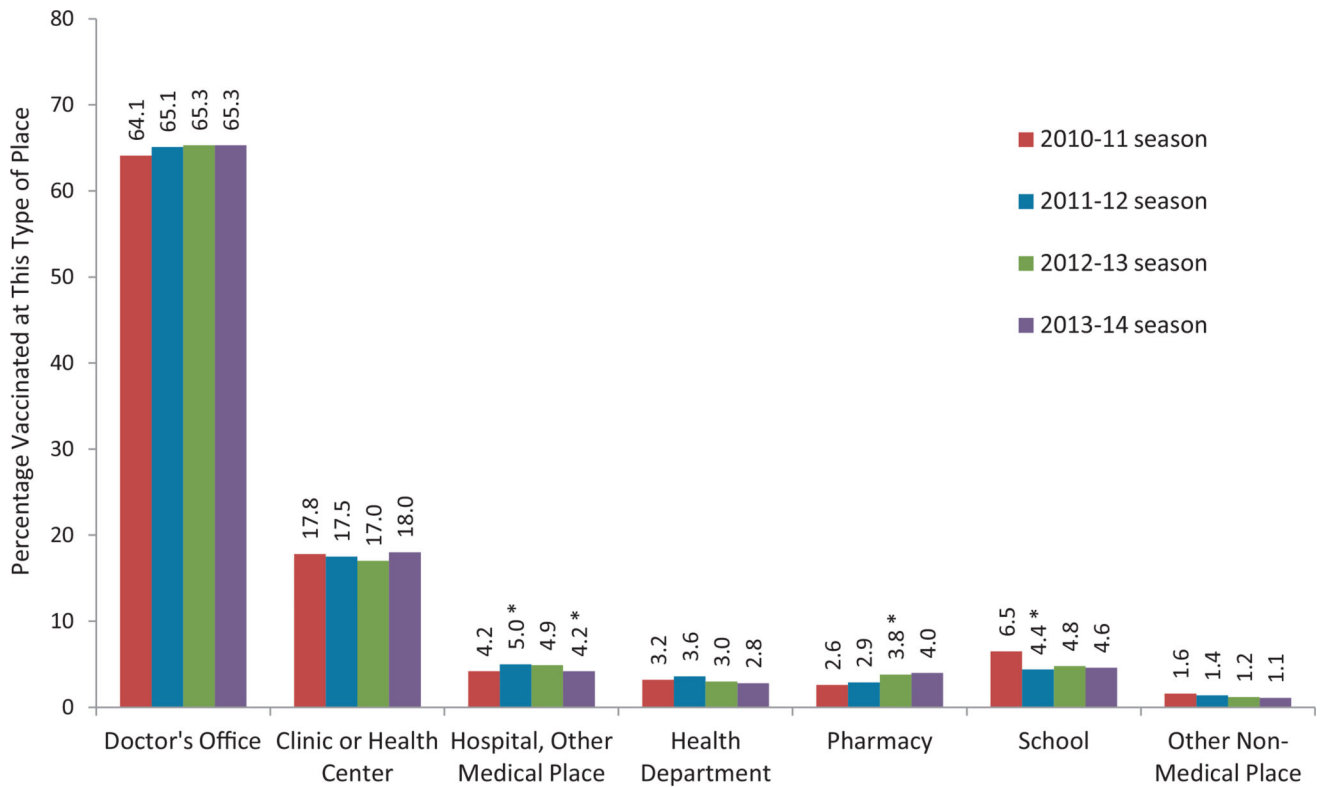
* Indicates a statistically significant change from the previous influenza season, P < 0.05.

Fig. 1.
Reported place of influenza vaccination, children 6 months–17 years, United States, National Immunization Survey-Flu (NIS-Flu), 2010–11 through 2013–2014 influenza seasons.

MSA=Metropolitan Statistical Area
* Age is age as of November 1, 2013.
† Race is reported by respondent; people of Hispanic ethnicity may be of any race.
‡ Income/Poverty was defined based on total family income in the past calendar year, and the U.S. Census poverty thresholds for that year specified for the applicable family size and number of children <18 years. Poverty thresholds are available at http://www.census.gov/hhes/www/poverty/data/threshld/index.html.
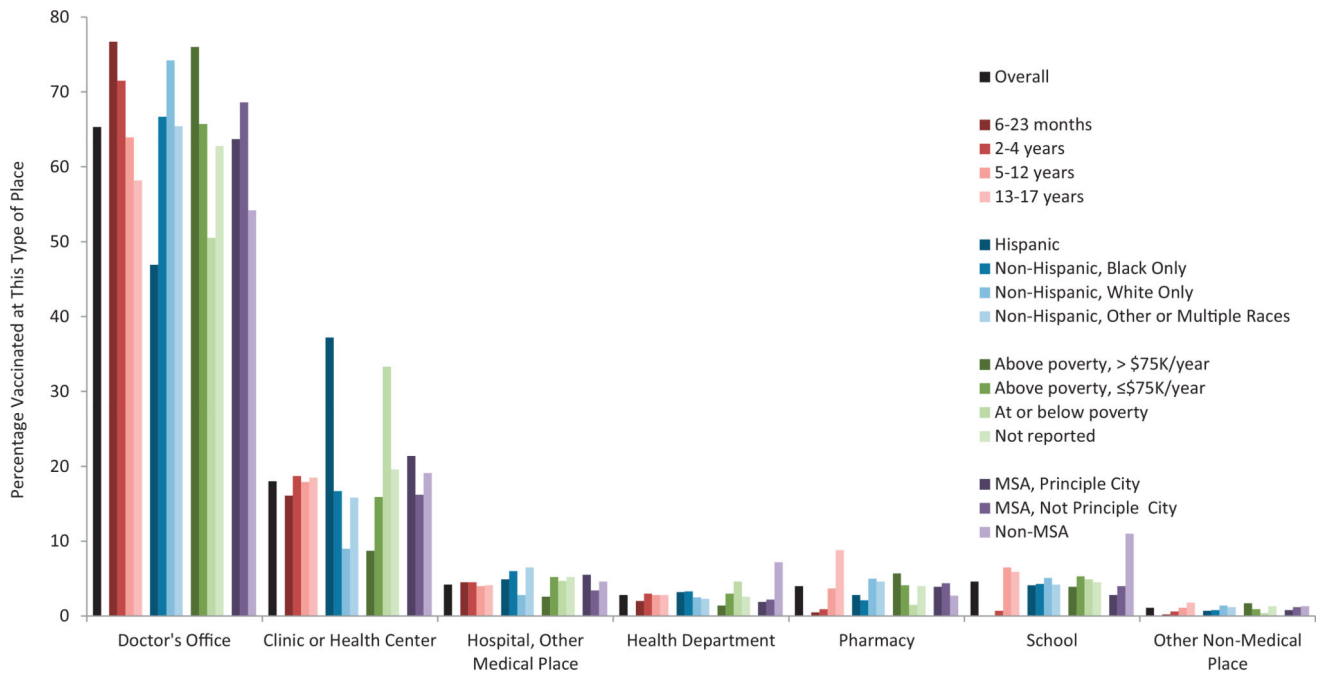
Fig. 2.
Reported place of influenza vaccination by age*, race/ethnicty†, income/poverty‡, and MSA, children 6 months–17 years, United States, National Immunization Survey-Flu (NIS-Flu), 2013–14 influenza season. (For interpretation of the references to color in the text, the reader is referred to the web version of the article.)

Table 1

Reported place of influenza vaccination by select socio-demographic characteristics, children 6 months–17 years, United States, National Immunization Survey-Flu (NIS-Flu), 2010–11 through 2013–14 influenza seasons.

	n	Doctor's office		Clinic or health center		Hospital, other medical place		Health Department		Pharmacy		School		Other non-medical place	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
2010–11															
Overall	44,736	64.1	(63.0–65.2)	17.8	(16.8–18.8)	4.2	(3.8–4.6)	3.2	(2.9–3.6)	2.6	(2.3–3.0)	6.5	(6.0–7.0)	1.6	(1.4–1.8)
Age group[*]															
a. 6–23 months	7591	72.8	(70.3–75.2)[c,d]	18.5	(16.3–20.9)	4.6	(3.8–5.6)	3.0	(2.3–3.9)	0.6	(0.3–1.0)[c,d]	-[†]	-	0.4	(0.2–0.8)[b,c,d]
b. 2–4 years	9683	72.5	(70.1–74.8)[c,d]	17.2	(15.1–19.5)	4.0	(3.3–4.9)	3.4	(2.6–4.3)	0.9	(0.7–1.3)[c,d]	1.2	(0.7–2.1)[c,d]	0.8	(0.6–1.2)[a,c,d]
c. 5–12 years	18,644	61.8	(60.2–63.3)[a,b,d]	17.6	(16.2–19.0)	4.1	(3.4–4.8)	3.2	(2.7–3.7)	2.5	(2.1–3.0)[a,b,d]	9.2	(8.4–10.1)[b]	1.7	(1.4–2.1)[a,b,d]
d. 13–17 years	8818	56.2	(53.7–58.7)[a,b,c]	18.4	(15.9–21.1)	4.6	(3.8–5.5)	3.3	(2.6–4.2)	6.1	(5.2–7.2)[a,b,c]	8.8	(7.6–10.1)[b]	2.6	(2.1–3.2)[a,b,c]
Race/ethnicity[‡]															
a. Hispanic	7016	45.8	(43.0–48.6)[b,c,d]	36.5	(33.7–39.4)[b,c,d]	6.3	(5.1–7.6)[c]	2.4	(1.7–3.3)[b,c]	1.5	(0.9–2.3)[c,d]	6.3	(5.2–7.6)	1.4	(0.9–2.0)
b. Black only, non-Hispanic	4450	58.6	(54.9–62.2)[a,c,d]	21.0	(17.5–25.0)[a,c,d]	6.8	(5.4–8.4)[c,d]	4.0	(3.0–5.4)[a]	1.2	(0.7–1.8)[c,d]	7.2	(5.6–9.2)	1.2	(0.8–2.0)
c. White only, non-Hispanic	28,203	73.2	(72.1–74.2)[a,b,d]	9.2	(8.6–9.9)[a,b,d]	2.6	(2.2–2.9)[a,b,d]	3.4	(3.0–3.9)[a]	3.4	(3.0–3.8)[a,b,d]	6.5	(5.9–7.1)	1.8	(1.6–2.1)[d]
d. Other or multiple race, non-Hispanic	5067	65.9	(62.7–69.1)[a,b,c]	15.4	(13.0–18.1)[a,b,c]	4.9	(4.1–6.0)[b,c]	2.9	(2.0–4.3)	3.5	(2.3–5.2)[a,b,c]	6.2	(4.9–7.8)	1.2	(0.8–1.7)[c]
Income/poverty level[§]															
a. Above poverty, >$75K/year	18,234	77.2	(76.0–78.5)[b,c,d]	8.1	(7.3–9.0)[b,c,d]	2.2	(1.8–2.7)[b,c,d]	1.8	(1.4–2.3)[b,c,d]	3.7	(3.2–4.3)[b,c,d]	4.9	(4.4–5.6)[b,c]	2.0	(1.6–2.4)[b,c]
b. Above poverty, ≤$75K/year	15,809	62.8	(61.0–64.6)[a,c]	16.9	(15.5–18.5)[a,c,d]	5.0	(4.3–5.8)[a]	3.9	(3.3–4.6)[a,d]	2.7	(2.1–3.4)[a,c]	7.3	(6.5–8.3)[a]	1.3	(1.0–1.7)[a]
c. At or below poverty	6797	45.6	(42.6–48.6)[a,b,d]	33.7	(30.7–36.9)[a,b,d]	6.1	(5.1–7.4)[a]	4.6	(3.6–5.8)[a,d]	1.0	(0.7–1.5)[a,b,d]	7.9	(6.5–9.5)[a]	1.1	(0.7–1.7)[a]
d. Not reported	3896	61.1	(57.4–64.6)[a,c]	21.0	(17.7–24.8)[a,b,c]	4.7	(3.5–6.2)[a]	2.8	(2.1–3.6)[a,b,c]	2.3	(1.4–3.8)[a,c]	6.2	(4.9–7.9)	2.0	(1.3–3.0)
Metropolitan Statistical Area (MSA)															
a. MSA, central city	14,724	60.5	(58.4–62.6)[b,c]	21.9	(20.0–24.0)[b]	6.0	(5.1–7.0)[b,c]	2.1	(1.6–2.7)[c]	2.1	(1.7–2.5)[b]	5.8	(4.9–6.9)[c]	1.5	(1.1–2.0)
b. MSA, non-central city	20,993	69.9	(68.5–71.3)[a,c]	14.1	(13.0–15.3)[a,c]	3.2	(2.8–3.7)[a]	2.3	(1.9–2.9)[c]	3.3	(2.8–3.9)[a,c]	5.6	(4.9–6.3)[c]	1.6	(1.4–1.9)
c. Non-MSA	9019	51.2	(48.4–53.9)[a,b]	21.4	(18.7–24.5)[b]	3.8	(3.1–4.6)[a]	9.0	(7.8–10.5)[a,b]	1.6	(1.1–2.3)[b]	11.5	(10.1–13.1)[a,b]	1.5	(1.1–1.9)

	n	Doctor's office		Clinic or health center		Hospital, other medical place		Health Department		Pharmacy		School		Other non-medical place	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
2011–12															
Overall	41,621	65.1	(63.9–66.3)	17.5	(16.5–18.6)	5.0	(4.5–5.6)	3.6	(3.1–4.3)	2.9	(2.5–3.3)	4.4	(4.0–4.8)	1.4	(1.2–1.7)
Age group															
a. 6–23 months	5740	73.7	(70.6–76.5)c,d	17.0	(14.6–19.7)	6.1	(4.6–8.1)	2.3	(1.7–3.2)b,d	-	-	-	-	-	-
b. 2–4 years	8406	69.7	(66.5–72.8)c,d	19.0	(16.1–22.4)	4.7	(3.7–6.0)	3.6	(2.7–4.6)a	1.3	(0.6–2.6)c,d	0.6	(0.4–0.9)c,d	1.1	(0.6–2.0)d
c. 5–12 years	19,029	63.4	(61.7–65.0)a,b,d	17.1	(15.8–18.6)	5.1	(4.3–6.0)	3.3	(2.5–4.4)	3.1	(2.6–3.6)b,d	6.3	(5.7–7.0)b	1.7	(1.3–2.1)
d. 13–17 years	8446	58.7	(56.0–61.3)a,b,c	17.3	(15.2–19.5)	4.6	(3.8–5.5)	5.3	(3.7–7.4)a	5.9	(4.9–7.2)b,c	6.4	(5.5–7.5)b	1.9	(1.5–2.5)b
Race/ethnicity															
a. Hispanic	7488	46.3	(43.5–49.1)b,c,d	37.3	(34.4–40.3)b,c,d	7.0	(5.7–8.5)c	2.6	(1.8–3.6)b	2.1	(1.4–3.1)c	4.1	(3.3–5.1)d	0.7	(0.5–1.0)c,d
b. Black only, non-Hispanic	4584	64.3	(61.1–67.3)a,c	15.7	(13.7–17.9)a,c	7.8	(6.1–9.8)c	4.9	(3.6–6.6)a,d	2.0	(1.3–2.9)c	3.8	(2.9–5.0)d	1.6	(0.8–3.1)
c. White only, non-Hispanic	24,717	74.1	(72.6–75.5)a,b,d	9.2	(8.2–10.3)a,b,d	3.1	(2.6–3.6)a,b,d	3.8	(3.0–4.9)	3.5	(3.0–4.2)a,b	4.6	(4.1–5.0)	1.7	(1.4–2.2)a
d. Other or multiple race, non-Hispanic	4832	64.9	(61.3–68.3)a,c	14.8	(12.7–17.2)a,c	7.7	(5.6–10.5)c	2.8	(2.0–3.9)b	2.5	(1.6–3.8)	5.7	(4.7–6.8)a,b	1.6	(1.0–2.7)a
Income/poverty level															
a. Above poverty, >$75K/year	16,608	78.1	(76.6–79.4)b,c,d	7.4	(6.6–8.3)b,c,d	3.6	(2.9–4.5)b,c,d	1.5	(1.2–2.0)b,c,d	3.9	(3.2–4.7)c,d	3.6	(3.2–4.0)b,c	1.9	(1.4–2.5)c,d
b. Above poverty, ≤$75K/year	14,191	63.9	(61.7–66.0)a,c	16.7	(15.1–18.4)a,c	5.0	(4.0–6.2)a,c	4.8	(3.4–6.7)a	3.1	(2.4–4.0)c	5.1	(4.4–5.9)a	1.5	(1.1–2.0)
c. At or below poverty	6845	48.5	(45.5–51.6)a,b,d	32.5	(29.5–35.6)a,b,d	7.0	(5.8–8.5)a,b	5.1	(4.1–6.3)a,d	1.3	(0.9–1.9)a,b,d	4.7	(3.8–5.7)a	0.9	(0.5–1.6)a
d. Not reported	3977	63.4	(59.7–66.9)a,c	19.9	(16.4–23.8)a,c	5.2	(4.1–6.8)a	3.5	(2.6–4.6)a,c	2.4	(1.8–3.3)a,c	4.6	(3.7–5.7)	1.0	(0.7–1.5)a
Metropolitan Statistical Area (MSA)															
a. MSA, central city	14,280	59.7	(57.5–61.9)b,c	23.3	(21.3–25.4)b,c	7.0	(6.0–8.2)b,c	2.4	(1.8–3.2)c	2.7	(2.0–3.5)	3.7	(3.1–4.5)c	1.2	(0.8–1.7)
b. MSA, non-central city	19,079	71.6	(69.8–73.3)a,c	13.4	(12.0–15.0)a,c	4.0	(3.3–4.8)a	2.9	(2.1–4.1)c	3.2	(2.7–3.8)	3.3	(2.9–3.8)c	1.5	(1.2–2.0)
c. Non-MSA	8262	54.1	(51.6–56.6)a,b	18.6	(16.8–20.5)a,b	4.1	(3.2–5.3)a	9.0	(7.5–10.9)a,b	2.3	(1.7–3.2)	10.0	(8.8–11.3)c	1.8	(1.3–2.6)
2012–13															
Overall	51,826	65.3	(64.4–66.2)	17.0	(16.3–17.8)	4.9	(4.5–5.4)	3.0	(2.7–3.3)	3.8	(3.4–4.1)	4.8	(4.4–5.2)	1.2	(1.0–1.4)
Age group															
a. 6–23 months	7328	73.3	(70.7–75.8)c,d	17.0	(14.9–19.3)	6.5	(5.2–8.3)c	1.8	(1.4–2.3)b,c,d	0.9	(0.4–1.9)c,d	-	-	0.5	(0.2–0.9)c,d

	n	Doctor's office		Clinic or health center		Hospital, other medical place		Health Department		Pharmacy		School		Other non-medical place	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
b. 2–4 years	10,458	70.5	(68.5–72.5)[c,d]	18.1	(16.4–20.0)	5.2	(4.4–6.3)	3.5	(2.8–4.5)	1.2	(0.8–1.9)[c,d]	0.6	(0.4–0.8)[c,d]	0.8	(0.5–1.1)[d]
c. 5–12 years	24,325	64.6	(63.3–65.9)[a,b,d]	17.0	(15.9–18.1)	4.3	(3.7–4.9)[a]	2.7	(2.4–3.1)[a,d]	3.6	(3.1–4.1)[a,b,d]	6.6	(6.0–7.3)[b]	1.1	(0.9–1.4)[a,d]
d. 13–17 years	9715	58.5	(56.5–60.5)[a,c]	16.1	(14.7–17.6)	5.3	(4.2–6.5)	3.8	(3.1–4.6)[a,c]	7.7	(6.8–8.7)[a,b,c]	6.6	(5.7–7.8)[b]	2.1	(1.7–2.5)[a,b,c]
Race/ethnicity															
a. Hispanic	9733	49.2	(47.0–51.4)[b,c,d]	33.9	(31.7–36.1)[b,c,d]	6.3	(5.3–7.5)[c]	2.9	(2.3–3.6)	2.4	(1.9–3.1)[c]	4.5	(3.7–5.5)	0.9	(0.6–1.2)[c]
b. Black only, non-Hispanic	5249	62.6	(59.7–65.3)[a,c]	17.8	(15.8–19.9)[a,c,d]	7.5	(6.0–93)[c]	3.4	(2.5–4.5)	2.8	(2.0–4.0)[c]	5.3	(4.1–6.7)	0.7	(0.5–1.1)[c]
c. White only, non-Hispanic	30,439	73.7	(72.6–74.7)[a,b,d]	9.3	(8.6–10.0)[a,b,d]	3.1	(2.6–3.6)[a,b,d]	3.0	(2.6–3.4)	4.6	(4.1–5.2)[a,b]	4.8	(4.3–5.3)	1.5	(1.3–1.8)[a,b]
d. Other or multiple race, non-Hispanic	6405	65.8	(63.1–68.3)[a,c]	14.0	(12.3–15.9)[a,b,c]	7.7	(6.5–9.1)[c]	3.0	(2.1–4.3)	3.8	(2.6–5.6)	4.7	(3.9–5.6)	1.0	(0.6–1.7)
Income/poverty level															
a. Above poverty, >$75K/year	20,498	76.2	(75.0–77.4)[b,c,d]	7.9	(7.2–8.6)[b,c,d]	3.4	(2.8–4.1)[b,c,d]	1.5	(1.2–1.9)[b,c,d]	5.6	(4.9–6.4)[b,c,d]	3.7	(3.2–4.2)[b,c]	1.7	(1.4–2.1)[b,c]
b. Above poverty, ≤$75K/year	17,038	65.1	(63.5–66.7)[a,c,d]	16.0	(14.7–17.2)[a,c,d]	5.1	(4.4–5.9)[a]	3.7	(3.2–4.4)[a,d]	3.5	(2.9–4.3)[a,c]	5.5	(4.8–6.4)[a]	1.1	(0.8–1.4)[a]
c. At or below poverty	8709	51.5	(49.1–53.8)[a,b,d]	30.4	(28.3–32.6)[a,b,d]	6.1	(5.1–7.3)[a]	4.4	(3.6–5.3)[a,d]	1.4	(1.1–2.0)[a,b,d]	5.5	(4.6–6.5)[a]	0.7	(0.5–1.0)[a]
d. Not reported	5581	61.6	(58.9–64.3)[a,b,c]	19.6	(17.4–21.9)[a,b,c]	6.7	(5.2–8.5)[a]	2.6	(2.0–3.4)[a,b,c]	3.8	(3.0–4.8)[a,c]	4.6	(3.7–5.8)	1.1	(0.8–1.6)
Metropolitan Statistical Area (MSA)															
a. MSA, central city	18,259	63.4	(61.7–65.0)[b,c]	20.5	(19.0–22.0)[b]	5.9	(5.2–6.8)[b,c]	2.1	(1.7–2.5)[c]	3.0	(2.6–3.5)[b]	4.1	(3.4–4.8)[c]	1.1	(0.9–1.3)
b. MSA, non-central city	22,744	69.3	(68.0–70.7)[a,c]	14.1	(13.1–15.1)[a,c]	4.3	(3.7–5.1)[a]	2.5	(2.1–3.0)[c]	4.7	(4.1–5.3)[a,c]	3.9	(3.5–4.4)[c]	1.2	(0.9–1.5)
c. Non-MSA	10,823	56.9	(54.9–58.9)[a,b]	18.6	(17.2–20.2)[b]	4.5	(3.9–5.3)[a]	6.8	(5.8–7.9)[a,b]	2.5	(2.0–3.0)[b]	9.1	(8.0–10.4)[a,b]	1.6	(1.1–2.2)
2013–14															
Overall	67,843	65.3	(64.3–66.2)	18.0	(17.1–18.9)	4.2	(3.9–4.5)	2.8	(2.5–3.1)	4.0	(3.7–4.4)	4.6	(4.3–5.0)	1.1	(0.9–1.3)
Age group															
a. 6–23 months	9008	76.7	(74.7–78.6)[b,c,d]	16.1	(14.4–17.9)	4.5	(3.7–5.3)	2.0	(1.5–2.5)[c,d]	0.5	(0.1–1.7)[c,d]	-	-	0.2	(0.2–0.4)[b,c,d]
b. 2–4 years	13,316	71.5	(69.1–73.8)[a,c,d]	18.7	(16.5–21.1)	4.5	(3.7–5.5)	3.0	(2.2–4.1)	0.9	(0.7–1.1)[c,d]	0.7	(0.5–1.1)[c,d]	0.6	(0.4–0.9)[a,c,d]
c. 5–12 years	33,979	63.9	(62.6–65.1)[a,b,d]	17.9	(16.8–19.1)	4.0	(3.6–4.4)	2.8	(2.5–3.3)[a]	3.7	(3.3–4.1)[a,b,d]	6.5	(6.0–7.1)[b]	1.1	(0.9–1.4)[a,b,d]
d. 13–17 years	11,540	58.2	(55.9–60.4)[a,b,c]	18.5	(16.3–20.9)	4.1	(3.4–4.9)	2.8	(2.3–3.5)[a]	8.8	(7.7–10.1)[a,b,c]	5.9	(5.1–6.7)[b]	1.8	(1.3–2.5)[a,b,c]

	n	Doctor's office		Clinic or health center		Hospital, other medical place		Health Department		Pharmacy		School		Other non-medical place	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Race/ethnicity															
a. Hispanic	13,174	46.9	(44.6–49.3)[b,c,d]	37.2	(34.7–39.8)[b,c,d]	4.9	(4.2–5.7)[c,d]	3.2	(2.5–4.2)	2.8	(2.1–3.8)[c,d]	4.1	(3.3–5.2)	0.7	(0.5–1.0)[c]
b. Black only, non-Hispanic	6813	66.7	(64.2–69.1)[a,c]	16.7	(14.7–19.0)[a,c]	6.0	(5.1–7.2)[c,d]	3.3	(2.5–4.4)	2.1	(1.6–2.8)[c,d]	4.3	(3.4–5.5)	0.8	(0.3–1.7)
c. White only, non-Hispanic	39,418	74.2	(73.3–75.1)[a,b,d]	9.0	(8.4–9.6)[a,b,d]	2.8	(2.5–3.2)[a,b]	2.5	(2.2–2.8)	5.0	(4.6–5.5)[a,b]	5.1	(4.7–5.5)[d]	1.4	(1.1–1.7)[a]
d. Other or multiple race,non-Hispanic	8438	65.4	(62.9–67.8)[a,c]	15.8	(13.9–18.0)[a,c]	6.5	(5.4–7.8)[a,c]	2.3	(1.8–3.1)	4.6	(3.5–6.0)[a,b]	4.2	(3.5–5.0)[c]	1.2	(0.7–1.8)
Income/poverty level															
a. Above poverty, >$75K/year	27,338	76.0	(74.8–77.1)[b,c,d]	8.7	(7.9–9.5)[b,c,d]	2.6	(2.2–3.0)[b,c,d]	1.4	(1.1–1.8)[b,c,d]	5.7	(5.2–6.3)[b,c,d]	3.9	(3.6–4.4)[b,c]	1.7	(1.2–2.2)[b,c]
b. Above poverty, ≤$75K/year	21,374	65.7	(64.1–67.3)[a,c]	15.9	(14.6–17.4)[a,c,d]	5.2	(4.6–5.9)[a]	3.0	(2.6–3.4)[a,c]	4.1	(3.4–4.8)[a,c]	5.3	(4.6–6.0)[a]	0.9	(0.7–1.1)[a,c]
c. At or below poverty	11,561	50.5	(48.1–53.0)[a,b,d]	33.3	(30.8–36.0)[a,b,d]	4.7	(4.0–5.5)[a]	4.6	(3.7–5.7)[a,b,d]	1.5	(1.0–2.3)[a,b,d]	4.9	(4.2–5.8)[a]	0.4	(0.3–0.6)[a,b,d]
d. Not reported	7570	62.8	(60.3–65.2)[a,c]	19.6	(17.5–21.9)[a,b,c]	5.2	(4.4–6.2)[a]	2.6	(2.0–3.3)[a,c]	4.0	(3.1–5.2)[a,c]	4.5	(3.3–6.0)	1.3	(0.9–2.0)[c]
Metropolitan Statistical Area (MSA)															
a. MSA, central city	19,154	63.7	(61.7–65.6)[b,c]	21.4	(19.6–23.3)[b]	5.5	(4.9–6.3)[b]	1.9	(1.5–2.4)[c]	3.9	(3.2–4.7)[c]	2.8	(2.4–3.4)[b,c]	0.8	(0.6–1.1)[b,c]
b. MSA, non-central city	36,319	68.6	(67.3–69.8)[a,c]	16.2	(15.0–17.4)[a,c]	3.4	(3.1–3.8)[a,c]	2.2	(1.8–2.6)[c]	4.4	(4.0–4.9)[c]	4.0	(3.6–4.5)[a,c]	1.2	(0.9–1.5)[a]
c. Non-MSA	12,370	54.2	(52.1–56.2)[a,b]	19.1	(17.3–21.0)[b]	4.6	(3.9–5.4)[b]	7.2	(6.3–8.1)[a,b]	2.7	(2.2–3.3)[a,b]	11.0	(9.8–12.4)[a,b]	1.3	(0.0–1.7)[a]

CI = confidence interval. MSA = Metropolitan Statistical Area. K = 1000.

The presence or absence of superscripted letters denotes whether that estimate was statistically significantly different at $P < 0.05$ from another row, and denotes which row it differed from (a, b, c, or d) based on pair-wise comparison t-tests. For example, in 2010–11, the percentage of vaccinated 6–23 month olds (a) who received their vaccination at a doctor's office (72.8%) was statistically significantly different from the percentage of vaccinated 5–12 year olds (c) and 13–17 year olds (d) receiving vaccination at a doctor's office.

*
Age is age as of November 1.

†
Estimate was not reported because numerator $n < 30$ so as to avoid risk of survey participant disclosure.

‡
Race is reported by respondent; people of Hispanic ethnicity may be of any race.

§
Income/poverty was defined based on total family income in the past calendar year, and the U.S. Census poverty thresholds for that year specified for the applicable family size and number of children <18 years. Poverty thresholds are available at http://www.census.gov/hhes/www/poverty/data/threshld/index.html.

Table 2

Logistic regression results: socio-demographic variables independently associated with place of influenza vaccination, children 6 months–17 years, United States, National Immunization Survey-Flu (NIS-Flu), 2013–14 influenza season.

	Doctor's office APR*	Clinic or health center APR	Hospital, other medical place APR	Health Department APR	Pharmacy APR	School APR	Other non-medical place APR
Age group[†]							
6–23 months	Referent	Referent	Referent	Referent	Referent	**0.07**	Referent
2–4 years	**0.93**	1.15	1.01	**1.55**	1.87	Referent	**2.58**
5–12 years	**0.83**	**1.13**	0.92	**1.47**	**7.49**	**8.74**	**4.38**
13–17 years	**0.74**	**1.22**	0.94	**1.47**	**17.80**	**7.84**	**6.97**
Race/ethnicity[‡]							
Hispanic	**0.69**	**3.11**	**1.51**	1.10	0.82	0.88	0.81
Black only, non-Hispanic	**0.94**	**1.45**	**1.81**	1.22	**0.52**	0.95	0.77
White only, non-Hispanic	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Other or multiple race, non-Hispanic	**0.88**	**1.58**	**2.15**	0.99	1.00	0.96	0.99
Income/poverty level[§]							
Above poverty, >$75K/year	Referent	Referent	Referent	Referent	Referent	Referent	Referent
Above poverty, ≤$75K/year	**0.91**	**1.39**	**1.73**	**1.87**	0.83	**1.28**	**0.57**
At or below poverty	**0.79**	**2.20**	**1.36**	**2.93**	**0.34**	**1.33**	**0.32**
Not reported	**0.89**	**1.60**	**1.67**	**1.71**	**0.74**	1.09	0.83
Metropolitan Statistical Area (MSA)							
MSA, central city	**1.25**	0.87	1.06	**0.25**	**1.69**	**0.28**	0.68
MSA, non-central city	**1.26**	0.84	**0.75**	**0.34**	**1.58**	**0.39**	0.85
Non-MSA	Referent	Referent	Referent	Referent	Referent	Referent	Referent

MSA = Metropolitan Statistical Area. K = 1000.

*
Adjusted prevalence ratio (APR) from a logistic regression model. Estimates in bold are statistically significantly different from the referent (*P* < 0.05). One logistic regression model was performed for each place of vaccination with all demographic variables listed in the table included each model. The outcome variable was receipt of influenza vaccination at this type of place versus receipt at a different type of place. The referent category for school needed to be changed from 6–23 months to 2–4 years because the model did not converge due to the small number in that category.

[†]
Age is age as of November 1, 2013.

[‡]
Race is reported by respondent; people of Hispanic ethnicity may be of any race.

§Income/poverty was defined based on total family income in the past calendar year, and the U.S. Census poverty thresholds for that year specified for the applicable family size and number of children <18 years. Poverty thresholds are available at http://www.census.gov/hhes/www/poverty/data/threshld/index.html.