Racial/Ethnic Differences in Influenza Vaccination Coverage in High-Risk Adults

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Objectives. This study identified racial/ethnic disparities in influenza vaccination in high-risk adults.

Methods. We analyzed data on influenza vaccination in 7655 adults with high-risk conditions, using data from the 1999 National Health Interview Survey (NHIS). We stratified data by age and used multiple logistic regression to adjust for gender, education, income, employment, and health care access.

Results. After control for covariates, White patients with diabetes, chronic heart conditions, and cancer had a higher prevalence of influenza vaccination than did Black patients with the same conditions. Similarly, White patients with 2 or more high-risk conditions were more likely to receive the influenza vaccine than Black patients with the same conditions.

Conclusions. Significant racial/ethnic differences exist in influenza vaccination of high-risk individuals, and missed vaccination opportunities seem to contribute to the less-than-optimal influenza vaccination coverage in the United States. (*Am J Public Health.* 2003;93:2074–2078)

Influenza is a major cause of morbidity and mortality in the United States. In 1997, pneumonia and influenza combined to be the sixth leading cause of death in the United States and were responsible for more than 86 000 deaths.[1] The economic burden of influenza is tremendous; influenza is associated with excess hospitalizations and increased health care costs.[2] The influenza vaccine is an efficacious and cost-effective tool for decreasing the morbidity and mortality associated with influenza in vulnerable segments of the US population.[3,4]

Certain segments of the population are particularly at high risk of serious illness and death from influenza and related complications. These high-risk groups include elderly persons, immunocompromised individuals, and people with medical conditions such as diabetes, chronic heart conditions, chronic obstructive pulmonary disease (COPD), and asthma.[5] Consequently, the Advisory Committee on Immunization Practices recommends yearly influenza vaccination for all adults aged 65 years and older and for high-risk adults aged 18 to 64 years.[5]

Evidence exists of substantial current racial/ethnic disparities in the quality of health care in the United States.[6] Compared with White Americans, Black Americans appear less likely to receive quality health care for several medical conditions.[7–10] Similar racial/ethnic disparities in vaccination coverage against influenza exist, and studies have shown that Blacks have lower influenza vaccination rates than do Whites.[11–14] However, few data exist regarding whether racial/ethnic differences exist in influenza vaccination coverage for specific high-risk chronic medical conditions, such as cancer, chronic heart conditions, COPD, and asthma.

This study used nationally representative data to examine the following 2 questions: (1) Do racial/ethnic disparities in influenza vaccination exist among individuals with specific high-risk chronic medical conditions, such as diabetes, chronic heart conditions, COPD, cancer, and asthma? and (2) Should racial/ethnic differences in influenza vaccination exist, do differences in age, gender, household income, education, employment, and access to care adequately explain them?

METHODS

This was a cross-sectional study using 1999 National Health Interview Survey (NHIS) data.

Subjects

The study used civilian noninstitutionalized adults aged 18 years and older in the United States with at least 1 of the following chronic medical conditions: diabetes, chronic heart conditions, COPD, cancer, and asthma (n=7655).

Data

The NHIS is a national household survey of nonmilitary and noninstitutionalized persons in the United States, sponsored by the National Center for Health Statistics of the Centers for Disease Control and Prevention.[15] This analysis used variables from the sample adult core. In the sample adult core, 1 adult per family was randomly selected to respond to a computer-assisted personal interview questionnaire. For the 1999 survey, 30 801 persons aged 18 years and older were interviewed, with a final response rate of 70%. The NHIS sample was selected through the use of a complex sampling design involving stratification, clustering, and multistage sampling with a nonzero probability of selection for each person. We used final weights provided by NHIS to account for unequal probability of selection, nonresponse, and oversampling of certain demographic groups so that weighted estimates in this study can be generalized to the adult civilian population of the United States. Details about the methodology of the 1999 NHIS are available online.[16,17]

Demographic Variables

We examined data on age, gender, race/ethnicity, education, household income, employment, and marital status. Race/ethnicity was restricted to non-Hispanic Whites and non-Hispanic Blacks; Hispanics and others were excluded in this analysis. Similarly, for analytic purposes, we created dichotomous groups for education (<high school vs ≥high school), household income (<$20 000 vs ≥$20 000), employment (employed vs not

employed), and marital status (married vs not married).

High-Risk Patients

We defined high-risk patients as individuals with diabetes, chronic heart conditions, COPD, cancer, or asthma per the Centers for Disease Control and Prevention definition.[5] Clinical conditions were based on self-report. The diabetes group excluded patients diagnosed during pregnancy, and the chronic heart condition group included patients with coronary heart disease, angina pectoris, myocardial infarction, and congestive heart failure. We created 2 comorbidity categories: people with only 1 high-risk condition and people with 2 or more high-risk conditions.

Clinical and Access-to-Care Variables

Influenza vaccination status was based on self-report. Health status was based on perceived change in physical health in the previous 12 months. We dichotomized responses as "worse" versus "better" or "about the same." Indicators of access to health care included having a usual source of care, having health care coverage, and having contact with a primary care physician in the past 12 months.

Statistical Analyses

We used SAS[18] for statistical analyses and SUDAAN[19] to generate population estimates weighted to the US population in 1999 and to account for the complex sampling design of the NHIS. We compared demographic, clinical, and access-to-care variables and the proportion of individuals with high-risk medical conditions in Whites and Blacks, using χ^2 statistics to identify baseline differences. We then calculated the crude prevalence of influenza vaccination for Whites and Blacks, using χ^2 statistics to determine differences in prevalence estimates by patient characteristics. Finally, we determined the adjusted prevalence of influenza vaccination for each high-risk condition. We chose to adjust for variables that were most likely to influence influenza vaccination coverage, on the basis of previous research. Also, we eliminated variables that did not contribute to the models in our preliminary analyses.

For each high-risk condition, we stratified patients by age and used SUDAAN to obtain the conditional marginal prevalence of influenza vaccination in Whites and Blacks, adjusting for gender, education, household income, employment, and having had a physician checkup within the previous 12 months. We performed a similar analysis for patients with 2 or more high-risk conditions to account for the fact that the clinical categories were not mutually exclusive. The conditional marginal procedure estimates the probability of receiving the influenza vaccine after control for the independent variables. For example, to compare the prevalence of influenza vaccination among Whites with that among Blacks, the conditional marginal procedure computes the probability of receiving the influenza vaccine for both Whites and Blacks after control for other independent variables. This procedure is different from the multiple logistic regression procedure, which designates either Whites or Blacks as the reference and computes odd ratios. The results from the conditional marginal procedure are easier to interpret. Details about the conditional marginal procedure are available in the SUDAAN 8.0 users' manual.[20]

RESULTS

Sample Characteristics

Our final sample consisted of 7655 adults with diabetes, chronic heart conditions, COPD, cancer, and asthma. Of this number, 6482 were White and 1172 were Black. Table 1 shows other characteristics of our study population.

Crude Prevalence of Influenza Vaccination

Table 2 shows the unadjusted prevalence of influenza vaccination in White and Black high-risk patients by patient characteristics. Across all age, gender, socioeconomic, access-to-care, and health status strata, Whites were more likely to be vaccinated compared with Blacks. Racial/ethnic differences in prevalence of influenza vaccination were found among patients with diabetes (60% vs 41%, $P<.0001$), with

TABLE 1—Characteristics of Adults With High-Risk Chronic Medical Conditions: United States, 1999

	All (n = 7655), No. (%)	Whites (n = 6482), No. (%)	Blacks (n = 1172), No. (%)	*P* Value[a]
Aged ≥ 65 y	2858 (32)	2536 (34)	322 (23)	<.0001
Women	4643 (56)	3848 (55)	795 (63)	.0002
≥ High school	3630 (49)	3191 (50)	439 (38)	<.0001
Income ≥ $20,000	4724 (75)	4223 (77)	501 (56)	<.0001
Employed	3990 (57)	3378 (57)	612 (57)	.8713
Married	3521 (59)	3219 (61)	302 (37)	<.0001
Health status worse	1136 (14)	953 (14)	183 (15)	.3529
Physician checkup: yes	5980 (79)	5088 (79)	892 (78)	.698
Usual source of care: yes	7316 (96)	6204 (96)	1112 (96)	.4874
Health care coverage: yes	7008 (91)	6006 (92)	1002 (85)	<.0001
Diabetes	1471 (19)	1101 (17)	370 (32)	<.0001
Chronic heart conditions	3169 (40)	2745 (41)	424 (36)	.0136
COPD	1529 (20)	1329 (20)	200 (15)	.0001
Cancer	1931 (25)	1781 (26)	150 (12)	<.0001
Asthma	2232 (30)	1839 (30)	393 (35)	.0083
1 comorbid condition	5549 (74)	4676 (73)	873 (77)	.0336
≥ 2 comorbid conditions	2106 (26)	1806 (27)	300 (23)	.0336

Note. COPD = chronic obstructive pulmonary disease; No. = unweighted sample size; % = percentage of weighted sample (may differ slightly from percentage of unweighted sample); weighted sample = SUDAAN-generated population estimates weighted to the US population in 1999.
[a]*P* values are for unadjusted comparisons of Whites with Blacks.

TABLE 2—Crude Prevalence of Influenza Vaccination in White and Black High-Risk Adults, by Patient Characteristics: United States, 1999

	All, No. (%)	Whites, No. (%)	Blacks, No. (%)	*P* Value[a]
Age				
≥65 y	1976 (71)	1799 (73)	177 (56)	<.0001
18–64 y	1431 (30)	1230 (31)	201 (24)	.0024
Gender				
Men	1382 (45)	1250 (46)	132 (35)	.0011
Women	2025 (42)	1779 (44)	246 (29)	<.0001
Education				
≥High school	1537 (41)	1407 (42)	130 (28)	<.0001
<High school	1843 (45)	1600 (47)	243 (33)	<.0001
Income				
≥$20,000	2007 (42)	1849 (42)	158 (32)	.0011
<$20,000	1177 (46)	977 (50)	200 (30)	<.0001
Employment				
Employed	2094 (60)	1865 (62)	229 (44)	<.0001
Not employed	1229 (31)	1096 (32)	133 (21)	<.0001
Marital status				
Married	1595 (45)	1500 (46)	95 (32)	<.0001
Not married	1805 (41)	1523 (43)	282 (31)	<.0001
Health status				
Better or same	2839 (42)	2532 (44)	307 (30)	<.0001
Worse	555 (49)	485 (50)	70 (37)	.0031
Physician checkup: yes	2878 (46)	2565 (48)	313 (34)	<.0001
Usual source of care: yes	3371 (45)	3002 (46)	369 (32)	<.0001
Health care coverage: yes	3307 (46)	2959 (47)	348 (34)	<.0001
Comorbidity status				
1 comorbid condition	2269 (39)	2011 (41)	258 (29)	<.0001
≥2 comorbid conditions	1138 (54)	1018 (55)	120 (41)	.0001
Chronic medical condition				
Diabetes	808 (56)	653 (60)	155 (41)	<.0001
Chronic heart condition	1612 (51)	1458 (52)	154 (36)	<.0001
COPD	693 (43)	635 (45)	58 (38)	<.0001
Cancer	1037 (52)	983 (53)	54 (32)	.0002
Asthma	743 (32)	643 (33)	100 (27)	.1299

Note. COPD = chronic obstructive pulmonary disease; n = unweighted sample size; % = percentage of weighted sample (may differ slightly from percentage of unweighted sample); weighted sample = SUDAAN-generated population estimates weighted to the US population in 1999.
[a]*P* values are for unadjusted comparisons of Whites with Blacks.

chronic heart conditions (52% vs 36%, *P*<.0001), and with COPD (45% vs 38%, *P*<.0001). Similar racial/ethnic differences were found among patients with cancer (53% vs 32%, *P*<.0001) and with 2 or more high-risk conditions (55% vs 41%, *P*=.0001). However, among patients with asthma, no significant racial/ethnic differences were observed (33% vs 27%, *P*=.1299).

Adjusted Prevalence of Influenza Vaccination in High-Risk Patients Aged 65 Years or Older

The adjusted prevalence of influenza vaccination, stratified by age and race/ethnicity, is shown in Table 3. The adjusted prevalence of influenza vaccination was significantly higher in elderly White patients than in elderly Black patients, among patients with diabetes (75% vs 61%, *P*=.0057), those with chronic heart conditions (73% vs 55%, *P*=.0002), and those with cancer (74% vs 53%, *P*=.0014). Similar results were observed among patients with 2 or more high-risk conditions (72% vs 58%, *P*<.0001). In contrast, the adjusted prevalence of influenza vaccination in elderly White and Black patients with COPD (76% vs 63%, *P*=.1508) and those with asthma (73% vs 58%, *P*=.1385) did not differ significantly.

Adjusted Prevalence of Influenza Vaccination in High-Risk Patients Aged 18 to 64 Years

The adjusted prevalence of influenza vaccination was significantly higher in younger White patients than in younger Black patients among those with diabetes (46% vs 33%, *P*=.0073), with chronic heart conditions (34% vs 26%, *P*=.0449), and with COPD (31% vs 21%, *P*=.0476). A similar pattern was observed among individuals with 2 or more high-risk conditions (30% vs 24%, *P*=.0149). However, there were no significant racial/ethnic differences in the adjusted prevalence of influenza vaccination in younger adults with cancer or asthma.

DISCUSSION

The results of this study provide 3 important additions to current knowledge about racial/ethnic inequalities in influenza vaccination. First, among patients with diabetes or chronic heart conditions and among those with 2 or more high-risk conditions, Whites appear more likely to be vaccinated than Blacks. Second, racial/ethnic differences in vaccination appear to be independent of gender, socioeconomic status, and access to health care. Finally, regardless of race/ethnicity, patients aged 64 years or younger seem less likely to be vaccinated than those aged 65 years or older.

Our results concur with the findings of earlier studies that have documented racial/ethnic differences in influenza vaccination in the United States[11–14,21,22] and suggest that although influenza vaccination coverage has improved over time, racial/ethnic differences have remained unchanged. In addition, our findings contradict the prevailing assumption

TABLE 3—Adjusted Prevalence of Influenza Vaccination in White and Black High-Risk Adults, by Age Group and Chronic Medical Condition: United States, 1999

	≥ 65 y			18–64 y		
	% Vaccinated			% Vaccinated		
High-Risk Conditions	Whites	Blacks	*P* Value	Whites	Blacks	*P* Value
Diabetes	75	61	.0057[a]	46	33	.0073[a]
Chronic heart conditions	73	55	.0002[a]	34	26	.0449[a]
COPD	76	63	.1508	31	21	.0476[a]
Cancer	74	53	.0014[a]	33	20	.1131
Asthma	73	59	.1385	26	27	.8485
≥ 2 of above conditions	72	58	<.0001[a]	30	24	.0149[a]

Note. COPD = chronic obstructive pulmonary disease. Percentage and *P* values are adjusted for covariates. Covariates include gender, education, income, employment, and having a physician checkup.
[a]Proportion vaccinated in Whites compared with Blacks significantly different at $P < .05$.

that differences in socioeconomic status and access to health care between Whites and Blacks[23] are responsible for racial/ethnic differences in influenza vaccination. Future studies need to examine the contribution of other factors, such as racial/ethnic differences in the administration of vaccines by health care providers and racial/ethnic differences in the acceptance of vaccines by patients.

We also found that regardless of race/ethnicity, the prevalence of influenza vaccination in younger-aged patients with high-risk conditions was suboptimal. For example, the adjusted prevalence of influenza vaccination ranged from 20% (in Blacks with cancer) to 46% (in Whites with diabetes). The low vaccination coverage in this age group is worrisome, and unless effective strategies that target this group of patients are implemented, it is unlikely that the goal of vaccinating 60% of these patients by the year 2010[24] will be met. Of particular concern is the low vaccination coverage for younger-aged Black patients. In this group of patients, the highest coverage was 33% (in those with diabetes), which is a far cry from the target of 60% by the year 2010.

The major implication of our findings is that opportunities to administer the influenza vaccine during patient–provider encounters are being missed, particularly for Blacks and for younger-aged patients. In our study, only 46% of high-risk patients with a physician encounter in the past year reported receipt of the influenza vaccine. Similar results have been previously reported. One study found that among people aged 65 years or older with 5 or more physician contacts during the previous 12 months, only 69% of Whites and 44% of Blacks reported receipt of the influenza vaccine.[14] Another study found that a significant proportion of generalist and subspecialist physicians failed to strongly recommend influenza and pneumococcal vaccinations to their elderly and high-risk patients.[25]

These missed vaccination opportunities must be exploited, especially in light of data suggesting that a physician's recommendation strongly influences a patient's decision to be vaccinated.[26–28] It is crucial that healthcare systems adopt and widely implement effective strategies that increase vaccination rates, and that healthcare providers ensure that the influenza vaccine is offered to all patients during the flu season. In addition, creative strategies that target younger adults and minority patients and that also address culture-specific erroneous beliefs about and attitudes toward vaccination are likely to be beneficial.

The results of this study are subject to some limitations. Bias in recall of influenza vaccine administration is one potential limitation. However, studies have shown that self-report of influenza vaccination is reliable,[29] so that our estimates are likely to be reliable. A second potential limitation is misclassification of asthma and COPD that may result from the similarity in these diseases' clinical manifestations. We see no obvious reason to expect misclassification of asthma and COPD to differ between Whites and Blacks; therefore, it is unlikely that our estimates would be affected by such misclassification. Finally, our findings cannot be generalized beyond nonmilitary and noninstitutionalized persons, which means that our results may not be applicable to institutionalized patients such as those in nursing homes.

In conclusion, this study documents significant racial/ethnic differences in influenza vaccination of high-risk individuals and the contribution of missed vaccination opportunities to the less-than-optimal prevalence of influenza vaccination in the United States. ■

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Contributors

All authors helped to conceptualize ideas, interpret findings, and review drafts of the article.

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Human Participant Protection

This study was approved by the institutional review board of Medical University of South Carolina.

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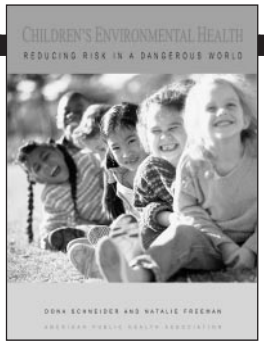

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