Status of Influenza and Pneumococcal Vaccination Among Older American Indians and Alaska Natives

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Objectives. We sought to estimate the influenza and pneumococcal vaccination coverage among older American Indian and Alaska Native (AIAN) adults nationally and the impact of sociodemographic factors, variations by geographic region, and access to services on vaccination coverage.

Methods. We obtained our sample of 1981 AIAN and 179845 White respondents 65 years and older from Behavioral Risk Factor Surveillance System data from 2003 to 2005. Logistic regression provided predictive marginal vaccination coverage for each covariate and adjusted for demographic characteristics and access to care.

Results. Unadjusted influenza coverage estimates were similar between AIAN and White respondents (68.1% vs 69.5%), but pneumococcal vaccination was lower among AIAN respondents (58.1% vs 67.2%; P<.01). After multivariable adjustment for sociodemographic characteristics, self-reported coverage for both vaccines was statistically similar between AIAN and White adults.

Conclusions. Although there was no disparity in influenza coverage, pneumococcal coverage was lower among AIAN than among White respondents, probably because of sociodemographic risk factors. Regional variation indicates a need to monitor coverage and target interventions to reduce disparities within geographically and culturally diverse subpopulations of AIAN persons. (Am J Public Health. 2008;98:932-938. doi:10.2105/AJPH.2007.119321)

Racial and ethnic disparities in influenza and pneumococcal vaccinations among older adults are well documented. In the 2005 National Health Interview Survey, 63% of Whites 65 years and older in the United States reported receiving an influenza vaccine in the last 12 months, compared with 42% of Hispanics and 39% of African Americans.1 For pneumococcal vaccination, gaps of similar or greater magnitude were observed.

1 These disparities have persisted over time, even as overall influenza and pneumococcal vaccination coverage has increased.2

American Indians and Alaska Natives comprise approximately 1.5% of the US population,3 but they experience a significant and disproportionate burden of poor health.4 American Indian and Alaska Native (AIAN) adults are more likely than are Whites to report risk factors for chronic disease including tobacco use, obesity, diabetes, and physical inactivity, and these disparities persist among adults 55 years and older.5,6 Rates of infant mortality and deaths associated with alcoholism, tuberculosis, and accidents are all higher among AIAN populations than among Whites, and older AIAN

adults experience higher rates of invasive pneumococcal disease than does the general US population.7,8 Urban AIAN residents, who may live farther from health facilities designated specifically for American Indians, experience similar disparities compared with general urban populations.9,10

On the basis of county- and state-level assessments using various methodologies, estimates of influenza vaccination coverage among AIAN adults 50 years and older11,12 or 65 years and older4 range from 30% to 70%, and pneumococcal vaccination estimates range from 21% to 67%. These data suggest that in some areas, older AIAN adults receive recommended vaccines at approximately the same rate as Whites nationwide. However, there are no published estimates of vaccination coverage among a nationally based sample of AIAN adults. We sought to provide a national estimate of influenza and pneumococcal vaccination coverage among older AIAN adults (=65 years) in the United States and explored the impact of sociodemographic factors, variations by geographic region, and access to services on vaccination coverage.

METHODS

To create an adequately sized AIAN population for analysis, we pooled Behavioral Risk Factor Surveillance System (BRFSS) data from 2003 to 2005. BRFSS is a state-based, continuously conducted telephone survey of disease risk factors and health behaviors among noninstitutionalized adults 18 years and older in the United States and selected territories. Detailed information on the validity and reliability of BRFSS data has been published elsewhere.13,14

We restricted our analysis to those respondents self-identifying as single-race, non-Hispanic AIAN or White adults 65 years or older, because this age group would be indicated for both influenza and pneumococcal vaccination. Respondents were asked, "Are you Hispanic or Latino?" and "Which one or more of the following would you say is your race?" Respondents reporting AIAN or White race in combination with any other race were excluded from analysis, as were all respondents reporting Hispanic ethnicity. Analysis was restricted to respondents from the 50 states and Washington, DC.

Influenza vaccination coverage was measured by asking, "During the past 12 months, have you had a flu shot?" Pneumococcal vaccination coverage was measured by asking, "Have you ever had a pneumonia shot?" We included demographic information on educational attainment (less than high school, high school equivalent, more than high school), employment status (employed vs unemployed), annual income (<$15000, $15000-$50000, >$50000), age (65-69, 70-74, 75-79, and =80 years), and gender. We measured access to health care by reported health insurance coverage (any vs none) and presence of a primary care physician (at least 1 vs none). We also analyzed whether respondents reported current diabetes (not including gestational diabetes) and asthma, because both conditions are indications for influenza vaccination, and diabetes is an indication for pneumococcal vaccination.

Because there is considerable regional variation in health indicators among American Indians and Alaska Natives,15 we examined differences in vaccination by geographic region (Alaska, East, northern plains, southern plains, Pacific coast, Southwest). Finally, because demographics and health behaviors may differ by telephone coverage,16-18 we included a variable measuring whether the respondent had experienced a telephone service interruption of at least 1 week in the past 12 months (yes vs no) as a proxy measure for having no telephone coverage.19

To measure the impact of availability of services funded by the Indian Health Service (IHS) on vaccination coverage, we used residence in an IHS service county-also known as a contract health services delivery area-as a proxy for access to IHS-funded services. IHS-funded services are provided free of charge to members of federally recognized AIAN tribes residing in contract health services delivery areas; these services may include preventive and ambulatory care, laboratory and diagnostic services, inpatient hospital care, and specialty services for the treatment of acute or chronic physical and mental health disorders.15

IHS service counties represent the catchment area for IHS-funded services, which may be delivered in facilities run by IHS, by tribes directly, or through contracts with other organizations. 15 IHS service counties are typically on or near Indian reservations, and most are rural. AIAN adults residing in an IHS service county may or may not be eligible for IHS-funded services, and those who are eligible may or may not access services for a variety of reasons.15,20 Urban Indian health care organizations (UIHOs) were established in large metropolitan areas that have significant AIAN populations because they were designated as federal relocation sites for AIAN people in the 1950s.10 We examined the effects of residence in an UIHO catchment area separately, because UIHOs are not necessarily located in IHS service counties.

We conducted analyses using SAS 9.1 (SAS Institute, Cary, NC) and SUDAAN 9.0.0 (Research Triangle Institute, Cary, NC) to account for the complex survey design. We compared demographic characteristics and vaccination coverage by race, using regression models to examine race differences in influenza and pneumococcal vaccination coverage. P values of less than .05 were considered statistically significant. Univariate analysis was conducted using the Mantel-Haenszel ÷2 test. Multivariable analysis was performed using logistic regression to obtain predictive marginal vaccination coverage for each variable of interest.

A predictive marginal prevalence is an estimated prevalence adjusted for all of the independent variables in a logistic model using a direct standardization procedure.21 Predictive marginals have several advantages over odds ratios, including ease of interpreting the magnitude of subgroup differences and obviating the need to designate an arbitrary referent group.21,22 Because annual income and county of residence were missing for approximately 14% of the sample, we performed an additional set of regressions for each variable, limited to persons for whom that information was not missing, to assess the impact of these factors on vaccination disparities.

RESULTS

From 2003 to 2005, a total of 924618 people responded to the BRFSS survey; median Council of American Survey Research Organizations response rates ranged from 51.1% to 53.2%.23 Of 924618 respondents, 208060 (23.0%) were US residents 65 years and older. Of these, 1981 respondents (1.0%) were non-Hispanic American Indians and Alaska Natives and 179845 (86.4%) were non-Hispanic Whites; 26234 respondents reporting other races or ethnicities were excluded from analysis. Of the 181826 AIAN or White respondents 65 years and older, 471 (0.3%) missing influenza vaccination status and 5000 (2.8%) missing pneumococcal vaccination status were excluded from multivariable analysis, leaving a total of 181355 and 176826 respondents for the analyses of influenza and pneumococcal vaccination coverage, respectively.

Nearly all respondents (>95%) reported a source of health insurance, and most (>85%) reported having a primary care provider (Table 1), although AIAN respondents were significantly less likely than were White respondents to report either (P<.001). AIAN respondents were also less likely than were Whites to report having more than a high school education (32.4% vs 50.1%) or an annual income of more than $50 000 (11.6% vs 23.0%; P<.001 for both). AIAN respondents tended to be younger than Whites (34.4% vs 27.2% were younger than 70 years) but were significantly more likely than were Whites to report having diabetes (27.9% vs 15.2%). AIAN respondents were also more likely than were Whites to report telephone service interruption (3.3% vs 1.8%; P<.05), although few respondents experienced interruptions overall. Gender, employment status, and self-reported asthma did not differ by race; slightly more women than men responded, and most respondents were unemployed (a category that included retirees). Approximately 36.5% of AIAN respondents lived in an IHS county, compared with 24.0% of Whites (P<.001).

In univariate analysis, influenza vaccination coverage did not differ significantly by race: 68.1% of AIAN and 69.5% of White respondents reported vaccination in the past 12 months (Table 2). Influenza vaccination in both races varied by region, ranging from 63.7% to 77.6% among AIAN and 63.0% to 71.5% among White respondents; regional variation was not statistically significant among AIAN respondents, but it was among White respondents. Pneumococcal vaccination coverage differed significantly by race, with 58.1% of American Indians and Alaska Natives compared with 67.2% of Whites reporting lifetime receipt of pneumococcal vaccine (P<.01; Table 3). Regional variation in pneumococcal vaccination was similar to influenza for White respondents (range=60.6%-69.6%) and much greater for AIAN respondents (range=45.1%-70.6%); this variation was statistically significant in both races. Residence in an IHS service county did not appear to affect race differences in vaccination: in both IHS and non-IHS counties, influenza coverage was comparable for AIAN and White respondents, and pneumococcal coverage was higher among Whites (data not shown).

We used a multivariable model to adjust for the covariates described previously. Predictive marginal coverage for influenza vaccine among AIAN respondents (71.8%) remained statistically the same as among Whites (69.5%; Table 4), although adjusted

coverage for AIAN respondents was slightly higher than the unadjusted rate of 68.1%. Respondents reporting health insurance coverage or a primary care provider were more likely than those who did not to have received an influenza vaccination, as were respondents reporting current diabetes or asthma. Women and respondents reporting current employment were less likely to be vaccinated compared with men and the unemployed; likelihood of vaccination increased with increasing age and level of education. Respondents in the northern plains reported higher vaccination coverage than those in the East; no other regional variation was significant. Influenza vaccination coverage was not significantly associated with telephone service interruption in this model.

For pneumococcal vaccination, adjustment for covariates rendered the observed race disparity in vaccination coverage nonsignificant, with predictive marginal coverage of 61.7% for AIAN and 67.3% for White respondents (Table 4). Like influenza, increased coverage was observed among respondents reporting health insurance, a primary care provider, older age, greater education, diabetes, or unemployment. Again, telephone service interruption was nonsignificant; however, women were more likely than were men to report pneumococcal vaccination. Vaccination coverage in the Southwest was significantly higher than coverage in all other regions except Alaska. Adjusting for year of data collection did not alter coverage estimates for either vaccine, so this variable was not included in the models presented.

Restricting analysis to respondents who reported annual income, influenza vaccination coverage was 3 to 7 percentage points higher among respondents with incomes of $15000 to $50 000 or greater than $50 000, respectively, compared with less than $15000 ($P<.001$). Telephone service interruption was significantly associated with influenza vaccine coverage in this multivariable model, but predictive marginal coverage for all other nonrace variables did not change substantially. Income was also a predictor of pneumococcal vaccination ($P<.05$), although coverage varied less than 2 percentage points among all income categories. Adjusting for income resulted in higher predicted coverage among AIAN respondents for both influenza (74.2%) and pneumococcal (65.9%) vaccines.

Among AIAN respondents not missing county of residence, living in an IHS service county was not significantly associated with influenza or pneumococcal vaccination, whereas residence in a UIHO area was significantly associated with higher pneumococcal vaccination among AIAN respondents (76.2% vs 54.6%; $P<.05$). In a multivariable model adjusting for sociodemographic characteristics, the association of residence in a UIHO area and pneumococcal vaccination coverage among AIAN respondents remained statistically significant.

DISCUSSION

We examined influenza and pneumococcal vaccination coverage measured during 2003 through 2005 in a nationally based sample of older AIAN and White adults. Unlike other racial and ethnic minorities during the study period,1 AIAN adults did not experience

disparities in influenza vaccination coverage. For pneumococcal vaccination, a race gap of approximately 9 percentage points was observed, although the disparity was accounted for after multivariable adjustment for a standard set of sociodemographic factors. Notably, similar adjustments do not fully account for vaccination coverage disparities between older African Americans and Whites.24-26 Coverage varied by geographic region for AIAN adults, particularly for pneumococcal vaccine.

The free, comprehensive health care provided by IHS has been cited as one possible explanation for why young AIAN children complete recommended vaccination series at rates not statistically lower than those of other children, despite increased risk factors for underimmunization. 27,28 Free vaccination and community health outreach, including education and vaccination in nonclinic settings, are strategies employed by many IHS facilities for children and adults. One IHS service unit reported achieving influenza vaccination rates for older AIAN adults comparable to rates among the general US population through the use of such multidisciplinary strategies.29 Among low-income AIAN adults younger than 65 years, those whose only source of health insurance was through IHS fared as well as insured Whites on many preventive care measures.30 However, eligibility for IHSfunded services depends on both residence in a defined geographic area and membership in a federally recognized tribe7; therefore, not all AIAN persons are eligible for IHS-funded care. Even among eligible AIAN people (the service population), only approximately 79% actually access services in a given year (the user population; IHS Division of Program Statistics, unpublished data, 2005).

In our study, living in an IHS service county was not a significant predictor of vaccination among AIAN adults. As noted previously, one reason for this lack of association might be that AIAN people residing in these counties were not eligible for care from IHS. In addition, because most people in the study are also eligible for Medicare (which covers influenza and pneumococcal vaccinations), it is possible that AIAN respondents had access to vaccine through other sources. Finally, American Indians and Alaska Natives are a relatively mobile population, and people currently living in an IHS service area may have recently resided in a nonservice area. Regardless of the reason, proximity to IHS-funded services did not substantially affect access to vaccine among AIAN adults in this study.

Notably, residence in a UIHO area was significantly associated with increased pneumococcal, but not influenza, vaccination coverage among AIAN adults. Although American Indians and Alaska Natives in urban settings tend to have limited access to IHS-funded services, and urban Indian health programs are relatively few,9,10 this population may have better access to vaccination because urban areas typically offer a wider range of vaccination providers, including alternative providers such as grocery stores and pharmacies. Further research is needed to explain the reasons for this observation and the lack of a similar finding for influenza vaccination, although this finding may not be applicable to all urbandwelling American Indians and Alaska Natives, because the majority of urban-dwelling American Indians and Alaska Natives do not reside in UIHO service areas.10

Coverage for both vaccines varied by geographic region, although regional differences were more pronounced for pneumococcal vaccination, particularly among AIAN adults. After adjustment for demographics and healthcare access, pneumococcal coverage among AIAN respondents did not differ significantly by region except that coverage in the southern plains was notably higher than in the East or Southwest. Health care use by American Indians and Alaska Natives differs widely by geographic region, as do many types of cause-specific mortality, including deaths from pneumonia and influenza.15 Regional differences in utilization may be caused in part by variations in IHS-funded facilities and services available15; the quality of federal, state, and tribal collaboration in different parts of the country may also affect provision of health care.11 In addition, differential implementation of vaccine recommendations by region may lead to variations in coverage for AIAN people. 31 Finally, sociodemographic risk factors for underimmunization are likely to be distributed unevenly across geographic regions. Although models adjusting for these factors facilitate understanding of characteristics associated with underimmunization, the existence of true regional disparities in vaccination coverage must not be overlooked. Such disparities may in turn contribute to regional differences in vaccine-preventable pneumonia and influenza deaths.

Methodological Considerations

We chose to study only people reporting 1 race and non-Hispanic ethnicity. This strategy may have resulted in the exclusion of multiracial people as well as Indians from Central and South America, who represented approximately 4% of American Indian and Alaska Native-occupied housing units in the 2000 US Census.32 Among those reporting a single race, unadjusted coverage for both influenza and pneumococcal vaccines was similar, whether or not persons reporting Hispanic ethnicity were included, for both races. Including multiracial persons in the sample resulted in substantially lower estimates of influenza and pneumococcal coverage among AIAN respondents and slightly lower estimates for both vaccines among Whites. These differences disappeared after adjustment for sociodemographic variables, again suggesting that demographic risk factors for underimmunization are unevenly concentrated in some subpopulations-here, multiracial AIAN adults-and underscoring the need for accurate coverage estimates in these subgroups to target interventions to reduce disparities.

Because study data were collected through a telephone survey, respondents may not be representative of the entire US AIAN population. Telephone coverage among AIAN persons is extremely variable: no telephone service was available for 12% of AIAN households in the 2000 US Census; in some tribes, telephone noncoverage may exceed 40%.32 As a result, the AIAN sample in this telephone-based study may not be representative, particularly for tribes such as the Navajo with lower-than-average telephone coverage.

In general, US adults without telephones have lower income and less education and are more likely to be unemployed than those with phones18; these findings have been replicated in a sample of AIAN adults.16 Furthermore, a recent study showed that adults without landline telephones are significantly less likely than those with telephones to

receive influenza or pneumococcal vaccination.18 Telephone-based surveys result in somewhat higher vaccination coverage estimates than do face-to-face surveys, as well as significant subgroup variation in estimates of pneumococcal vaccination coverage.17 Therefore, our results may underestimate true coverage disparities between AIAN and White adults. However, national estimates of influenza vaccination using pooled face-to-face survey data have shown statistically similar coverage (61.8% vs 65.6%) between older AIAN and White adults (G. E., National Heath Interview Survey, unpublished data from 1998-2005; 2006).

Estimates of the proportion of AIAN people living in an IHS service area ranged from 40% to 60%, depending on the data source.15,32 In our study, only 36.5% of AIAN respondents resided in an IHS service county, which may indicate that telephone survey methodology selectively reaches urbandwelling AIAN persons and therefore does not adequately capture the population of AIAN persons represented in IHS data systems. IHS data from 2005 showed 59% coverage for influenza and 69% for pneumococcal vaccination33 among older AIAN adults compared with unadjusted coverage of 68% and 58%, respectively, in our study. However, comparing rates obtained from the IHS data system to rates obtained through BRFSS is difficult, because, in addition to assessing different populations, IHS data represent vaccinations documented in the clinical setting rather than obtained through self-report.

Our results are subject to at least 4 limitations. First, vaccination receipt in BRFSS is self-reported and not verified with medical records. Studies have validated self-reported influenza vaccination status as acceptably accurate, 34,35 although influenza vaccination coverage tends to be overreported, whereas pneumococcal vaccination coverage tends to be underreported.35 In addition, validity of self-reported vaccination may vary by race/ethnicity, particularly for pneumococcal vaccine. Second, 3 years of data were pooled to create an adequately sized sample of AIAN respondents. Pooling data may not be statistically appropriate when there is significant year-to-year variation. However, adjusting for year of data collection did not alter coverage estimates, indicating that yearly variations in data are unlikely to have biased study results. Previous studies of AIAN health and healthcare also have relied on pooled data.5,27

Third, the small sample sizes of AIAN persons that necessitate pooling data also result in less precise coverage estimates for this population. As a result, statistically significant differences in subgroup coverage, particularly regional variations, may be obscured by wide confidence intervals. Finally, the US AIAN population is composed of hundreds of tribes with heterogeneous lifestyles, cultural practices, and connections to the healthcare infrastructure. Therefore, coverage estimates and predictors of vaccination are unlikely to apply uniformly to older AIAN adults in different tribes.

Conclusions

To obtain accurate data to inform AIAN health policy, large national surveys such as BRFSS should incorporate questions about current and lifetime usage and availability of IHS-funded services for respondents identifying as AIAN. In addition, these surveys

should oversample AIAN populations to obtain adequate sample sizes for valid singleyear, regional, or subgroup estimates, and special efforts should be made to reach AIAN populations with limited telephone coverage.

Our analysis, which provides the first published estimate of vaccination coverage among a nationally based sample of AIAN adults, does not indicate significant racial disparities in influenza vaccination between older AIAN and White adults. By contrast, pneumococcal vaccination coverage among older AIAN adults in some parts of the country is substantially below that of Whites, probably because of uneven distribution of sociodemographic risk factors for underimmunization. Pneumococcal vaccine is given once after age 65 years, and coverage rates tend to rise with age, so the younger age distribution among AIAN respondents contributes to this finding.

Regional coverage differences indicate a need to monitor vaccination coverage within geographically and culturally diverse segments of the AIAN population, because national estimates may mask substantial disparities. Finally, coverage levels among AIAN adults for both vaccines fall short of the Healthy People 2010 goal of 90% coverage. 36 Providers serving older AIAN adults should implement evidence-based, culturally appropriate strategies37 to increase influenza and pneumococcal vaccination in this population.

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M. C. Lindley, A.V. Groom, and P. Wortley designed the study. A.V. Groom and P.M. Wortley supervised the study implementation. G. L. Euler assisted with the analytic design and the interpretation of statistical findings. M. C. Lindley completed the analyses and led the writing of the article. All authors helped to conceptualize ideas, interpret findings, and review drafts of the article.
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Behavioral Risk Factor Surveillance System conducted a survey that told researchers the difference in the available health care services provided to older American Indians and Alaska Natives (AIAN) and Whites. It concluded that AIANs are more likely to have chronic disorders such as diabetes, obesity, and physical inactivity. Though there are less no disparity in receiving influenza vaccinations between AIANs and Whites, there is a wide disparity between the races which receive pneumoccoccal vaccination.