ORIGINAL INVESTIGATION

HEALTH CARE REFORM

# Immunization Disparities by Hispanic Ethnicity and Language Preference

*Amelia M. Haviland, PhD; Marc N. Elliott, PhD; Katrin Hambarsoomian, MS; Nicole Lurie, MD, MSPH*

**Background:** Seasonal influenza and pneumococcal immunization rates are substantially lower for older Hispanics than for non-Hispanic whites.

**Methods:** Beneficiary-reported past-year influenza and lifetime pneumococcal immunization for English- and Spanish-preferring Hispanic beneficiaries were compared with those for non-Hispanic whites in cross-sectional bilingual survey data using data from 244 618 randomly sampled community-dwelling respondents (age ≥65 years) with the 2008 Medicare Consumer Assessment of Healthcare Providers and Systems survey (a 62% response rate). Weighted logistic regression estimated immunization disparities with and without adjustment for health status, sociodemographic variables related to access, and location. Hierarchical models examined the role of specific geographic factors in immunization disparities.

**Results:** Pneumococcal immunization rates for Spanish- and English-speaking Hispanics were substantially lower than those for non-Hispanic whites (40% and 56% vs 74%; $P < .001$ for both comparisons). Influenza immunization rates for Spanish- and English-speaking Hispanics were also lower than for non-Hispanic whites (64% and 68% vs 76%; $P < .001$ for both comparisons). Health status–adjusted differences were similar; additional adjustment for sociodemographics reduced pneumococcal disparities by approximately one-third and influenza disparities by approximately half, but all disparities remained significant. Pneumococcal disparities were consistently smaller for patients in managed care plans. Influenza disparities were greater both in linguistically isolated areas and in "new destination" areas without long-standing Hispanic populations.

**Conclusions:** Hispanic seniors, especially when Spanish-preferring and in linguistically isolated "new destinations," such as the Southeast, continue to be immunized at markedly lower rates than non-Hispanic whites, even after adjustment for health and sociodemographics. Individual physicians and policymakers may be able to assist this vulnerable group by addressing cultural and linguistic barriers to immunization.

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**Author Affiliations:** Economics and Statistics Group, RAND Corp, Santa Monica, California (Drs Haviland and Elliott and Ms Hambarsoomian); and US Department of Health and Human Services, Washington, DC (Dr Lurie).

ELDERLY INDIVIDUALS ARE AT high risk for serious complications from influenza and pneumococcal pneumonia.[1] The Advisory Committee on Immunization Practices (ACIP) recommends that all seniors (people aged ≥65 years) obtain influenza immunization annually and pneumococcal immunization once after age 65 years (even if received earlier), with a 5-year booster for high-risk seniors.[2]

Nonetheless, many seniors do not obtain these immunizations.[1] Significant racial/ethnic disparities are evident, with Hispanic seniors being much less likely to be immunized than non-Hispanic whites.[1,3] In 2004, 55% of Hispanic seniors reported that they "received a flu shot," compared with 67% of non-Hispanic white seniors. Only 34% of Hispanic seniors indicated that they "received a pneumonia vaccine," compared with 61% of white seniors.[1]

There is intense policy interest in improving low immunization rates and reducing disparities. However, the elderly Hispanic population is diverse, and efforts to reduce immunization disparities may require understanding how immunization rates differ within Hispanic subgroups. For example, both English proficiency and degree of acculturation vary widely among Hispanics[4]; such characteristics may influence access to health care, which is more problematic for Hispanics than non-Hispanic whites.[5] These and other obstacles to access may then influence the consequent likelihood that elderly Hispanics receive immunizations.[6,7]

Hispanic seniors living in newer immigrant destination communities may be at a particular disadvantage by having more limited access to care than is available in more established communities, such as those in New York and California. Indeed, Hispanic immigrants in the Southeast (out-



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side of Florida) and other nontraditional destinations have reported less access to care.[8,9] In addition, Hispanic seniors living in linguistically isolated areas with a substantial number of Spanish speakers with limited English proficiency may be at a greater disadvantage related to potential isolation of the Hispanic community from local health care systems as a result of issues such as language access and cultural competency.

Medicare-eligible Hispanic seniors may also differ in insurance coverage, with the biggest distinctions being between fee-for-service (FFS) Medicare and Medicare Advantage (MA) plans, the managed care version of Medicare. While both Landon et al[10] and Schneider et al[3] have suggested that immunization rates are higher overall for MA beneficiaries than in FFS Medicare, African American vs white immunization disparities were not smaller in MA. It is not clear whether MA plans have since reduced immunization disparities for Hispanic seniors relative to FFS Medicare.

We estimated current pneumococcal and seasonal influenza immunization disparities for Hispanic seniors and explored potential causes: language status, linguistic isolation, presence of a long-standing Hispanic community, and type of Medicare (FFS vs MA). In doing so, we aimed to inform efforts to increase immunization among elderly Hispanic individuals.

## METHODS

### DATA SOURCE

We used the 2008 Medicare Consumer Assessment of Healthcare Providers and Systems (CAHPS) survey, a standardized survey instrument for collecting consumer assessments of care developed by the CAHPS consortium under the sponsorship of the Agency for Healthcare Research and Quality (AHRQ) and modified for the Medicare population.[11] The 2008 Medicare CAHPS survey was administered to a stratified random sample of Medicare beneficiaries as a mail survey with telephone follow-up of nonrespondents. States served as strata for FFS beneficiaries without a free-standing prescription drug plan (PDP); contracts (MA or PDP) served as strata for all other beneficiaries.

The survey is fielded in both English and Spanish. Development of the Spanish version of the 2008 Medicare CAHPS instrument involved initial professional translation, review by a bilingual committee from the CAHPS Cultural Comparability Team, and review of the adaptations specific to recent survey modifications by a professional translator experienced in CAHPS instrument design issues. The 2008 Medicare CAHPS survey was fielded mid-February through late June of 2008 with bilingual prenotification, 2 survey mailings (English by default, Spanish by request), and bilingual telephone follow-up.

### STUDY SAMPLE

We studied community-dwelling Hispanic and non-Hispanic white Medicare beneficiaries 65 years or older residing in the continental United States. Beneficiaries in Puerto Rico were excluded because prior Medicare CAHPS research has suggested that there are substantial differences in the provision of health care in Puerto Rico compared with the continental United States.[12]

The 2008 Medicare CAHPS survey yielded 318 266 complete responses from beneficiaries 65 years or older residing in the 50 states and the District of Columbia. We restricted our sample to the 247 832 respondents who reported (1) Hispanic ethnicity or (2) non-Hispanic ethnicity and only white race and (3) responded "yes" or "no" to at least 1 of the immunization questions.

### OUTCOME MEASURES

We used the 2 immunization-related Medicare CAHPS questions asked of all beneficiaries. Each had 3 response options: *Yes*, *No*, and *Don't know*.

1. "Did you get a flu shot last year, that is any time from September to December 2007?"
2. "Have you ever had a pneumonia shot? This shot is usually given only once or twice in a person's lifetime and is different from the flu shot. It is also called the *pneumococcal vaccine*."

We report 4 immunization disparity measures: *unadjusted*, *health adjusted*, *fully individually adjusted*, and *individually/regionally adjusted*.[13] Unadjusted immunization rates directly measure differences in the attainment of a guideline applicable to all seniors. Because differences in immunization rates may be associated with differences in health status, we also examine disparities after controlling for measures of health status. The third immunization disparity measure additionally controls for individual sociodemographic variables that may be related to access to care, including educational attainment and income, to better understand the influence of such factors on differences in immunization rates. The final immunization disparity measure additionally controls for geographic variation in immunization rates for seniors at the hospital referral region (HRR) level. These final disparities are thus within HRR and fully adjusted for individual characteristics.

### INDEPENDENT VARIABLES

Hispanic ethnicity was assessed using the standard Office of Management and Budget item ("Are you of Hispanic or Latino origin or descent?"). Race was also self-reported; respondents selected 1 or more options from a list. We used the survey language selected by the beneficiary (English or Spanish) as a proxy for language preference. We classified respondents as Hispanic based on the Hispanic ethnicity question only, regardless of race. Respondents were classified as non-Hispanic white if they responded "No" to the Hispanic ethnicity question and selected "white" as their only answer to the race question. Based on these variables we created 3 mutually exclusive categories: Spanish-preferring Hispanic, English-preferring Hispanic, and non-Hispanic white. In addition, our analyses used 3 sets of covariates: those related to health status are age, self-rated overall health (with 5 ordinal response options ranging from "poor" to "excellent"), and 6 chronic condition indicators (angina/coronary disease, cancer other than skin cancer, chronic obstructive pulmonary disease/emphysema/asthma, diabetes mellitus, cardiac infarction, and stroke). Those related to individual sociodemographics/access are educational attainment, dual eligibility for Medicaid, eligibility for a low-income supplement (income <150% of the federal poverty line), self-rated mental health (with 5 ordinal response options ranging from "poor" to "excellent"), and proxy respondent status (no assistance with survey completion, assistance from a proxy who did not answer for the beneficiary including translation, proxy response); and those related to general location are indicators for the nation's 306 HRRs.[14] Similar adjustment has been used for immunization and Healthcare Effectiveness Data and Information Set measures in other contexts.[15,16] Medicaid eligibility and low-income supplement status were derived from Medicare administrative files; all other covariates were derived from survey responses. We distin-



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**Table 1. Sample Characteristics 2008 Medicare CAHPS Survey, Beneficiaries 65 Years or Older in the 50 States and Washington, DC, Hispanic and Non-Hispanic White[a]**

| Characteristic | Weighted, % | | | |
|---|---|---|---|---|
| | Non-Hispanic White (n=224 387) | Hispanic, English-Preferring (n=16 676) | Hispanic, Spanish-Preferring (n=3555) | Total (N=244 618) |
| Health status measures | | | | |
| Age, y | | | | |
| 65-69 | 27 | 29 | 32 | 28 |
| 70-74 | 24 | 27 | 29 | 24 |
| 75-79 | 20 | 20 | 18 | 20 |
| 80-84 | 15 | 15 | 14 | 15 |
| ≥85 | 13 | 9 | 7 | 13 |
| Self-rated general health | | | | |
| Excellent | 9 | 9 | 12 | 9 |
| Very good | 29 | 22 | 7 | 29 |
| Good | 37 | 36 | 28 | 37 |
| Fair | 20 | 26 | 43 | 20 |
| Poor | 5 | 7 | 10 | 5 |
| Chronic conditions | | | | |
| Angina/coronary disease | 13 | 11 | 15 | 13 |
| Cancer other than skin | 18 | 14 | 17 | 18 |
| COPD/emphysema/asthma | 8 | 9 | 4 | 8 |
| Diabetes mellitus/high blood glucose | 17 | 11 | 10 | 17 |
| Cardiac infarction | 15 | 12 | 14 | 14 |
| Stroke | 23 | 37 | 36 | 24 |
| Sociodemographic measures | | | | |
| Education | | | | |
| <Eighth grade | 6 | 33 | 72 | 8 |
| Some high school | 11 | 16 | 10 | 11 |
| High school diploma/GED | 36 | 24 | 10 | 35 |
| Some college or 2-y degree | 25 | 16 | 4 | 24 |
| 4-y college graduate | 10 | 5 | 4 | 10 |
| ≥4-y college degree | 13 | 6 | 2 | 12 |
| Self-rated mental health | | | | |
| Excellent | 33 | 29 | 17 | 33 |
| Very good | 35 | 30 | 12 | 35 |
| Good | 24 | 28 | 38 | 24 |
| Fair | 6 | 11 | 30 | 7 |
| Poor | 1 | 3 | 4 | 1 |
| Proxy help | | | | |
| None | 90 | 65 | 100 | 89 |
| Proxy assisted respondent (exclude answered) | 6 | 29 | 0 | 7 |
| Proxy answered for respondent | 4 | 6 | 0 | 4 |
| Eligible for Medicaid | 1 | 5 | 9 | 1 |
| Eligible for low-income supplement | 3 | 11 | 16 | 4 |
| Insurance type | | | | |
| MA-PDP | 15 | 28 | 23 | 15 |
| MA-only | 3 | 2 | 1 | 3 |
| FFS-PDP | 37 | 44 | 64 | 38 |
| FFS-only | 45 | 27 | 11 | 44 |
| Geographic variables | | | | |
| County % Spanish, limited English proficiency, mean (SD) | 0.05 (0.51) | 0.13 (0.86) | 0.18 (0.96) | 0.05 (0.60) |
| 1990 State proportion of persons of Hispanic origin, mean (SD) | 0.08 (0.91) | 0.18 (0.92) | 0.18 (0.75) | 0.09 (0.94) |

Abbreviations: CAHPS, Consumer Assessment of Healthcare Providers and Systems; COPD, chronic obstructive pulmonary disease; FFS, fee for service; GED, General Educational Development; MA, Medicare Advantage; PDP, prescription drug plan.

[a]Sample was restricted to those who answered either influenza or pneumococcal immunization items.

guished MA and traditional FFS Medicare beneficiaries using Medicare administrative files.

## INDEPENDENT VARIABLES DERIVED FROM ADDITIONAL DATA SOURCES

To construct a measure of local-level linguistic isolation at a level that corresponds to local health care access, we linked each beneficiary to the proportion of their residential county population that both had limited English proficiency and spoke Spanish at home using 2005-2007 American Community Survey (ACS) data. For 54 053 Medicare CAHPS respondents (21.8%), this information was unavailable (all variables are suppressed by ACS for confidentiality/imprecision when the total population of an area is small), so we assigned the state mean. This variable thus measures the proportion of the



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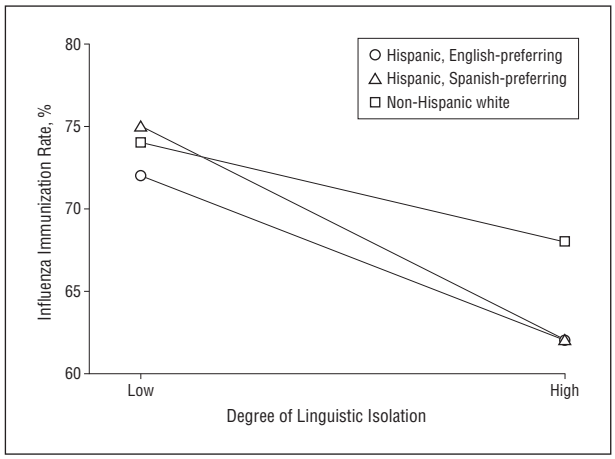


**Figure 1.** Influenza immunization for language and ethnicity groups, by degree of local linguistic isolation (derived from American Community Survey 3-year average, 2005-2007, proportion of county population having both limited English proficiency and speaking Spanish at home[18]). Points plotted in the figure are model-based estimates of the adjusted influenza immunization rates (adjusted for individual health status and sociodemographics) for beneficiaries living in counties with low or high levels of linguistic isolation (2005-2007; percentage of population that is Spanish-preferring and with limited English proficiency, 7%-32%).

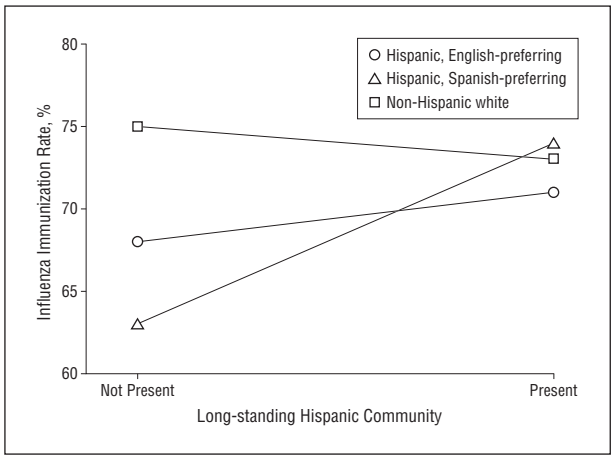


**Figure 2.** Influenza immunization for language and ethnicity groups, by extent of long-standing Hispanic community (US Census Bureau 1990; proportion of the state population with Hispanic ethnicity[19]) in state. Points plotted in the figure are model-based estimates of adjusted influenza immunization rates (adjusted for individual health status and sociodemographics) for beneficiaries living in states with or without a long-standing Hispanic community (1990; percentage of Hispanic ethnicity in state, 3%-26%).

county population needing Spanish-language health care services.

To measure the presence of a long-standing Hispanic community at a level that corresponded to public health resources for a Hispanic community and the availability of public health information and resources from within a Hispanic community, we linked each beneficiary's current address to the 1990 state-level proportion of the population that was Hispanic in the 1990 US Census. We note that the size of the Hispanic community (the state-level proportion) in 1990 was highly correlated with its 2005-2007 (ACS) size (r=0.99 weighted to the beneficiaries in our sample). In particular, states with the highest current Hispanic proportions also all had high Hispanic proportions in 1990 and vice versa. Thus, the measure of a long-standing Hispanic community can also be interpreted as measure of a currently large Hispanic community. For simplicity, we will continue to label this variable as the *presence of a long-standing Hispanic community* and return to issues of interpretations in the "Comment" section.

## STATISTICAL ANALYSIS

We compared the national proportion immunized for pneumococcal pneumonia and seasonal influenza across 3 populations: (1) Spanish-preferring Hispanic beneficiaries, (2) English-preferring Hispanic beneficiaries, and (3) non-Hispanic white beneficiaries. First, we compared the proportion immunized in groups 1 and 2 with the reference category 3 using unadjusted logistic regression. We then estimated 3 adjusted models: the first adds only health status variables; the second also adds the individual sociodemographic variables listed in the "Independent Variables" subsection and in **Table 1**; the third also adds indicators for HRRs. Results from the adjusted models are displayed as the covariate-adjusted proportion immunized (also known as "recycled predictions"[17]) and as adjusted disparities in the proportion immunized between each Hispanic group and non-Hispanic whites.

Additional models examined variations in these disparities with respect to 3 contextual factors: Medicare coverage type, linguistic isolation, and presence of an established Hispanic community. In each of these analyses we built on the individually adjusted models by adding (1) a main effect for a single contextual factor and (2) interactions of that factor with indicators of the (a) Hispanic-English and (b) Hispanic-Spanish groups (models with county-level Spanish-preferring proportions also included a flag indicating imputation). This approach allowed us to estimate whether each of these 3 contextual factors was associated with (1) higher or lower immunization rates for non-Hispanic whites (main effect) and (2) larger or smaller disparities (interactions). Because the measures of linguistic isolation and long-standing Hispanic community are continuous variables, we selected illustrative levels of each, calculate covariate-adjusted proportions at these levels, and display these model-based results graphically in **Figure 1** and **Figure 2**.

Data were weighted to represent the Medicare population within each county and MA contract, followed by a raking procedure[20] to match weighted sample distributions within each contract of 10 beneficiary characteristics available from administrative data. Control variables were missing for fewer than 2.2% of cases for all variables and were imputed as within-stratum means, where strata were states for FFS beneficiaries without Part D coverage and contracts for all others. Analyses were performed using SAS statistical software (version 9.1; SAS Inc, Cary, North Carolina) and accounted for the design effects of weights using the linearization method implemented by SAS survey procedures.[21]

## RESULTS

Sample sizes and characteristics of each of the 3 populations are presented in Table 1. Hispanic beneficiaries, especially those who were Spanish preferring, were younger, and had lower self-rated overall health than non-Hispanic white beneficiaries. Educational attainment differed greatly, with 83% of non-Hispanic white seniors, 51% of English-preferring Hispanic seniors, and 18% of Spanish-preferring Hispanic seniors having a high school diploma. English- and Spanish-preferring Hispanic seniors were approximately 4 to 9 times as likely to be eligible for Medicaid or a low-income supplement than non-Hispanic white seniors. English- and Spanish-preferring Hispanic seniors were, respectively, 6 and 12



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**Table 2. Unadjusted and Adjusted Weighted Percentages of Beneficiaries Immunized, by Hispanic Ethnicity and Language Preference**

| Racial/Ethnic Language Group | Had Influenza Shot Last Year: Percentage (95% CI) | Had Influenza Shot Last Year: Difference (95% CI)[a] | Ever Had Pneumonia Shot: Percentage (95% CI) | Ever Had Pneumonia Shot: Difference (95% CI)[a] |
|---|---|---|---|---|
| **Unadjusted** | | | | |
| Non-Hispanic white | 76 (75-76) | | 74 (73-74) | |
| Hispanic-English preferring | 68 (67-69) | 8 (7-9)[b] | 56 (55-58) | 18 (17-19)[b] |
| Hispanic-Spanish preferring | 64 (61-66) | 12 (10-14)[b] | 40 (37-43) | 33 (31-35) |
| **Adjusted for Individual Health Status[c]** | | | | |
| Non-Hispanic white | 76 (75-76) | | 73 (73-74) | |
| Hispanic-English preferring | 68 (67-69) | 8 (6-9)[b] | 56 (55-58) | 17 (16-18)[b] |
| Hispanic-Spanish preferring | 64 (62-67) | 11 (9-14)[b] | 41 (38-44) | 32 (29-35)[b] |
| **Additionally Adjusted for Individual Sociodemographics[d]** | | | | |
| Non-Hispanic white | 75 (75-76) | | 73 (73-74) | |
| Hispanic-English preferring | 71 (70-72) | 4 (3-6)[b] | 61 (60-63) | 12 (11-13)[b] |
| Hispanic-Spanish preferring | 70 (68-73) | 5 (3-8)[b] | 49 (46-52) | 24 (21-27)[b] |
| **Additionally Adjusted for Health Referral Region** | | | | |
| Non-Hispanic white | 74 | | 73 | |
| Hispanic-English preferring | 72 | 2[e] | 63 | 10[b] |
| Hispanic-Spanish preferring | 74 | 0 | 54 | 18[b] |
| **Sample Size** | | | | |
| Non-Hispanic white | 222 969 | | 213 659 | |
| Hispanic-English preferring | 16 439 | | 14 942 | |
| Hispanic-Spanish preferring | 3508 | | 3201 | |

Abbreviation: CI, confidence interval.
[a] Differences are with respect to non-Hispanic white group.
[b] $P < .001$.
[c] Self-reported health status, 6 chronic disease indicators, age.
[d] Educational attainment, proxy respondent status, dual eligibility for Medicaid, eligibility for a low-income supplement (income <150% of the federal poverty level), mental health, and Centers for Medicare and Medicaid Services region of residence.
[e] $P < .01$.

percentage points more likely to be enrolled in an MA plan than non-Hispanic white seniors.

**Table 2** presents current immunization rates. Three-fourths (76%) of non-Hispanic white seniors reported receiving an influenza immunization in the past year compared with 68% of English-preferring and 64% of Spanish-preferring Hispanic seniors ($P < .001$ for disparities). Three-fourths (74%) of non-Hispanic white seniors also reported ever receiving a pneumonia vaccine, but considerably fewer Hispanic seniors did so—56% of English-preferring and 40% of Spanish-preferring Hispanics—differences of 18 and 33 percentage points, respectively ($P < .001$ for all comparisons).

Immunization differences were reduced 1 percentage point or less by adjusting for differences in health status. Larger reductions in these disparities are seen after further adjusting for individual sociodemographic characteristics (with education and income especially important), but large and statistically significant disparities remain. Overall, approximately one-third of the Hispanic/non-Hispanic white pneumococcal immunization disparities and one-half of the influenza immunization disparities appear to be related to differences in sociodemographic characteristics. Adjusting additionally for HRRs further reduced estimated immunization disparities. The within-region disparities for influenza immunization were one-quarter the size of the unadjusted disparity for English-preferring Hispanics and were not statistically significant for Spanish-preferring Hispanic seniors ($P = .84$). The within-region pneumonia immunization disparities, while still large and statistically significant, were reduced to almost one-half the unadjusted disparities ($P < .001$ both comparisons).

**Table 3** compares MA and FFS immunization rates. For both Spanish- and English-preferring Hispanic seniors, health status–adjusted influenza immunization disparities were generally similar for MA and FFS, with influenza immunization rates fairly similar across coverage type within each of the 3 demographic groups. Seasonal influenza immunization disparities were slightly larger for English-preferring Hispanics in FFS Medicare than in MA ($P < .01$). Disparities for pneumococcal immunizations were consistently larger in FFS than in MA (Hispanic-English, $P < .001$; Hispanic-Spanish, $P < .05$) due to lower FFS than MA pneumococcal immunization rates for Hispanic seniors.

Figure 1 shows the relationship between seasonal influenza immunization rates and the degree of local linguistic isolation that exists, adjusted for individual health status and sociodemographic characteristics. As these models seek to explain some of the observed geographic variation, they do not directly control for HRR. On the left side of the figure are adjusted immunization rates corresponding to areas with low levels of linguistic isolation (7% of the county population preferred Spanish and had low English proficiency [LEP], which is the 25th per-



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**Table 3. Adjusted Weighted Percentages of Beneficiaries Immunized, by Managed Care Status, Hispanic Ethnicity, and Language Preference[a]**

| Coverage Type | Had Influenza Shot Last Year | | | Ever Had Pneumonia Shot | | |
|---|---|---|---|---|---|---|
| | Non-Hispanic White | Hispanic, English-Preferring | Hispanic, Spanish-Preferring | Non-Hispanic White | Hispanic, English-Preferring | Hispanic, Spanish-Preferring |
| **Adjusted for Individual Health Status[b]** | | | | | | |
| Overall | 75 | 68 (7)[c] | 64 (11)[c] | 73 | 56 (17)[c] | 41 (32)[c] |
| FFS | 76 | 67 (8)[c] | 65 (10)[c] | 74 | 55 (19)[c] | 40 (34)[c] |
| MA | 75 | 69 (6)[c] | 62 (13)[c] | 75 | 61 (14)[c] | 46 (29)[c] |
| **Additionally Adjusted for Individual Sociodemographics[d]** | | | | | | |
| Overall | 75 | 70 (5)[c] | 70 (5)[c] | 73 | 60 (13)[c] | 49 (24)[c] |
| FFS | 76 | 70 (5)[c] | 71 (4)[e] | 73 | 60 (14)[c] | 48 (25)[c] |
| MA | 74 | 72 (2)[c] | 69 (5)[c] | 74 | 65 (9)[c] | 55 (19)[c] |
| **Sample Size** | | | | | | |
| FFS | 94 736 | 4549 | 1126 | 91 038 | 4134 | 1026 |
| MA | 128 233 | 11 890 | 2382 | 122 621 | 10 808 | 2175 |

Abbreviations: FFS, fee for service; MA, Medicare Advantage.
[a] Unless otherwise indicated, data are reported as percentage (difference in percentage) from non-Hispanic whites.
[b] Self-reported health status, 6 chronic disease indicators, age.
[c] $P<.001$.
[d] Educational attainment, proxy respondent status, dual eligibility for Medicaid, eligibility for a low income supplement (income below 150% of the federal poverty level), mental health, and Centers for Medicare and Medicaid Services region of residence.
[e] $P<.05$.

centile of Spanish/LEP for Hispanic seniors). Seasonal influenza immunization rates corresponding to areas with high linguistic isolation (32% of the county population preferred Spanish and had LEP, the 90th percentile of Spanish/LEP for Hispanic seniors) are on the right side of the figure. At low levels of linguistic isolation, there was no statistically significant immunization disparity for either group of Hispanic seniors. At high levels of linguistic isolation, similar to what is seen in some agricultural regions in Texas and California, influenza immunization rates were lower for all groups, but they were lower to a greater extent ($P<.05$) for both Hispanic groups, resulting in pronounced disparities. For pneumococcal immunization (results not displayed), counties with greater linguistic isolation again corresponded to lower immunization rates for all groups and significantly greater disparities for English-preferring Hispanic seniors ($P<.05$), but statistically significant disparities existed at all observed levels of linguistic isolation.

The relationship between seasonal influenza immunization rates, adjusted for individual health status and sociodemographics, and living in a long-standing Hispanic community are displayed in Figure 2. On the left are model-based estimates of adjusted rates in states where there is not an appreciable long-standing Hispanic community (3% of the 1990 state population was Hispanic, the 10th percentile for Hispanic seniors); on the right are model-based estimates of adjusted rates in states where a sizable long-standing Hispanic community exists (26% of the 1990 state population was Hispanic, the 90th percentile for Hispanic seniors). Regardless of language preference, Hispanic seniors living in areas that do not have a long-standing Hispanic community had much lower immunization rates than white seniors ($P<.001$). In contrast, immunization disparities were small to nonexistent among seniors living in areas with long-standing Hispanic populations, due both to large increases in immunization rates for both groups of Hispanic seniors and a small decrease in immunization rates for non-Hispanic white seniors ($P<.001$). For pneumococcal immunization (results not shown), the presence of a sizeable long-standing Hispanic community was associated with lower pneumococcal immunization rates for all groups, with no evidence of varying disparities.

## COMMENT

Substantial disparities in both influenza and pneumococcal immunization rates persist for Hispanic seniors. Using the 2008 Medicare CAHPS survey with its large sample size, we were able to examine factors that may represent contributing causes for these disparities. These factors, in turn, may be particularly actionable in focusing efforts to increase immunization of Hispanic seniors.

Consistent with prior work,[7] we find strong evidence that language preference is an important factor for immunization, with considerably larger disparities for Spanish-preferring than English-preferring Hispanic seniors. While approximately 75% of non-Hispanic white seniors received both recommended influenza and pneumococcal immunizations, rates for English- and Spanish-preferring Hispanic seniors were, respectively, 8 and 12 percentage points lower for influenza and 18 and 33 percentage points lower for pneumococcal immunizations. These disparities do not appear to be related to differences in health status and are only partly explained by sociodemographic differences between the populations. However, adjusting for these factors plus regional differences in immunization rates using HRRs explains all or nearly all of the seasonal influenza immunization disparities but less than half of the pneumonia disparities.



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Two hypothesized geographic factors captured much of this geographic variation and in addition were associated with the observed disparities. First, living in Spanish-speaking, linguistically isolated areas was associated with significantly *larger* white-Hispanic immunization disparities compared with nonlinguistically isolated areas, regardless of language preference. Furthermore, immunization rates were lower for both Hispanic and white seniors in such areas. Second, we found that the presence of a long-standing Hispanic community was associated with significantly *smaller* disparities in influenza immunization, regardless of language preference. Immunization rates were much higher for Hispanic seniors and slightly lower for white seniors in such areas.

Finally, in some cases, disparities varied by type of Medicare plan, with Hispanic seniors in MA plans having higher pneumococcal immunization rates and experiencing lower white-Hispanic disparities than those in traditional FFS Medicare, regardless of language preference. This finding suggests that the structural advantages of managed care with respect to uniform preventive care[10] may be somewhat more advantageous to Hispanic seniors.

While all of the disparities are striking, disparities for pneumococcal immunization are consistently larger than those for influenza immunization, with large disparities remaining even within local areas. In contrast to the annual influenza immunization recommendation, pneumococcal immunization is recommended once for all seniors on turning 65 years old, potentially making receipt of this vaccination more sensitive to continuity of care or having a medical home. Prior work has suggested that Hispanics, especially those with limited English proficiency, face greater barriers to continuity of care.[6]

These findings have important implications for increasing immunization among Hispanic seniors, suggesting that further efforts are needed to improve cultural and linguistic access to care. In particular, geographic targeting of the subgroups at greatest risk, in combination with surname lists[22] and health literacy mapping, may help optimize outreach and targeting of vaccine resources.[23] These findings are thus particularly actionable, suggesting that use of the ACS to identify areas that are linguistically isolated or that represent new destination areas for Hispanics (areas with relatively small historic and current Hispanic populations) may identify areas with both high immunization disparities and low immunization rates for white seniors. Information about these high-risk areas (eg, agricultural areas in the Southeast) could then be shared with immunization partners in the public and private sectors (eg, local health departments, chain pharmacies offering immunization) as well as in the health care system, and efforts at reaching those who are linguistically isolated could be prioritized. During vaccination season, the Centers for Medicare and Medicaid Services (CMS) could produce biweekly estimates of vaccination coverage in these high-risk areas to provide feedback on improvement efforts. Harris et al[24] recently demonstrated the viability of "real-time" influenza prevalence estimates by racial/ethnic and age subgroups during the influenza season that can be used to monitor progress toward such benchmarks.[25] At the same time, educational efforts that aim to increase demand for immunization in these areas are also needed.

While the data source we used has many advantages, our findings may be affected by 3 limitations. First, receipt of immunization is self-reported; while research has shown little evidence of bias in self-reporting immunization, there is some risk of recall bias or other error.[26] Second, we were not able to clearly determine if nonresponse to Medicare CAHPS differed by Hispanic ethnicity/language preference, given limitation in CMS Administrative data. However, it is likely that survey nonrespondents were also on average less likely to be immunized than respondents. Thus, if the nonresponse rate was higher for Hispanic seniors, especially those who were Spanish preferring, than for non-Hispanic whites (which is also likely), true disparities may be larger than what we report herein. Finally, using state-average linguistic isolation information as a substitute for county-level information for one-fifth of our sample may have underestimated its true association with immunization.

The magnitude of the disparities, the rapid growth and mobility of the Spanish-preferring population, and the fact that immunization saves lives highlight the need for targeted interventions to address these disparities. Tools now exist to identify populations at risk of significant immunization disparities. As can be seen from the relatively low uptake of 2009 H1N1 vaccine and high mortality from the disease among Hispanics,[27] it is critical to do something about these disparities in immunization.

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**Correspondence:** Marc N. Elliott, PhD, RAND Corp, 1776 Main St, Santa Monica, CA 90401 (elliott@rand.org).
**Author Contributions:** Drs Haviland and Elliott had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Haviland, Elliott, and Lurie. *Acquisition of data:* Elliott. *Analysis and interpretation of data:* Haviland, Elliott, Hambarsoomian, and Lurie. *Drafting of the manuscript:* Haviland, Elliott, and Lurie. *Critical revision of the manuscript for important intellectual content:* Haviland, Elliott, Hambarsoomian, and Lurie. *Statistical analysis:* Haviland, Elliott, and Hambarsoomian.
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## *Correction*

**Error in Wording.** In the research letter titled "Suboptimal Potassium Intake and Potential Impact on Population Blood Pressure" by van Mierlo et al, published in the September 13 issue of the *Archives* (2010;170[16]: 1501-1502), an error occurred in the "Results" section, where the third sentence should have read "This is in the same order of what can be predicted for a reduction in salt [rather than sodium] intake from 9 to 5 g/d."



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