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BRIEF OBSERVATIONS

Influenza Vaccination Coverage among Adults with Asthma: Findings from the 2000 Behavioral Risk Factor Surveillance System

Earl S. Ford, MD, MPH, Seymour G. Williams, MD, David M. Mannino, MD, Stephen C. Redd, MD

The prevalence of asthma has increased substantially in the United States since 1980 (1). The primary clinical and public health strategy to reduce the burden of asthma is to prevent exacerbation of the disease, of which upper and lower respiratory tract infections are a major cause (2–5). One such infection—*influenza*—and its complications are potentially preventable with annual vaccination, which is a safe and effective method (6,7), including among persons with asthma (8). Because persons with asthma are at increased risk of complications from *influenza*, they are advised to receive annual *influenza* vaccinations (9), unless there are contraindications.

Little is known about how adults with asthma or health care providers comply with the annual *influenza* vaccination recommendations issued by the Advisory Committee on Immunization Practices (9). Among children with asthma, however, vaccination levels are low (10–15). We therefore sought to assess the *influenza* vaccination coverage among adults with asthma, as well as to identify predictors of receiving such a vaccination.

METHODS

Data are from the 2000 Behavioral Risk Factor Surveillance System, an annual standardized state-based telephone survey of risk factors for chronic disease (16). Health agencies in the 50 states, the District of Columbia, and three U.S. territories (Guam, Puerto Rico, and the Virgin Islands) selected for interview an independent probability sample of noninstitutionalized adult residents aged ≥ 18 years who were living households that had telephones. All states used an identical core questionnaire administered over the telephone by trained interviewers. The survey was reviewed and approved by the human subjects office at the Centers for Disease Control and Prevention.

Respondents were asked, “Did a doctor ever tell you that you had asthma?” Those who responded “yes” were then asked, “Do you still have asthma?” Respondents who answered affirmatively to both questions were classified as having “current” asthma. In 17 states, participants were also asked, “During the past 12 months, have you had a flu shot?”

We examined the percentages of participants with asthma who reported having an *influenza* vaccination, by age, sex, race or ethnicity, and education. Direct age adjustment was performed using the age distribution of the U.S. population in 2000. We used logistic regression analysis to examine the independent associations of age, sex, race or ethnicity, education, health status, health insurance status, time since the last checkup, and state of origin with vaccination status. Health status was determined from the question “Would you say that in general your health is excellent, very good, good, fair, or poor?” Insurance status was determined from four questions. Time since the last checkup was determined from the question “About how long has it been since you last visited a doctor for a routine checkup?” Answers included the following: within the past year (1 to 12 months ago), within the past 2 years (1 to 2 years ago), within the past 5 years (2 to 5 years ago), 5 or more years ago, and never.

Statistical Analysis

Analyses were conducted with SUDAAN (Research Triangle Institute, Research Triangle Park, North Carolina) to produce valid estimates of the variance (17).

RESULTS

From 17 states, we included in our analysis 3939 participants with current asthma who were aged ≥ 18 years and had complete data. The mean age was 45 years (range, 18 to 96 years); 40% were men; 83% were white; and the mean length of education was 14 years.

Overall, 41% of participants with asthma reported having received an *influenza* vaccination during the preceding year. *Influenza* vaccination levels were 27% among participants aged 18 to 49 years, 56% among those aged 50 to 64 years, and 75% among those aged ≥ 65 years.

In univariate analyses, age, sex, race or ethnicity, health status, medical insurance, and time since the last physician visit were associated with vaccination status ($P = 0.05$ for sex; <0.001 for all other variables); education was not ($P = 0.30$). In a multivariate analysis, all of these univariate associations, except for sex, continued to be significant (Table 1). In addition, after adjusting for age (and other variables), higher levels of education were associated with being vaccinated (Table 1).

Table 1. Characteristics Associated with Influenza Vaccination among Persons with Asthma

Variable	Number of Participants	Number Vaccinated (%) [*]	Adjusted Odds Ratio [†] (95% Confidence Interval)
Age (years)			
18–49	2306	670 (27)	1.0
50–64	900	512 (56)	2.8 (2.1–3.7)
≥65	733	544 (75)	5.0 (3.0–8.4)
Sex			
Male	1134	472 (37)	1.0
Female	2805	1254 (43)	1.2 (0.9–1.6)
Race or ethnicity			
White	3255	1490 (44)	1.0
African American	363	122 (28)	0.5 (0.3–0.7)
Mexican American	169	55 (27)	0.6 (0.4–1.0)
Other	152	59 (46)	1.0 (0.6–1.9)
Education			
<High school	569	286 (44)	1.0
High school/general equivalency diploma	1212	487 (38)	1.1 (0.8–1.7)
Some college	1188	521 (40)	1.6 (1.1–2.4)
Postgraduate	970	432 (45)	2.2 (1.4–3.5)
Health status			
Excellent	469	167 (37)	1.0
Very good	1081	411 (32)	0.9 (0.6–1.4)
Good	1253	535 (41)	1.2 (0.8–1.8)
Fair	696	350 (44)	1.3 (0.8–2.1)
Poor	440	263 (66)	2.4 (1.3–4.3)
Insurance			
Private	2320	911 (36)	1.00
Medicare	1008	673 (66)	1.4 (0.8–2.2)
Medicaid	234	82 (40)	1.1 (0.6–1.8)
None	377	60 (18)	0.5 (0.3–0.8)
Time since last checkup (years)			
<1	3107	1498 (46)	1.0
1–2	387	119 (33)	0.8 (0.5–1.3)
2–5	196	56 (27)	0.6 (0.4–1.2)
>5	230	49 (24)	0.5 (0.3–0.9)
Never	19	4 (16)	0.2 (0.0–1.0)

* Percentages were calculated using sampling weights. Standard errors range from 2% to 10%.

† Adjusted for all variables shown in Table.

Influenza vaccination levels varied almost twofold among the states that had included the influenza vaccination question in their surveys (Table 2): South Dakota (61%) had the highest coverage and New Jersey (32%) had the lowest. After adjusting for the variables in Table 1, these differences among states remained ($P = 0.001$).

DISCUSSION

We found that influenza vaccination levels were generally low among adults with asthma. Only 41% of adults with asthma reported being vaccinated during the previous year: 27% of participants aged 18 to 49 years, 56% of those aged 50 to 64 years, and 75% of those aged ≥65 years. Furthermore, there was substantial interstate vari-

ation in the percentage of participants who were vaccinated. During 1999 to 2001, vaccination levels in the general population ranged from 64% to 68% among people aged ≥65 years and from 32% to 38% among those aged 50 to 64 years (9).

Influenza and asthma are important sources of morbidity and mortality in the United States. Each year, about 114,000 excess hospitalizations and 36,000 deaths are attributed to influenza (9). In 1999, about 10.5 million people reported having one or more asthma attacks during the past 12 months (1). Influenza may be responsible for as many as 19% of asthma attacks or exacerbations in children and adults (2,18,19). Because inactivated influenza vaccine may prevent about 70% to 90% of influenza illnesses among people aged <65 years during

Table 2. Influenza Vaccination Coverage among Persons with Asthma, by State

State	Number of Participants	Number Vaccinated (%) [*]	Adjusted Odds Ratio [†] (95% Confidence Interval)
South Dakota	274	168 (61)	2.9 (1.8–4.7)
Nebraska	195	101 (51)	1.9 (1.2–3.1)
North Dakota	135	61 (49)	2.0 (1.1–3.6)
Arizona	198	86 (48)	1.6 (0.8–3.0)
Minnesota	206	98 (46)	1.6 (1.0–2.6)
South Carolina	231	110 (46)	1.9 (1.2–3.2)
Tennessee	233	102 (46)	1.3 (0.8–2.2)
North Carolina	217	102 (45)	1.5 (0.9–2.4)
Vermont	256	115 (44)	1.6 (1.0–2.5)
Iowa	227	107 (42)	1.4 (0.9–2.3)
Virginia	129	56 (42)	1.8 (1.1–3.1)
California	299	124 (41)	1.7 (1.1–2.8)
Ohio	263	90 (38)	1.3 (0.8–2.1)
Kansas	329	128 (37)	1.1 (0.7–1.7)
Montana	245	109 (37)	1.2 (0.7–2.1)
Georgia	258	94 (33)	1.1 (0.7–1.9)
New Jersey	244	75 (32)	1.0 (Reference)

^{*} Percentages were calculated using sampling weights. Standard errors range from 2% to 10%.

[†] Adjusted for age, sex, race or ethnicity, education, health status, insurance, and time since last checkup.

the years when the vaccine and circulating influenza strain match (9), vaccination could substantially reduce influenza-associated morbidity among persons with asthma.

Estimating the excess morbidity, mortality, and health care use among persons with asthma who do not receive an influenza vaccination is difficult because the benefits to patients with asthma have not been well established and the cost-effectiveness of routinely vaccinating people with asthma is not well defined (20). A recent study showed that the vaccine effectiveness in reducing hospitalizations for pneumonia and influenza or all-cause mortality ranged from 27% to 48% among persons aged ≥ 65 years with lung conditions that included asthma (21).

Our analysis of data from the Behavioral Risk Factor Surveillance System shows that 73% of participants with asthma reported seeing a provider during the past 12 months. For those who do see a health care provider on a regular basis, opportunities exist for physicians and their staff to discuss the need for vaccination or to administer the vaccine. Furthermore, there is a range of patient-, provider-, and system-specific strategies for improving vaccination coverage, including sending computerized reminder letters, implementing patient reminder/recall systems, and using audit and feedback (22–24). The Centers for Disease Control and Prevention has summarized strategies for improving vaccination coverage among adults (25). In addition, physicians may need to address other concerns about influenza vaccination that are more specific to persons with asthma, such as effects of the

vaccine while taking inhaled corticosteroids or increased risk of allergic reactions to vaccine components.

Some of the predictors of vaccination status that we found, such as age, health status, and medical insurance, have been described by others (26,27). Thus, to reach groups with low coverage of influenza vaccination, interventions should be aimed at young adults, African Americans, Mexican Americans, and those without insurance. The variation in vaccination levels among states suggests that states with higher levels may employ strategies that other states could use to improve their vaccination levels.

Several limitations should be considered when interpreting our results. All data were self-reported and subject to misclassification; however, the validity of self-reported asthma (28–30) and influenza vaccination status (31–35) has been demonstrated. Because our results are based on the 17 states that administered the question about influenza vaccination, these results are not nationally representative. Additionally, the survey did not include institutionalized adults and households without telephones.

In general, influenza vaccination levels have increased among adults aged ≥ 65 years in the United States, although the trend among people with asthma is unknown (9). Should the general favorable trend continue, progress will be made in achieving the objectives of the Healthy People 2010, which call for 90% of noninstitutionalized adults aged ≥ 65 years and 60% of noninstitutionalized high-risk adults (including persons with asthma) aged 18 to 64 years to undergo annual influenza vaccinations (36).

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