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National and state-specific estimates of place of influenza vaccination among adult populations – United States, 2011–12 influenza season☆

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ABSTRACT

Background: Annual influenza vaccination has been recommended for all persons ≥6 months since the 2010–11 season. New partnerships between public health agencies and medical and nonmedical vaccination providers have increased the number of vaccination providers and locations where vaccination services are delivered.

Methods: Data from the 2011–12 Behavioral Risk Factor Surveillance System (BRFSS) were analyzed. Point estimates of place of vaccination and 95% confidence intervals were calculated. Multivariable logistic regression and predictive marginal modeling were conducted to identify factors associated with vaccination settings.

Results: Among adults vaccinated during the 2011–12 influenza season, a doctor's office was the most common place (38.4%) for receipt of influenza vaccination, with stores (e.g., supermarkets or drug stores) (20.1%) the next common, and workplaces (17.6%) the third common. Overall, reported vaccination in nonmedical settings by state ranged from 32.2% in California to 60.4% in Nevada, with a median of 45.8%. Characteristics significantly associated with an increased likelihood of receipt of vaccination in nonmedical settings were higher education, not having certain identified high-risk conditions, not having had a routine checkup in the previous 12 months, and not having a primary doctor for health care. Being a member of a racial/ethnic minority group, unemployed or not in the work force were significantly associated with a decreased likelihood of receipt of vaccination in nonmedical settings.

Conclusion: Doctor's offices were the most common medical setting for adult influenza vaccination; workplaces and stores were important nonmedical settings. Increasing access to vaccination services in medical and nonmedical settings should be considered as important strategies for improving vaccination coverage. These results also can help guide development of strategies for achieving *Healthy People 2020* objectives for influenza vaccination of adult populations.

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1. Introduction

Seasonal influenza is associated with substantial morbidity and mortality in the United States [1–3]. Incidence of serious illness and death are higher among adults ≥65 years, children younger than 5 years (but especially those younger than 2 years), pregnant women, and persons of any age who have medical conditions that place them at increased risk for complications from influenza [1]. The economic impact of influenza illness is substantial [1,2,4,5]. Influenza vaccination is the primary tool for preventing and controlling influenza [1]. Annual influenza vaccination has been recommended by the Advisory Committee on Immunization Practices (ACIP) for all persons ≥6 months since the 2010–11 season [1]. By the 2011–12 season, influenza vaccination coverage was 38.8% for persons aged ≥18 years [6].

During the 2009 influenza A pdm09 (H1N1) pandemic, new partnerships between public health agencies and medical and nonmedical vaccination providers were formed. These partnerships increased the number of vaccination providers and locations where vaccination services are delivered [7,8]. Although a doctor's office

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was the most common place for receipt of influenza vaccine during the 2010–11 season, vaccination in nonmedical settings, including stores (e.g., supermarkets or drug stores) and workplaces was also common [8]. Nonmedical settings provide expanded convenient access to vaccinations and potentially lower costs for the person being vaccinated [9]. Vaccination in nonmedical settings could both increase vaccination coverage [1] and enhance the overall capacity of the health care system to effectively deliver vaccinations.

To assess national and state-level influenza vaccination in medical versus nonmedical settings among persons ≥18 years and examine factors associated with vaccination in medical or nonmedical settings, data from the 2011–12 Behavioral Risk Factor Surveillance System (BRFSS) were analyzed.

2. Methods

The BRFSS is a continuous, population-based telephone survey collecting information from adults aged ≥18 years selected randomly using a multistage cluster design among the noninstitutionalized civilian population in 50 states and the District of Columbia (DC). The objective of the BRFSS is to collect uniform, state-specific data on self-reported preventive health practices and risk behaviors that are linked to preventable infectious diseases, chronic diseases, and injuries. Data are weighted by age, sex, and, in some states, race/ethnicity, to reflect each area's estimated adult populations [10].

The BRFSS median Council of American Survey Research Organizations (CASRO) state response and cooperation rates for the 2011–12 season were 49.2% (range: 31.7–65.1%) and 73.7% (range: 49.6–84.9%) for September–December 2011, respectively, and 47.5% (range: 32.1–62.7%) and 58.9% (range: 38.1–76.1%) for January–June 2012, respectively [6].

Respondents were asked whether they had received a flu vaccination during the past 12 months and if so, in which month and year and at what type of place. Individuals who were interviewed September 2011 through June 2012 and reported receiving influenza vaccination from August 2011 through May 2012 were included in the analysis (132,743). Individuals for whom place of influenza vaccination data were missing ($n = 94$, 0.07%), those who said they received their vaccinations in Canada or Mexico ($n = 53$, 0.04%), those who said they did not know where they received their vaccination ($n = 224$, 0.17%), and those who declined to answer the question ($n = 50$, 0.04%) were excluded from the analysis. Differences in the reported place of vaccination were analyzed by month of interview and reported by month of vaccination.

Responses to the question on place of vaccination were divided into medical and nonmedical settings. Medical settings were doctor's office or health maintenance organizations, health departments, other types of clinics or health centers (e.g., a community health center), and hospitals (e.g., inpatient) or emergency departments. Nonmedical settings were senior, recreation, or community centers, workplaces, stores (e.g., supermarket, drug store), schools, and places other than those indicated here.

Covariates were selected from coded survey questions to measure associations of influenza vaccination with medical and nonmedical settings, including: age, sex, race/ethnicity, employment status, education, history of certain chronic conditions that increase the risk for influenza complications (i.e., asthma, diabetes, cardiovascular disease, chronic obstructive pulmonary disease, emphysema, chronic bronchitis, and cancer), health insurance status, time since last routine checkup, having a personal doctor, and cost as a barrier to seeing a doctor in the past 12 months.

SUDAAN (Software for the statistical analysis of correlated data, Research Triangle Institute, Research Triangle Park, NC) was used to calculate point estimates and 95% confidence intervals (CIs). *T* tests were used to determine significance within strata for medical and nonmedical settings. Statistical significance was defined as $p < 0.05$. Multivariable logistic regression and predictive marginal modeling under the logistic procedure were conducted to calculate prevalence ratios and identify factors independently associated with medical and nonmedical vaccination settings.

3. Results

A total of 132,743 participants who were interviewed September 2011 through June 2012 and reported receiving influenza vaccination from August 2011 through May 2012 were included in the analysis. Overall for the 2011–12 season, 56.9% of adults ≥18 years received influenza vaccination at medical settings and 43.1% at nonmedical settings. A greater proportion (48.8%) of younger adults 18–49 years reported vaccination at nonmedical settings compared with adults 50–64 years (43.2%) and ≥65 years (35.7%) (Table 1).

Overall, doctor's office was the most common place of vaccination (38.4%), followed by stores (20.1%), and workplaces (17.6%) (Table 1). Doctor's office was also the most common place of vaccination in each age groups: 18–49 years (30.1%), 50–64 years (38.2%), and ≥65 years (49.1%). For those 18–49 years and 50–64 years, workplace was the second most common place of influenza vaccination (28.0% and 20.3%, respectively) with stores the next most common (14.6% and 18.8%, respectively). For persons ≥65 years, a store was the second most common place of influenza vaccination (28.4%) (Table 1). There were no differences in reported place of vaccination by month of interview or month of vaccination (data not shown).

Among adults who reported influenza vaccination receipt in the 2011–12 season, the proportion reporting vaccination in nonmedical settings compared to the prior season was 1.7% higher among those ≥18 years overall, 3.1% higher among those aged 18–49 years, and 2.7% higher among those ≥65 years (Table 1).

Overall, and in each age group, non-Hispanic whites were more likely to report vaccination in nonmedical settings compared with non-Hispanic blacks, Hispanics, and those reporting other race and ethnicity (Table 2).

Overall and across all age groups, nonmedical settings were the most likely places of influenza vaccination for adults who had attended college (47.0%) versus had high school education (39.4%) or had less than high school education (30.0%), were employed (53.5%) versus unemployed (32.6%) or not in the workforce (32.9%), reported no identified high-risk conditions (48.4%) versus had high-risk conditions (34.9%), whose last routine checkup was ≥1 year (54.9%) versus <1 year (40.5%), or had no primary doctor (54.7%) versus had a primary doctor (41.9%) (Table 2). Vaccinees reporting cost was not an obstacle to medical care were more likely to report receiving influenza vaccination in nonmedical settings (43.4%) compared to vaccinees reporting cost was a barrier (40.4%) (Table 2).

Multivariable logistic regression and predictive marginal modeling were performed with setting of receipt of influenza vaccination as the outcome (Table 3). Overall, among adults ≥18 years, characteristics significantly associated with an increased likelihood of receipt of vaccination in nonmedical settings were: higher education, not having certain identified high-risk conditions (i.e., asthma, diabetes, cardiovascular disease, chronic obstructive pulmonary disease, emphysema, chronic bronchitis, and cancer), not having had a routine checkup in the previous 12 months, and not having a primary doctor for health care. Individuals who were unemployed and not in the work force were less likely to receive vaccination in nonmedical settings when compared to employed individuals. Non-Hispanic blacks, Hispanics, and those reporting