

RESEARCH ARTICLE

# What's in a word? Language and self-assessed health in the National Health and Nutrition Examination Survey

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**Abstract:** This study examines the extent to which the Spanish language influences the way in which respondents report health using the ubiquitous self-assessed health (SAH) outcome. We account for citizenship status, ethnicity, and a series of other covariates. The study uses the 2003-2016 national health and nutrition examination survey (NHANES) ( $n=39,107$ ). Analyses treat SAH as non-ordered categorical and employ multinomial regressions. Results indicate that those answering in Spanish are considerably and significantly more likely to rate health as “fair/regular” *ceteris paribus*. Non-U.S. citizens and naturalized citizens are significantly more likely to rate their health favorably in comparison to U.S.-born; those identifying as Hispanic, Black, and other/multiracial are likely to rate health less favorably than others regardless of citizenship or interview language. A model that examines only foreign-born and accounts for years lived in the U.S. shows Spanish language still strongly predicted SAH outcomes, but years spent in the U.S. did not, a finding that does not support notions of acculturation. The study concludes that there is a language bias in the standard SAH measure typically used national-level health surveys and national-level surveys such as NHANES should adjust the question translation to better understand the health of immigrants.

**Keywords:** *self-assessed health; citizenship status; immigrant health; National Health and Nutrition Examination Survey; survey language*

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## 1. Introduction

This paper contributes to literature aiming to understand how language influences how health is reported and subsequently interpreted, and how the intersection of language, citizenship, and ethnicity shape perceptions of immigrants' health in the U.S. Uncertainty surrounding health status and health-care utilization of immigrant populations in the U.S. amidst today's shifting health and immigration policies makes these issues particularly timely and salient for health researchers and policymakers alike. Because immigrants from Mexico and Central America represent the largest proportion of foreign-born individuals living in the U.S., understanding the health status and challenges facing the nation's Hispanic communities – one-third of whom were born abroad (Pew, 2016) – is especially important. (We use the term “Hispanic” rather than Latinx, Chicano/a, or specific national origins because it follows the ethnicity categories provided in the National Health and Nutrition Examination Survey (NHANES) and suits analysis of the Spanish survey language.) Further, additional barriers to health care access may exist among foreign-born Hispanics who do not speak English; yet only 34% of foreign-born Hispanics report speaking English proficiently (Pew, 2015).

Specifically, this study looks at whether an evaluation of someone's health status, using a self-assessed health (SAH) survey question as a health outcome measure, varies if the SAH question is asked in Spanish versus in English. The topic of this study gains significance given earlier research that has exposed a "Hispanic paradox" in which Hispanic immigrants experience better health relative to U.S.-born citizens of similar socioeconomic status (Markides and Coreil, 1986). Yet this paradox is increasingly subject to debate on multiple counts (Abraido-Lanza, Dohrenwend, Ng-Mak *et al.*, 1999; Franzini, Ribble, and Keddie, 2001; Palloni and Arias, 2004; Markides and Eschbach, 2005; Smith and Bradshaw, 2006; Rubalcava, Teruel, Thomas *et al.*, 2008). There is also evidence of poorer health among Hispanics born in the U.S. or who have resided in the U.S. at length (Cho, Frisbie, Hummer *et al.*, 2004; Vega, Rodriguez, and Gruskin, 2009). Further, research has indicated that the intersecting characteristics of being an immigrant, becoming racialized as a U.S. minority, and having limited English proficiency have consequences for health (DuBard and Gizlice, 2008; Vega, Rodriguez and Gruskin, 2009).

This line of inquiry into health disparities across categories of ethnic and citizenship status involves considerable debate over how to best measure the health status of immigrants, particularly those who do not speak English or do not speak it well (Finch, *et al.*, 2002; DuBard and Gizlice, 2008; Lee and Schwartz, 2014; Sanchez and Vargas, 2016). A number of standard health measures – such as mortality, service utilization, and birth weight – involve statistical and practical challenges among migrating populations. These include the likelihood of multiple border crossings and return migration, unavailability of birth and death records, inconsistent measurement of Hispanic populations, misclassification of Hispanic deaths, and mistranslation of healthy surveys (Abraido-Lanza, Dohrenwend, Ng-Mak *et al.*, 1999; Franzini, Ribble and Keddie, 2001; Palloni and Arias, 2004; Markides and Eschbach, 2005; Smith and Bradshaw, 2006; Rubalcava, Teruel, Thomas *et al.*, 2008).

SAH, based on a survey question that asks someone to simply rate their health overall on a simple scale from excellent to poor, has become standard on health surveys (Chirinda, Saito, Gu and Zungu, 2018). This global snapshot survey item may address some of the challenges involved in measuring migrant population health. SAH is commonly considered to be an economical, simple, quick to administer, and easily translatable indicator that can be validly and reliably employed across languages and cultures (Maddox and Douglass, 1973; Mossey and Shapiro, 1982; Kaplan and Camacho, 1983; Idler and Benyamini, 1997). SAH has been found to accurately predict mortality, even when controlling for demographic, socioeconomic, other health, and psychological factors (DeSalvo, Bloser, Reynolds, *et al.*, 2005; Idler and Benyamini, 1997). Given that SAH is thought to be a valid global health measure, it may not be subject to the same population-level measurement challenges as other indicators. Its advantages mean SAH could be a helpful gauge for studying inequalities across heterogeneous populations that vary by primary language.

Nevertheless, the degree to which SAH can be used in comparative research is unclear. Studies have suggested that SAH may be differentially perceived across cultures, ethnicities, and languages such that people with similar objective health measures may subjectively assess their health differently (Angel and Guarnaccia, 1989; Jylhä, Guralnik, and Ferrucci, 1998; Shetterly, Baxter, Mason *et al.*, 1996; Lee and Schwartz, 2014). Attitudes, perceptions, and interpretations of health vary across time and individual characteristics such as age, sex, and education (Ren and Amick, 1996; Zajacova and Dowd, 2011). Thus, it may be difficult to make cross-country and cross-linguistic assessments of health disparities using SAH (Jylhä, 2009; Zimmer, Natividad, and Lin *et al.*, 2000).

A small number of recent studies has explored the likelihood that immigrants who take a health survey in Spanish interpret the SAH scale differently, and these suggest reasons to be cautious. Shetterly, Baxter, Mason *et al.* (1996) analyzed a small sample of 419 Hispanic and 583 non-Hispanic white respondents of the San Luis Valley Health and Aging Study and found that when controlling for health conditions, Hispanics were 3.6 times more likely to report fair to poor health than non-Hispanic white respondents. (Notably, however, their study collapsed the "fair" and "poor" category.) Bzostek, Goldman, and Pebley (2007) examined data from approximately 3000 households from the Los Angeles Family and Neighborhood Survey conducted between 2000 and 2002. Their results suggested that the Spanish interview language, but not Spanish household language, is associated with a worse rating of SAH, suggesting that translational issues influence comparisons of health status. Viruell-Fuentes, Morenoff, Williams *et al.* (2011) analyzed data from the Chicago Community Adult Health Study, collected in 2001-2003, and the Behavior Risk Factor Surveillance System, collected in 2003. Their results showed that adjusting for interview language reduces a gap in SAH between Latino and white respondents. Finally, Sanchez and Vargas (2016) used data from the 2011 Latino Decisions survey to conduct a built-in language experiment comparing multiple translations of SAH in a nationally representative dataset of 1200 Latinos. They demonstrated that there is a problem with the response "fair" SAH when termed as regular in Spanish, which is how key agencies, such as the U.S. Centers for Disease Control (CDC) and Prevention, normally translate the word.

Our study builds on this extant literature in several ways. First, earlier studies (such as Shetterly, Baxter, Mason *et al.*, 1996) commonly dichotomized the measure or considered SAH as an ordered variable. Collapsing categories forces

response with different meanings into a single group. Ordered treatments are problematic if the conceptual distance between categories differs across languages. For example, the conceptual distance English speakers perceive between good and fair may be greater than the difference Spanish speakers perceive between Buena and regular. To address this limitation, the present study models SAH as a nominal measure with multiple categories.

Second, our study addresses “acculturation,” which many scholars account for when considering health disparities between immigrants and native-born populations. Acculturation supposedly signals degrees of immigrant integration into the receiving country’s characteristic “culture” – including language, behaviors, and social norms. However, the concept has been considered atheoretical and vague (Abraído-Lanza, Armbrister, Flórez *et al.*, 2006), and a systematic review by Hunt, Schneider, and Comer (2004) concludes that its application is highly variable since the constituents of a culture, differences between ethnic and “mainstream” culture, and what cultural adaptation means have not been adequately described. Rather than engaging with ill-defined notions of culture, we follow DuBard and Gizlice (2008) and Kimbro, Gorman, and Schachter (2012) in assessing acculturation by time spent in the U.S.

Third, we examine the phenomenon using a large nationally representative, inclusive and contemporary, dataset associated with the CDC, the NHANES, providing a higher level of statistical power than any such study to date. Earlier studies considered small samples and samples that were generally geographically limited. The large number of observations in our analysis, which spans the years 2003-2016, allows us to divide our sample by survey language, foreign nativity, immigrant status, and years lived in the U.S. to account for the multifaceted nature of immigration and health while maintaining statistical power. Using this dataset, our study asks: (1) Is there a significant association between survey language and SAH? (2) Is the association mediated by citizenship status? (3) Do associations hold when accounting for ethnic variation?

## 2. Data and Method

### 2.1 Data

The National Center for Health Statistics conducts NHANES biennially to assess the health and nutrition status of the civilian non-institutionalized U.S. population. Sampling follows a cross-sectional, multistage, stratified, and clustered design. To increase the number of surveys conducted in Spanish and among immigrants, our analysis aggregates data from the 2003 to 2016 surveys. The sample size across these surveys is 39,221 observations age 20 and older, which is reduced to 39,107 valid observations after deleting cases where citizenship status and SAH is unknown. This valid N includes over 3600 interviews conducted in Spanish and over 3400 among non-U.S. citizens. Weights included in NHANES data are applied in this analysis.

### 2.2 Measures

SAH is registered in NHANES as a response to the question, “would you say your health in general is ... ?/¿Diría usted que su salud en general es ...?” Responses are scored along the following (English/Spanish) scale: Poor/mala, fair/regular, good/buena, very good/muy buena, and excellent/excelente. Missing responses (including “do not know” or “refused”) represented <0.1% of total responses and were therefore excluded. For the remainder of this paper, we use the English terms to describe these categories; however, the Spanish categories are used when the survey language is Spanish.

Across survey waves, NHANES includes four standard responses to the question, “are you a citizen of the United States?”: “Citizen by birth or naturalization,” “not a citizen of the U.S.,” “do not know,” and “refused.” Those in the latter two categories represented <0.2% of total responses and were therefore removed from the study. Data on country of birth were then used to separate the U.S.-born citizens from naturalized while the non-citizen category remained intact. Unweighted N’s for these categories are 28,474 (82.9%); 5012 (7.9%); and 5621 (9.2%), respectively. Citizenship categories were converted into dichotomous variables, with U.S.-born used as the comparison category in multivariate models. Across all survey years examined here, ethnicity/race (NHANES does not distinguish between these constructs) is categorized as: Hispanic, Non-Hispanic white, non-Hispanic black, and other race – including multi-racial. The survey includes two different categories for Hispanic respondents: “Mexican American” and “other Hispanic.” Our analysis indicated that results do not differ significantly across these groups; therefore, we consider them together. Survey language is dichotomized into English and Spanish. Time lived in the U.S. is measured categorically in NHANES. For this study, four categories were created: <5 years, 5-10 years, 10-20 years, and 20 or more years.

Models adjust for other demographic and socioeconomic variables. Age was converted into decades to capture any nonlinear association with SAH (20-29, 30-39, 40-49, 50-59, 60-69, and 70+) and treated as a categorical variable. Sex

is dichotomous. Models include marital status (married vs. not married) and whether the respondent has health insurance (measured dichotomously). Income in NHANES is represented by annual family income across 17 categories. These were recorded into approximate terciles and called low, middle, and high. Missing income was included as a separate category. Education is coded in four categories: Less than high school, high school, some college, and completed college.

## 2.3 Statistical Analysis

The multivariate analysis employs a multinomial logistic regression model that treats each category of SAH as separate and unordered. Doing so avoids collapsing meaningfully different responses and allows for the possibility that responses may not be ordered along a scale with equidistant intervals – a likely outcome of inaccurate translation. In the multinomial model, each category of the outcome variable is compared against a single baseline. SAH is made up of five categories (poor, fair, good, very good, and excellent). The category excellent is chosen as the constant baseline, and the regression procedure compares the likelihood of being in any of the other four categories relative to the baseline, which is relative to excellent. Results are presented as log-odds ratios which center on zero such that negative coefficients indicate a negative association or lower likelihood of being in that category relative to the baseline, and positive coefficients indicate a positive association or higher likelihood. The exponent of the log-odds is the odds ratios. Three regression models are considered. Model 1 examines the association between survey language and SAH. Model 2 adds citizenship status to assess whether and how it mediates the association between survey language and SAH. Model 3 adds ethnicity. The -2LL deviation statistics is used to assess whether the added variables improve predictive capacity. To test for acculturation, a separate analysis, which only includes non-U.S. born respondents ( $n=6,457$ ), assesses whether time spent in the U.S. influences relationships between survey language and SAH by including a measure for years in the U.S. In general, we report three  $P$ -value levels of significance;  $0.05 < P < 0.10$ ;  $0.01 < P < 0.05$ ; and  $P < 0.01$ . All procedures are run using SPSS version 25.

## 3. Results

Table 1 provides distributions for all study variables for the total sample and across citizenship status. The sample consists of about 13% identifying as Hispanic, although about 60% of non-citizens are Hispanic. About 6% of the surveys were conducted in Spanish, but about half of the non-citizens completed the survey in Spanish.

Table 2 shows SAH distributions across the three variables of greatest interest in this analysis: Citizenship, ethnicity, and language of the survey. Chi-square statistics are provided to indicate whether differences in SAH are statistically significant across categories of citizenship status, ethnicity, and survey language. There are substantial differences across categories of these measures. The greatest contrast is seen with respect to language. While there is little difference

in percent rating their health as poor, almost 3 times as many Spanish (37.2%) versus English (13.0%) speakers rate their health as fair, and a greater percentage of those answering the survey in Spanish rate their health as good (40.6% vs. 33.8%). In contrast, far more English speakers rate their health as very good or excellent. Non-citizens are far more likely to rate their health as fair (23.3%) than either U.S. (13.2%) born or naturalized citizens (17.3%). Furthermore, U.S. born citizens are somewhat more likely than others to rate their health as excellent or very good. With respect to ethnicity, Hispanics are far more likely to rate their health as fair in comparison to those in other categories. White respondents rate their health best overall, with higher percentages in the very good and excellent category.

Multinomial models are presented in Table 3. While full models included a series of control variables (sex, age, marital status, insurance status, education, income, and year of survey), only the results that are most pertinent to this analysis are presented for parsimonious reasons: Language of interview, citizenship status, and ethnicity. The SAH category “excellent” is the contrast or baseline across all models, and therefore, all coefficients must be interpreted relative to the contrast category “excellent.” Model 1 indicates that in comparison to English speakers, respondents who take the survey in Spanish are significantly more likely to rate their health unfavorably. The most striking difference is in the category fair, which Spanish respondents are much more likely to select ( $\beta=+1.086$ ;  $p<0.01$ ) as opposed to excellent. When citizenship status is added in Model 2, the propensity among Spanish respondents to rate their health as “fair” becomes even more pronounced ( $\beta=+1.262$ ;  $p<0.01$ ). Yet this model also demonstrates that, when accounting for survey language, non-citizens and naturalized citizens are more likely than the U.S. born to rate their health favorably.

When ethnicity is added in Model 3, the effect of survey language persists. Spanish speakers, as opposed to English speakers, are still far more likely to rate their health as fair ( $\beta=+1.187$ ;  $p<0.01$ ). The effect of citizenship status becomes even more pronounced than in Model 2. Non-citizens and naturalized citizens are significantly more likely to report favorable health in comparison to U.S. born when ethnicity is taken into consideration, a strong indication that any relationship

**Table 1: Per cent distribution of study variables by citizenship status<sup>1</sup>**

Category	Total	U.S. born	Naturalized	Non-citizen
<b>N</b>	39,107	28,474	5,012	5,621
<b>Ethnicity</b>				
Hispanic	13.4	6.1	35.1	60.3
White	68.1	78.3	23.9	13.9
Black	11.4	12.3	8.8	5.8
Other	7.1	3.3	32.2	20.1
<b>Spanish language</b>	6.2	0.3	16.9	49.6
<b>Female</b>	51.9	52.4	53.1	47.0
<b>Age</b>				
20-29	18.9	18.8	11.0	26.0
30-39	18.2	17.0	18.1	29.4
40-49	19.7	19.0	23.2	22.9
50-59	18.2	18.6	20.2	12.5
60-69	12.8	13.6	13.7	5.4
70+	12.2	13.0	13.7	3.8
<b>Not married</b>	44.5	45.6	35.8	41.3
<b>Uninsured</b>	18.1	14.6	16.8	51.2
<b>Income</b>				
Lowest	34.8	33.3	31.9	50.9
Middle	32.0	32.3	32.0	29.0
Highest	29.6	31.4	30.1	13.2
Missing	3.5	2.9	6.1	6.9
<b>Education</b>				
Less than high school	17.3	13.7	22.2	45.6
High school	23.2	24.4	17.6	17.1
Some college	31.4	33.5	26.9	17.0
Completed college	28.1	28.5	33.2	20.3
<b>Survey year</b>				
2003/04	13.4	13.7	10.6	13.2
2005/06	13.7	14.0	10.8	13.2
2007/08	14.0	14.1	13.9	13.0
2009/2010	14.3	14.0	15.5	14.3
2011/2012	14.5	14.4	15.4	14.5
2013/2014	14.9	14.9	17.0	13.4
2015/2016	15.2	15.0	16.7	15.2
<b>Years in the U.S. (among non-U.S. born)</b>				
0-5	14.1	---	1.7	24.8
5-10	14.9	---	5.5	23.0
10-20	27.4	---	22.8	31.3
20+	43.7	---	70.0	20.9

<sup>1</sup>Total N's unweighted; distributions weighted.

**Table 2.** Percent distribution of self-assessed health by citizenship status, ethnicity and Spanish language.

Category	Poor	Fair	Good	Very good	Excellent	Total
Total	3.5	14.5	34.2	31.2	16.6	100.0
Citizenship status						
U.S. born	3.4	13.2	33.4	33.1	16.9	100.0
Naturalized	3.6	17.3	37.9	24.8	16.4	100.0
Non-citizen	3.9	23.3	38.9	19.9	14.0	100.0
Chi-square	533.3**					
Ethnicity						
Hispanic	4.7	25.7	39.8	18.3	11.5	100.0
White	3.1	11.5	32.3	35.0	18.1	100.0
Black	4.3	19.2	37.6	24.7	14.2	100.0
Other	3.4	14.5	36.9	29.6	15.6	100.0
Chi-square	1428.9**					
Survey language						
English	3.4	13.0	33.8	32.6	17.2	100.0
Spanish	5.1	37.2	40.6	9.6	7.4	100.0
Chi-square	1484.5**					

\*\* $p < 0.01$  \* $0.01 < p < 0.05$ .

**Table 3.** Multinomial regression results predicting self-assessed health, showing log odds coefficients<sup>1</sup>.

Category	Model 1				Model 2				Model 3			
	Poor	Fair	Good	Very good	Poor	Fair	Good	Very good	Poor	Fair	Good	Very good
	Versus excellent				Versus excellent				Versus excellent			
Spanish language (vs. English)	0.409**	1.086**	0.545**	-0.357**	0.523**	1.262**	0.527**	-0.195 <sup>†</sup>	0.297	1.187**	0.478**	-0.117
Citizenship (vs. US born)												
Naturalized					-0.107	-0.042	0.104 <sup>†</sup>	-0.242**	-0.488**	-0.416**	-0.122 <sup>†</sup>	-0.299**
Non-citizen					0.145	-0.269**	0.007	-0.198**	-0.496**	-0.609**	-0.204**	-0.258**
Ethnicity (vs. white)												
Hispanic									0.716**	0.604**	0.351**	-0.032
Black									0.216*	0.478**	0.230**	-0.107 <sup>†</sup>
Other									0.748**	0.820**	0.487**	0.185**
Deviation statistic <sup>2</sup>	7221.2 <sup>3</sup>				7459.8** <sup>4</sup>				12004.6** <sup>4</sup>			

\*\* $p < 0.01$  \* $0.01 < p < 0.05$  <sup>†</sup> $0.05 < p < 0.10$ . <sup>1</sup>All models also control for sex, age, income, insurance status, marital status, education, and year of survey. Full results are available on request. <sup>2</sup>Difference in log-likelihoods X -2. <sup>3</sup>Compared to the intercept only model. <sup>4</sup>Compared to the previous model.

between citizenship and SAH would be misinterpreted if ethnicity was not considered. Hispanic, black, and other/multiracial respondents are far more likely to rate their health in categories poor, fair, and good as opposed to excellent than are white respondents, indicating poorer self-reported health for these groups when citizenship status and language is controlled.

A large number of the other model covariates not shown in tabular form have significant associations with SAH. The notable associations are as follows: Age is significant, generally getting worse with increased age, although the magnitude

of coefficients levels off after about age 50. This suggests that the relationship between age and SAH is not linear; a result is consistent with other research (Rubin and Zimmer, 2015). Income and education are consequential. High education and high income are strongly and significantly associated with a higher likelihood of rating one’s health favorably. The opposite trend is true for low education and low income. This finding aligns with the broader literature that finds that socioeconomic status is positively correlated with SAH (van Doorslaer, Wagstaff, Bleichrodt *et al.* 1997; Huisman, van Lenthe, Mackenbach *et al.*, 2007). Interestingly, there are some temporal differences in SAH rating in NHANES as well. Compared to 2003/04, respondents in later years increasingly tend to rate their health significantly less favorably. Overall, this suggests a worsening of SAH over time, an issue that is somewhat puzzling but may be important for future research. These additional results are available from the authors on request.

Marginal effects for citizenship status, language, and ethnicity are provided in Table 4. Marginal effects for the comparison categories (U.S. born, English language, and white) are set at zero, and the values for other categories indicate

**Table 4.** Marginal effects of citizenship status, language, and ethnicity on the probability of being in each category of SAH.

Category	Self-assessed health					Total
	Poor	Fair	Good	Very good	Excellent	
Citizenship						
U.S. born	0.000	0.000	0.000	0.000	0.000	0.000
Naturalized	-0.007	-0.023	+0.029	-0.028	+0.030	0.000
Non-citizen	+0.006	-0.041	+0.008	-0.008	+0.035	0.000
English language						
Spanish language	-0.003	+0.155	+0.028	-0.127	-0.053	0.000
Ethnicity						
White	0.000	0.000	0.000	0.000	0.000	0.000
Hispanic	+0.015	+0.054	+0.044	-0.077	-0.035	0.000
Black	+0.002	+0.050	+0.037	-0.069	-0.021	0.000
Other	+0.010	+0.065	+0.038	-0.060	-0.054	0.000
Sample probability	0.024	0.127	0.359	0.312	0.177	1.000

SAH: Self-assessed health.

**Table 5.** Multinomial regression results for citizenship status, language, ethnicity, and years in the U.S. among non-U.S. born only, showing log odds ( $n=6457$ )<sup>1</sup>.

Category	Poor	Fair	Good	Very good
	Versus excellent			
Citizenship(vs. naturalized)				
Non-citizen	0.150	0.027	0.000	0.120
Spanish language (vs. English)	0.746**	1.494**	0.642**	0.048
Ethnicity (vs. White)				
Hispanic	-0.053	0.239	0.325*	-0.049
Black	-0.877*	-0.188	-0.040	-0.218
Other	0.000	0.559**	0.514**	0.196†
Years in the U.S.				
0-5	0.436	-0.224	-0.008†	-0.182
5-10	0.417	-0.096	-0.094	-0.144
10-20	0.203	0.008	0.003	-0.101

\*\* $p < 0.01$  \* $0.01 < p < 0.05$  † $0.05 < p < 0.10$ . <sup>1</sup>All models also control for sex, age, income, insurance status, marital status, education, and year of survey. Full results are available on request.

the difference in the probability of being in a specific category of SAH relative to that category, all else being equal. For instance, the probability that a naturalized citizen reports poor SAH is 0.007 points (i.e., 0.7 percentage points) lower than the probability for a U.S. born citizen. By design, the marginal effects across categories total zero, and therefore, it is relatively straightforward to determine into which categories of SAH an individual are more likely to be in comparison to the average. The sample probabilities reported in the last row of the table are the predicted probability based on the multinomial model that arises when all variables are set at their means. These are the chances of being in each SAH category for a hypothetical individual that is the most average across all covariates in Model 3 of Table 3.

By far the largest marginal effect is for the probability of a Spanish speaker rating their health as fair. It is fully 0.155 points (i.e., 15.5 percentage points) greater than for an English speaker when controlling for citizenship, ethnicity, and all other covariates. Spanish speakers are also much less likely to report very good or excellent health. In contrast, a non-citizen is more likely than a U.S.-born or naturalized citizen to report excellent health, other things being equal. On balance, citizenship status does not have an overly large impact on SAH, but in combination, excellent health is most often reported by English speaking non-citizens in comparison to any other individuals. Ethnicity is consequential. White respondents are by far the most likely to report very good and excellent health, while Hispanic, black, and other/multi-racial respondents are more likely in the poor, fair, or good category, controlling for other covariates. Finally, there is substantial variation in the probability of reporting excellent health across categories of language, citizenship, and ethnicity.

Turning to the issue of “acculturation,” Table 5 examines whether the length of residence in the U.S. weakens associations between language and SAH. As in Table 3, we show only the covariates of most interest, but the models control for other variables. The sample for this table includes only those not born in the U.S.; thus, the sample size is reduced and citizenship status includes only two categories (with naturalized as the comparison). The results show no significant association between years living in the U.S. and SAH. Other coefficients not shown are similar to the coefficients in the previous table. The Spanish language relates to a significantly greater likelihood of reporting fair SAH, while differences between naturalized and non-citizens are non-significant.

Supplementary analyses were performed and due to space limitations are not reported in tabular form. First, a set of analyses entered interaction effects into models. Some of these were statistically significant, but none substantively altered the interpretation of the association of language and health. Second, non-Hispanics do not use Spanish for these surveys, and as such empty cells are present. The models were tested on the population of Hispanics only, leaving ethnicity out of the model completely. The results were substantively the same as those reported. That is, looking only at Hispanics, the Spanish speakers are far more likely to report fair SAH than are English speakers, while non-citizens on balance report better SAH than do naturalize or the U.S. born.

#### **4. Discussion**

This paper examines the role of survey language, English or Spanish, in SAH reporting, when taking into account citizenship status, ethnicity, and a number of other demographic characteristics. Building on previous studies, it poses three primary research questions: (1) Is there an association between survey language and SAH? (2) If so, does citizenship status mediate the association between survey language and SAH? (3) Do these associations further hold when accounting for ethnic variation? These questions are addressed by leveraging seven waves of NHANES up to the most recently available. NHANES contains a large, nationwide, representative sample of the U.S. population. The study captures key aspects of immigration – including nativity, survey language, and duration in the U.S. – alongside standard SES variables in multivariate analyses. The analyses avoid pitfalls of prior studies that dichotomized or otherwise collapsed SAH categories or employed an ordered logit analysis of the measure. Instead, our analysis uses multinomial regression to better appreciate potential conceptual distinctions among SAH categories. Furthermore, it addresses ongoing health measurement challenges of migrating populations.

The results confirm that survey language is an extraordinarily critical factor in SAH reporting. When surveys are conducted in Spanish, the likelihood that a respondent will report their health as “fair” increases substantially. Overall, the Spanish language, in addition to non-white ethnicity, has a significant negative effect on a respondent’s SAH rating. These findings may not be surprising given the nature of structural health inequalities in the U.S., but the effect of the Spanish language is particularly robust. When ethnicity is added to models that include language, the effect of survey language persists. Being a non-citizen or naturalized citizen appears to have a protective health effect, but taking the survey in Spanish and identifying as Hispanic, black, or other/multiracial markedly offset this advantage. Thus, English-speaking white non-citizens are more likely than any other group to rate their health as excellent. Meanwhile, Spanish-speaking



Hispanic citizens who were born in the U.S. are more likely than other groups to rate their health unfavorably. Finally, and in contrast to our expectations, duration in the U.S. does not mitigate Spanish-speakers' greater likelihood of rating their health unfavorably. On balance then, in answer to our research questions, language does affect SAH, the association between language and SAH is not substantially mediated by citizenship status as results hold when entering citizenship into regression models, and it holds as well when considering ethnic variation.

These analyses are subject to a variety of limitations that could be addressed through future research. One important limitation is the dichotomous nature of NHANES citizenship categories. Our analysis teased out a third category (naturalized citizens) from available data, but information on permanent residence, visa-holder, and undocumented statuses would improve understanding of the citizenship-health association. Pourat, Wallace, Hadler *et al.* (2014) have developed a method of imputing undocumented status using answers to questions about permanent residence and length of time in the U.S., but without such information in NHANES, such imputation is impossible. Future data collection instruments would benefit from more variety in citizenship types, but they do so at the risk of alienating potential survey participants who fear disclosing their legal status – particularly under the current U.S. administration (Wang, 2018).

Another limitation is NHANES' categorization of ethnicity. There is no distinction between “ethnicity” and “race” in this measure. This conflation particularly affects Spanish speakers, who although classified as “Hispanic” may self-identify as any racial category (e.g., white or black) or multiple racial categories (Vega, Rodriguez and Gruskin, 2009). Furthermore, ethnic categories seem to have been determined colloquially rather than critically. In the original NHANES categories, “Mexican American,” for example, is not disaggregated between Mexican and Mexican American, despite distinct cultural, and geopolitical meanings. Finally, collapsing multiple ethnicities into “other/multi-racial” sacrifices information, although overall there were very few respondents in this category. Despite these drawbacks, these categorizations reflect important classificatory trends in the U.S., where non-white residents face racial discrimination, tend to occupy lower socioeconomic positions, and report worse SAH than their white counterparts (Ren, Amick, and Williams, 1999; Stuber, Galea, Ahern *et al.*, 2003; Cummings and Jackson, 2008). Future research should allow for a greater variety of ethnicities.

Finally, we recognize that many Hispanic respondents may speak both English and Spanish and that dichotomizing respondents according to the language in which they took the survey may not fully capture the nuance of their bilingual SAH interpretation. The so-called “acculturation” portion of the NHANES includes questions about language spoken at home, as a child, with friends, and while reading, speaking, and thinking, but the utility of these questions for our analysis is limited. Very few people actually responded to these questions, and they are not comprehensive enough to model bilingualism in the kinds of equations we have employed in this analysis. Future research should focus on collecting more robust information on bilingualism and how to model it adequately in relation to constructs such as SAH.

In spite of these limitations, our study has addressed an important issue regarding language and health status. Our analysis supports recent studies (Bzostek, Goldman, and Pebley 2007; Viruell-Fuentes, Morenoff, Williams *et al.*, 2011; Sanchez and Vargas, 2016) in indicating that Spanish speakers are much more likely to rate their health as fair than are others and that this is likely a function of the way in which the ubiquitous SAH item is translated in surveys. Our models followed the examples of Bzostek, Goldman, and Pebley (2007) to include citizenship status and Viruell-Fuentes, Morenoff, Williams *et al.* (2011) to treat SAH as multinomial. We advanced on these previous approaches using a large nationally-representative and more recent dataset (NHANES 2003-2016) that included thousands of observations on the variables of interest. We also include duration in the United States to account for acculturation. Given the likelihood that the commonly used translation of the five SAH categories itself shapes the distribution of SAH responses, alternate translations, such as replacing “regular” with “más o menos” to convey “fair” health (Viruell-Fuentes, Morenoff, and Williams *et al.*, 2011; Sanchez and Vargas, 2016), should be implemented in future survey design. Such validity questions must be addressed if SAH is to be translated and employed across linguistic groups.

Other findings address issues that are so far underdeveloped in literature. Despite numerous barriers to health access on the basis of legal status (Castañeda, Holmes, Madrigal *et al.*, 2014; Martinez, Wu, Sandfort *et al.*, 2015), our analysis in fact finds that in some cases being a non-citizen or naturalized citizen increases one's odds of a favorable health rating. The positive contribution of the “healthy immigrant effect” is outweighed by the effect of being racialized as non-white in the U.S., however, which associates with a less favorable SAH rating.

From a policy perspective, these results present a complex picture of immigrant health. Our study underscores the need to critically examine interrelated factors of survey language, citizenship status, and ethnicity to understand the health context of a large part of the U.S. population. It is crucial that large national level surveys of health meant to inform health-care policy consider novel measures that overcome challenges faced in assessing the health of migrating, heterogeneous populations. In particular, survey language may be a problem at the level of survey data collection and analysis, and the effects of citizenship status should be considered alongside ethnicity to capture the role that ethnic minority status has in

undermining the previously hypothesized immigrant health advantage. In addition to survey language, these intersecting factors, which are difficult to measure with precision, are very likely underlying the effects we see in our models. Future research should consider these complex factors when drawing conclusions regarding immigrant health in the U.S.

## 5. Conclusions

Spanish speakers are more likely than others to rate their health as “fair.” This result concurs with earlier studies that used much smaller samples and, as opposed to our study, examined data that were either cross-sectional or spanned a short period of time. Acculturation, or years spent in the U.S. among immigrants, does not attenuate the association. Earlier research has indicated that being an immigrant and having limited English proficiency has negative consequences for health. While our study does not negate this, it does suggest that some perceived health disadvantage among immigrants could be a function of differences in the way in which health is expressed across languages.

## Authors’ Contributions

Both authors contributed to all aspects of the manuscript, including conceptualization, analysis, interpretation, and writing.

## Ethics

The de-identified NHANES datasets used in this paper were downloaded by the first author as de-identified, publicly available files through the U.S. CDC and Prevention. Ethical approval for original data collection was provided by the National Center for Health Statistics’ Ethics Review Board.

## Availability of Support Data

All data files for the NHANES waves used in this manuscript are available through the National Center for Health Statistics.

## Conflicts of Interest

The authors have no conflicts of interest to disclose.

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