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## Article

## Oral health disparities: Racial, language and nativity effects

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## ABSTRACT

This study examined racial oral health disparities among Non-Hispanic Whites, Non-Hispanic Blacks, and Hispanics. For Hispanics, this study also examined the role of language in oral health disparities between English-speaking Hispanics and Spanish-speaking Hispanics. This study included 12,307 adults older than 20 from the National Health and Nutrition Examination Survey (NHANES) 2011–2016. Oral health is measured by self-rated oral health, the frequencies of dentist visits, and the number of missed teeth. Exposures of interest referred to social gradients, which include education, annual family income, foreign born, and citizenship. Covariates included age, gender, and marital status. Ordinal logistic regression models were used to estimate the effects of social gradients on self-rated oral health and dentist visits. Negative binomial regression model was applied to estimate the effects of social gradients on the number of missed teeth. Overall, Spanish-speaking Hispanics presented the most disadvantaged social gradients and the worst oral health results. Non-Hispanic Blacks and English-speaking Hispanics reported disadvantaged oral health status when compared to Non-Hispanic Whites. Foreign-born, higher education levels and annual family income play protective role on oral health outcomes, while respondents who do not have citizenship are at higher risk of self-rated fair/poor oral health and dentist visits.

## Background and significance

Oral health is a comprehensive indicator of an individual's socioeconomic status (SES) and accessibility to health care. Disorders of the mouth, including teeth, palate, and related soft tissues can have a significant impact on quality of life (Locker, 2002). Poor oral health is found to be associated with higher risk levels of chronic stress, depressive symptoms (Finlayson et al, 2010), cardiovascular disease (CVD), cancer (Kim et al, 2013) ischaemic heart disease (IHD), ischaemic stroke heart failure (HF), and peripheral vascular disease (PVD) and other mortal diseases (Joshy, Arora, Korda, John Chalmers, & Banks, 2016).

Race/ethnicity is an important stratification factor in oral health disparities, due to uneven distribution of dental care and socioeconomic status among different racial groups (Bastos, Celeste, & Paradies, 2018). Compared to Non-Hispanic Whites, African Americans with lower SES suffer more from tooth loss, dental decay, dental pain (Cohen et al., 2011; Gilbert, 2005) and chewing difficulties (Gilbert, 2005). Moreover, African Americans report more financial difficulties and are less likely to seek dental care than their white counterparts (Gilbert, 2005). There is also a racial difference in treatment choice. For instance, African Americans are less likely to select Root Canal Therapy than Non-Hispanic Whites (Tilashalski, Gilbert, & Litaker, 2007). Kelesidis

(2014) has found that, due to differences in education attainments, socioeconomic status, and access to dental care, African Americans report worse oral health perceptions and higher prevalence of dental decay than Asian Americans. Hwang, Smith, McCormick, and Barfield (2011) have found significant ethnic disparities among Non-Hispanic White and Black maternal oral health experiences. Non-Hispanic Blacks are more likely to suffer from dental problems but less likely to get dental care during pregnancy.

Huang and Park (2015) have found that Blacks and Hispanics seniors are more likely to report self-rated poor oral health compared to Non-Hispanic Whites. Black seniors are more likely to report potential chewing difficulties and fewer teeth. Wu, Liang, Plassman, Corey Remle, and Bai (2011) have reported that blacks and Mexican-Americans have more decayed teeth but fewer filled teeth than their white counterparts. Black adults present even worse oral health than Hispanics. For instance, Hispanics are less likely to report no natural teeth compared to Non-Hispanic Whites and Blacks.

On the other hand, language plays an important role in accessing dental care (e.g. accessing oral health insurance, and dentist visits). In the U.S., people who are not proficient in English face multiple barriers to accessing dental services, which in turn, have negative effects on their oral health. Previous work shows that immigrants, racial/ethnic minorities, and those with poor English proficiency face worse health,

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barriers to health care, and low rates of insurance coverage. Factors related to nativity, such as immigrants' length of stay in the U.S., the age at immigration, and the country of birth are also related to oral disease prevalence (Cruz et al., 2009).

Sanders (2010) have examined the "latino paradox" on oral health. He finds that compared to first generation of Hispanic immigrants, the latino advantage is modified by the length of stay in the U.S. among the second generation as a result of disadvantaged socioeconomic status, and language barriers. Other scholars also have come to recognize that English proficiency is one of the barriers to access health care. Non-English speakers are more likely to report less access to general health care and less use of preventive services (DuBard & Gizlice, 2008; Lebrun, 2012). Furthermore, patients with limited English proficiency are more likely to report lower quality of communication with physicians. Yet to date, studies on language-related oral health disparities have focused primarily on children. Children in non-English primary language households are more likely to be poor, overweight (Flores & Tomany-Korman, 2008), and lack oral health care (Yu et al., 2015). No study to date has focused on potential variations in oral health among adult non-English speakers, exploring the interlocking roles of nativity and English proficiency and whether the barriers are similar at different levels of socioeconomic status, which is what this study undertakes herein.

This paper focuses on the effects of racial/ethnicities and language related barriers to access to dental care and oral health status among different groups in the U.S. This study will report the differential access to dental care and oral health disparities among Hispanics (including Spanish-speakers and English speakers), Non-Hispanic Whites and Non-Hispanic Blacks. Demographic backgrounds are included to detect social determinants of oral health disparities among different racial and language groups.

#### *Study aims and hypotheses*

In this paper, the author focuses on the racial differences and language related oral health disparities. The author proposes four hypotheses on the effects of language and dental care on oral health disparities.

**Hypothesis 1.** Non-Hispanic Whites report better oral health than Non-Hispanic Blacks and Hispanics.

**Hypothesis 2.** Blacks and Hispanics are less likely to visit dentists than their white counterparts.

**Hypothesis 3.** Hispanics who speak Spanish report adverse oral health outcomes and fewer dentist visit than Hispanics who speak English.

**Hypothesis 4.** Differential oral health outcomes result from differential socioeconomic status (SES) among racial groups.

#### **Methods**

##### *Data source*

In this study, the data are from the National Health and Nutrition Examination Surveys (NHANES). NHANES is one of the programs of the National Center for Health Statistics (NCHS). It intends to investigate the health and nutritional status of both adults and children across the United States. Demographic, socioeconomic, dietary, and health-related questions are included in the survey. The first NHANES started in the early 1960s and became a continuous program in 1999. Besides the survey, NHANES also includes interview data, examination data, and laboratory data. Different population groups are included. Three waves are involved: the 2011–2012 survey, the 2013–2014

survey, and the 2015–2016 survey. In each wave, the demographic data, the questionnaire data, and the examination data are included. Then, three waves are pooled together.

##### *Study population*

This study restricts the analytical sample in several ways. First, only Hispanics, Non-Hispanic Black and Non-Hispanic Whites are included. Asians and other ethnicities in the survey are excluded due to the limited sample size and complicated language background. Second, the NHANES data include all age groups older than 6 months. In this study, only adults older than 20 are included. Third, among all qualified respondents, those whose information includes any missing data in outcome variables or independent variables are deleted. The pool of NHANES 2011–2016 included 29,902 respondents. The final sample consists of 12,307 respondents, including 1770 Hispanics whose primary language is Spanish, 1583 Hispanics whose primary language is English, 5666 Non-Hispanic Whites, and 3288 Non-Hispanic Blacks.

##### *Measurements*

###### *Outcome variables*

**Irregular dentist visits.** Respondents were asked, "when did you last visit a dentist? – six months or less; more than 6 months, but not more than 1 year ago; more than 1 year, but not more than 2 years ago; more than 2 years, but not more than 3 years ago; more than 3 years ago, but not more than 5 years ago; more than 5 years ago; and never have been." In this study, the responses are recoded as four categories: six months or less (1); more than 6 months, but no more than 2 years ago (2); more than 2 years, but not more than 5 years ago (3); and more than 5 years, or never (4).

**Self-rated oral health.** Respondents were asked to "rate the health of your teeth and gums—excellent, very good, good, fair or poor?" Responses are recoded as excellent or very good (1), good (2), fair (3), and poor (4).

**Number of missed teeth.** The information about the number of missed teeth is obtained from the examination datasets of NHANES. The coding include two steps: first, if a tooth is completed present, it is coded as 0, otherwise, all decayed or lost teeth are coded as 1. Second, the number of missed teeth is obtained by adding up all values together except four third molars. The final number of missed teeth ranges from 0 to 28.

###### *Independent variables*

The analysis includes a series of independent covariates. To capture socioeconomic status, this paper measured education and family income. Education is measured in 5 ordinal categories: no high school (1), some high school (2), high school (3), Some college or AA degree (4), and college graduate or above(5). Family income is measured with 14 income categories ranging from no income to \$100,000 or more. Based on the distribution of income for the analytic sample, the family income is collapsed these into 4 groups: \$0–19,999 (1); \$20,000–44,999 (2); \$45,000–74,999 (3); \$75,000- \$ 100,000 and over (4).

Other demographics included in the models are citizenship status, country of birth, marital status, gender and age. Citizenship status is coded as citizens (1) and non-citizens (0). Country of birth is coded as foreign born (1) and born in the U.S. (0). Marital status is coded as married or live with partners (1), and single (0, which includes divorced, widowed, and those who never get married). Gender is coded as female (1) and male (0). Age ranges from 20 to 80. People who are older than 80 are coded as 80 during the survey.

Language and races are considered as grouping variables. For language, the survey had reported the language spoken at home. Respondents who use Spanish only or use Spanish more than English at

**Table 1**  
Descriptive results of non-hispanic whites, non-hispanic blacks, English-Speaking hispanics, and Spanish-Speaking hispanics in NHANES (2011–2016, N = 12,307).

Variables	Non-Hispanic Whites (n = 5666)	Non-Hispanic Blacks (n = 3288)	English-speaking Hispanics (n = 1583)	Spanish-speaking Hispanics (n = 1770)
<b>Irregular Dentist Visits</b>				
Less Than 6 Months	46.13 <sup>a</sup>	32.54	35.44	28.81
6 months- 2 Years	23.53	31.84	29.69	29.10
2–5 Years	14.01	16.64	17.94	19.32
5 Years More Or Never	16.33	18.98	16.93	22.77
<b>Self-Rated Oral Health</b>				
Excellent or Very Good	39.25	26.92	26.41	14.46
Good	32.92	37.35	35.31	34.58
Fair	16.64	24.67	25.58	38.87
Poor	11.19	11.07	12.70	12.09
The Number Of Missed Teeth (0-28)	6.23(8.91) <sup>b</sup>	7.32(8.74)	4.63(6.92)	6.18(7.90)
<b>Age(20–80 +)</b>				
Female	51.44(18.74)	48.52(17.07)	45.76(16.95)	49.55(16.10)
Single	50.44	52.22	55.84	50.17
Education	38.92	57.09	40.37	30.51
No High School	3.39	4.90	6.25	40.68
Some High School	10.31	15.57	16.74	18.59
High School	22.29	26.4	24.32	17.74
Some College	34.2	34.4	35.12	15.37
BA Or Higher	29.81	18.73	17.56	7.63
<b>Non-Citizenship</b>				
Foreignborn	1.34	4.29	8.59	58.81
Annual Family Income	4.13	11.56	29.19	90.51
\$19,999 and Less	23.63	29.56	21.48	34.41
\$20,000–44,999	30.02	33.88	30.45	40.28
\$45,000–74,999	17.6	17.67	22.36	17.34
\$75,000–100,000 +	29.75	18.89	25.71	7.79

a, in percentages.  
b, Mean (SD).

home are coded as 1, and those who use Spanish equally to English, or use English more than Spanish, or only English are coded as 0. Finally, the whole sample is divided into four groups: Non-Hispanic Whites, Non-Hispanic Blacks, Hispanics preferring English (0), and Hispanics preferring Spanish (1).

*Statistical analysis*

The analyses are performed using the STATA software version 14.0. Two stages are used to proceed the analysis. First, the author reports the mean and standard deviation (as appropriate) of study variables for the total sample, then separately for four groups: English-speaking and Spanish-speaking Hispanics, Whites, and Blacks.

Second, the author applies ordered logistic regression models for the irregular dental visits and self-rated oral health. In addition, a negative binomial regression model is used to estimate the effects of independent variables on the number of missed teeth. All models are stratified by four racial and language groups. The purpose of this approach is to test for potential moderating effects within these subsamples of all of the covariates.

**Results**

**Table 1** presents the characteristics of the whole sample. Nearly half of Non-Hispanic Whites (46.13%) have visited their dentist in the past 6 months. The percentage of Non-Hispanic Blacks is 32.54%, for English-speaking Hispanics is 35.44%, and for Spanish-speaking Hispanics is 28.81. There are 39.25% Non-Hispanic Whites who report their oral health is excellent. The percentages are lower for other groups, especially for Spanish-speaking Hispanics, is only 14.46%. English-speaking Hispanics have missed 4.63 teeth on average, fewer than the other three groups. Non-Hispanic Blacks have missed 7.32 teeth on average, which is greater than all other groups.

The average age of each group is around 45–51. English-speaking Hispanics are younger, and Non-Hispanic Whites are older than the other groups. Female respondents take account half of the sample for each group. Non-Hispanic Blacks report the highest ratio of marital status as single (57.09%).

When it comes to socioeconomic status (SES), Non-Hispanic Whites present most advantaged status while Spanish-speaking Hispanics report the lowest status. 40.86% of Spanish-speaking Hispanics with no high school education while nearly one-third Non-Hispanic Whites (29.81%) have a bachelor degree or higher level of education. More than half of Spanish-speaking Hispanics (58.81%) do not have citizenship. Nearly one-third of English-speaking Hispanics (29.19%) are born outside of the United States, and 90.51% of Spanish-speaking Hispanics are foreign born. More than one-third of Spanish-speaking Hispanics (34.41%) report \$19,999 or less annual family income, and only 7.79% of this group report the highest annual family income (higher than \$75,000).

**Table 2** presents the effects of social gradients on irregular dentist visits. All social gradients have effects on irregular dentist visits except marital status. Among Non-Hispanic Whites (OR = 0.993, 95% CI = 0.990–0.995) and both Hispanic groups (OR = 0.993, 95% CI = 0.998–0.999; OR = 0.991, 95% CI = 0.985–0.997), older respondents are slightly less likely to visit their dentists irregularly. Among all four groups, females are less likely to visit their dentist irregularly. Education level plays an important role in dentist visit among all groups. There is a slight difference: compared to respondents who report no high school education, Non-Hispanic Whites of each education level report lower likelihood of irregular dentist visits. For the other three groups, there is no significant difference on irregular dentist visits between people who have some high school education and those with no high school education. Citizenship is significantly related to irregular dentist visits among Non-Hispanic Blacks (OR = 2.014, 95% CI = 1.369–2.963) and Spanish-speaking Hispanics (OR = 2.058, 95%

**Table 2**  
Ordinal logistic regression on irregular dentist visits of non-hispanic whites, non-hispanic blacks, English-Speaking hispanics, and Spanish-Speaking hispanics in NHANES (2011–2016, N = 12,307).

	Non-Hispanic Whites (n = 5666)	Non-Hispanic Blacks (n = 3288)	English-speaking Hispanics (n = 1583)	Spanish-speaking Hispanics (n = 1770)
Age(20–80 + )	0.993*** [0.990–0.995] <sup>a</sup>	1.003 [0.999–1.007]	0.993* [0.988–0.999]	0.991** [0.985–0.997]
Gender(ref = male)	0.702*** [0.635–0.776]	0.714*** [0.627–0.812]	0.693*** [0.577–0.833]	0.600*** [0.504–0.714]
Single	1.043 [0.936–1.162]	1.144 [0.998–1.312]	0.825 [0.680–1.002]	0.921 [0.759–1.118]
Education (ref = no high school)				
Some High School	0.667* [0.488–0.912]	0.932 [0.671–1.296]	0.714 [0.463–1.101]	0.793 [0.623–1.009]
High School	0.471*** [0.351–0.632]	0.715* [0.521–0.981]	0.564** [0.370–0.859]	0.612*** [0.475–0.789]
Some College	0.361*** [0.270–0.484]	0.539*** [0.393–0.740]	0.397*** [0.261–0.604]	0.539*** [0.412–0.706]
BA or Higher	0.195*** [0.144–0.263]	0.318*** [0.227–0.446]	0.266*** [0.168–0.422]	0.331*** [0.230–0.479]
Non-Citizenship	1.015 [0.590–1.747]	2.014*** [1.369–2.963]	1.102 [0.758–1.601]	2.058*** [1.667–2.540]
Foreignborn (ref = U.S. born)	0.628** [0.459–0.859]	0.795 [0.622–1.014]	0.695** [0.551–0.876]	0.510*** [0.369–0.704]
Family Income (ref = \$19, 999 and less)				
\$20,000–44,999	0.693*** [0.606–0.793]	0.795** [0.677–0.934]	0.775 [0.600–1.003]	0.827 [0.676–1.011]
\$45,000–74,999	0.505*** [0.430–0.594]	0.554*** [0.456–0.675]	0.504*** [0.378–0.673]	0.661** [0.509–0.858]
\$75,000–100,000 +	0.276*** [0.235–0.323]	0.420*** [0.340–0.519]	0.433*** [0.322–0.582]	0.470*** [0.327–0.676]
Log likelihood	– 6705	– 4234	– 2031	– 2314
Chi- squared	965.3	367.5	170.8	229.1

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001. a, 95% CI.

CI = 1.667–2.540). Those who do not have citizenships are more likely to visit their dentists irregularly. Foreign born Non-Hispanic Whites (OR = 0.628, 95% CI = 0.459–0.859), English-speaking Hispanics (OR = 0.695, 95% CI = 0.551–0.876), and Spanish-speaking Hispanics (OR = 0.510, 95% CI = 0.369–0.704) are less likely to report irregular dentist visit. Family income is significantly related to irregular dentist visit. For both Non-Hispanic Whites and Blacks, compared to the lowest income group (less than \$19,999), all the other groups are less likely to report irregular dentist visit. For Hispanics, there is no significant difference on dentist visits among the lowest income group and those whose annual family income is \$20,000–44, 999.

Table 3 presents the effects of social gradients on self-rated oral health. Older Non-Hispanic Whites (OR = 0.993, 95% CI = 0.990–0.995) are less likely to report fair/poor oral health, while older Non-Hispanic Blacks (OR = 1.006, 95% CI = 1.002–1.010) and English-speaking Hispanics (OR = 1.009, p < 0.01) are more likely to report fair/poor oral health. Non-Hispanic White females (OR = 0.750, 95% CI = 1.003–1.015) are less likely to report fair/poor oral health. There is no gender difference among other groups. Compared to respondents with no high school education, Non-Hispanic Whites who have finished high school and those with higher education report a lower likelihood of fair/poor self-rated oral health. Non-Hispanic Blacks with a BA degree (OR = 0.496, 95% CI = 0.354–0.696) and Hispanics with some college education or more are less likely to report fair/poor oral health. Spanish-speaking Hispanics who do not have citizenships (OR = 1.384, 95% CI = 1.119–1.713) are more likely to report fair/poor oral health. Foreign born Non-Hispanic Blacks (OR = 0.517, 95% CI = 0.403–0.664) and English-speaking Hispanics (OR = 0.752, 95% CI = 0.598–0.946) are less likely to report fair/poor oral health. For Non-Hispanic Whites and Blacks, and English-speaking Hispanics, compared to the lowest income group (less than \$19,999), all the other

groups are less likely to report fair/poor oral health. For Spanish-speaking Hispanics, there is no significant difference in fair/poor oral health between the lowest income group and those whose annual family income is \$20,000–44, 999.

Table 4 presents the effects of social gradients on the number of missed teeth among all four groups. Among all groups, older respondents report higher risk of missing teeth. Female Non-Hispanic Whites report fewer missed teeth (b = 0.099, SE = 0.036). Female Spanish-speaking Hispanics report more missed teeth (b = 0.182, SE = 0.053). Compared to respondents with no high school, Non-Hispanic Whites who have finished high school and those with higher education report fewer missed teeth. Non-Hispanic Blacks (b = –0.357, SE = 0.093) and English-speaking Hispanics (b = –0.341, SE = 0.144) who have a bachelor degree report fewer missed teeth. There is no educational effects for Spanish-speaking Hispanics. Foreign born Non-Hispanic Blacks report fewer missed teeth (b = –0.333, SE = 0.073) than their native born counterparts. Family income plays an important role in the number of missed teeth among all groups. Compared to the lowest income group (less than \$19,999), Non-Hispanic Whites who report higher family annual income report fewer missed teeth. For Non-Hispanic Blacks, respondents with family income higher than \$45,000 report fewer missed teeth. Compared to people with lowest family income, English-speaking Hispanics report fewer missed teeth at each higher family income. For Spanish-speaking Hispanics, respondents with family income range from \$20,000- \$74,999 report fewer missed teeth.

**Conclusion and discussion**

There are four key findings in this study. First, there are racial disparities on oral health and dentist visits. Non-Hispanic Blacks report

**Table 3**  
Ordinal logistic regression on self-rated oral health of non-hispanic whites, non-hispanic blacks, English-Speaking hispanics, and Spanish-Speaking hispanics in NHANES (2011–2016, N = 12,307).

	Non-Hispanic Whites (n = 5666)	Non-Hispanic Blacks (n = 3288)	English-speaking Hispanics (n = 1583)	Spanish-speaking Hispanics (n = 1770)
Age(20–80 + )	0.993*** [0.990–0.995] <sup>a</sup>	1.006*** [1.002–1.010]	1.009** [1.003–1.015]	1.004 [0.998–1.010]
Gender(ref = male)	0.750*** [0.680–0.827]	1.081 [0.951–1.228]	0.975 [0.812–1.170]	0.971 [0.815–1.156]
Single	0.992 [0.891–1.104]	1.044 [0.911–1.197]	0.821* [0.676–0.997]	0.870 [0.715–1.058]
Education (ref = no high school)				
Some High School	1.013 [0.755–1.360]	1.209 [0.867–1.686]	0.974 [0.632–1.502]	0.938 [0.736–1.196]
High school	0.726* [0.552–0.956]	0.940 [0.684–1.291]	0.668 [0.440–1.015]	0.779 [0.602–1.007]
Some College	0.550*** [0.419–0.721]	0.776 [0.564–1.066]	0.415*** [0.273–0.630]	0.601*** [0.457–0.789]
BA or higher	0.271*** [0.205–0.358]	0.496*** [0.354–0.696]	0.272*** [0.172–0.428]	0.336*** [0.233–0.484]
Non-Citizenship	1.004 [0.599–1.682]	1.169 [0.797–1.715]	0.991 [0.686–1.431]	1.384** [1.119–1.713]
Foreignborn (ref = U.S. born)	1.123 [0.837–1.507]	0.517*** [0.403–0.664]	0.752** [0.598–0.946]	0.897 [0.642–1.253]
Family income (ref = \$19, 999 and less)				
\$20,000–44,999	0.736*** [0.643–0.843]	0.762*** [0.647–0.896]	0.741* [0.571–0.962]	0.818 [0.667–1.004]
45,000–74,999	0.619*** [0.528–0.725]	0.640*** [0.525–0.779]	0.525*** [0.392–0.702]	0.703** [0.542–0.912]
\$75,000–100,000 +	0.361*** [0.309–0.423]	0.510*** [0.414–0.630]	0.445*** [0.331–0.597]	0.447*** [0.313–0.639]
Log likelihood	– 6831	– 4184	– 2007	– 2189
Chi- squared	802.2	247.4	197.1	116.9

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001. a, 95% CI.

worse self-rated oral health and a higher proportion of irregular dentist visits than Non-Hispanic Whites. Second, language is related to oral health, dentist visits, and social gradients that related to oral health. Spanish-speaking Hispanics report the poorest oral health, the highest risk of irregular dentist visits and fewest teeth. Spanish-speaking Hispanics report most disadvantaged social gradients related to oral health: the lowest education levels, lower family income, high proportion of non-citizenship, and half were born outside of the U.S. Third, social gradients play important roles on oral health and dentist visits. Education and family income play protective roles on self-rated poor oral health and irregular dentist visits. But the patterns are different for each racial group. For Non-Hispanic Whites, higher education and higher family income predict less dentist visits, better self-rated oral health, and fewer missed teeth. For other minorities, the threshold is higher. For instance, among Non-Hispanic Blacks and both Hispanic groups, only respondents with a bachelor degree report fewer missed teeth compared to people did not attend high schools. For Spanish-Speaking Hispanics, education and the highest family income did not show protective effects on tooth loss. This results from the facts that 40 percent Spanish-speaking Hispanics have not attend high school, and too few Spanish-Hispanics report family income as high as \$75,000(only 7.79%). Fourth, nativity is an important factor related to oral health and dentist visits. Foreign born respondents of Non-Hispanic Whites and Hispanics show fewer irregular dentist visits; Foreign born NH Blacks and English-speaking Hispanics report less self-rated poor oral health; foreign born NH Blacks report fewer missed teeth than their native born counterparts. Non-Hispanic Blacks and Spanish-speaking Hispanics who do not have citizenship are more likely to report irregular dentist visits. Spanish-speaking Hispanics with no citizenship are more likely to report self-rated poor oral health.

This study contribute to current racial oral health disparities in three aspects: first, this study has explored racial oral health disparities

among Whites, Blacks, and Hispanics through national wide data. Previous studies have mainly focused on local regions or single communities, which confound disparities with local issues of access to oral health care. Second, this study checks language barriers to good oral health among Hispanics. The author intends to propose that language is an important stratifying factors among Hispanics. Spanish-speaking Hispanics present lowest educational attainments and lowest family income. They also report highest proportion of irregular dentist visits and self-rated fair/poor oral health. This result can help scholars to rescrutinize the Hispanic/Latino Paradox and find out associations between socioeconomic status and health outcomes among different groups of Hispanics. The third contribution of this study involves the role of nativity on oral health disparities. In this study, not only Hispanics, but also Non-Hispanic Whites, of whom 4.13% in the sample were born outside of the U.S., reported lower risk of irregular dentist visits. Non-Hispanic Blacks, of whom 11.56% were born outside the U.S., presented lower risk of irregular dentist visits or self-rated fair/poor oral health. Non-Hispanic Blacks also report fewer missed teeth than their native born counterparts. In the future, it is meaningful to examine the combined effects of nativity, length of stay in the U.S., and the role of primary language on health disparities among all racial groups.

This study bears three major limitations. The first involve the definition of English-speaking and Spanish-speaking. The original question focused on the language they use in home. It is possible that people who speak only or mainly Spanish at home can also speak English very well in their workplaces or in public places. Second, the data are draw from self-reported information except the number of missed teeth. Therefore, the data may include some inaccurate measurements. Third, Mexican Americans are overrepresented in the sample. Therefore, the complexity of Hispanic population is not clearly presented. Finally, the magnitude of effects of social gradients on the number of missed teeth



**Table 4**  
Negative binomial regression on the number of missed teeth of non-hispanic whites, non-hispanic blacks, English-Speaking hispanics, and Spanish-Speaking hispanics in NHANES (2011–2016, N = 12,307).

	Non-Hispanic Whites (n = 5666)	Non-Hispanic Blacks (n = 3288)	English-speaking Hispanics (n = 1583)	Spanish-speaking Hispanics (n = 1770)
Age(20–80 +)	0.043*** (0.001) <sup>a</sup>	0.057*** (0.001)	0.059*** (0.002)	0.056*** (0.002)
Gender(ref = male)	-0.099** (0.036)	0.071 (0.037)	-0.050 (0.062)	0.182*** (0.053)
Single	-0.042 (0.039)	-0.030 (0.040)	-0.075 (0.065)	0.063 (0.059)
Education (ref = no high school)				
Some High School	0.158 (0.105)	0.157 (0.090)	0.254 (0.133)	-0.044 (0.075)
High school	-0.211* (0.098)	0.083 (0.086)	-0.071 (0.129)	0.049 (0.077)
Some College	-0.473*** (0.097)	-0.116 (0.087)	-0.163 (0.127)	0.031 (0.080)
BA or higher	-1.109*** (0.100)	-0.357*** (0.093)	-0.341* (0.144)	-0.172 (0.111)
Non-Citizenship	0.030 (0.192)	0.044 (0.117)	0.101 (0.127)	0.064 (0.061)
Foreign-born (ref = U.S. born)	0.113 (0.107)	-0.333*** (0.073)	-0.014 (0.076)	0.099 (0.099)
Family income (ref = \$19, 999 and less)				
\$20,000–44,999	-0.255*** (0.049)	-0.089 (0.046)	-0.205* (0.085)	-0.172** (0.061)
\$45,000–74,999	-0.497*** (0.058)	-0.134* (0.057)	-0.278** (0.095)	-0.192* (0.079)
\$75,000–100,000 +	-0.912*** (0.057)	-0.396*** (0.061)	-0.617*** (0.100)	-0.141 (0.109)
Constant	0.138 (0.116)	-1.012*** (0.118)	-1.259*** (0.181)	-1.452*** (0.154)
Inalpha	0.378*** (0.026)	-0.219*** (0.036)	0.010 (0.057)	-0.133** (0.048)
Log likelihood	-14209	-8827	-3542	-4582
Chi-squared	2388	1962	849.0	887.4

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001; a. standard error.

are comparatively slight. This is because the sample of this study includes adults from all age groups. It is possible that the effects of the number of missed teeth is counterproduced by young people.

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2019.100436>.

**References**

Bastos, J. L., Celeste, R. K., & Paradies, Y. C. (2018). Racial inequalities in oral health. *Journal of Dental Research, 97*(8), 878–886.

Cohen, L. A., Bonito, A. J., Eicheldinger, C., Manski, R. J., Macek, M. D., Edwards, R. R., et al. (2011). Behavioral and socioeconomic correlates of dental problem experience and patterns of health care-seeking. *The Journal of the American Dental Association, 142*(2), 137–149. <https://doi.org/10.14219/jada.archive.2011.0056>.

Cruz, Gustavo D., Chen, Yu, Salazar, Christian R., & Le Geros, Racquel Z. (2009). The Association of Immigration and Acculturation Attributes With Oral Health Among Immigrants in New York City. *American Journal of Public Health, 99*(S2), S474–S480. <https://doi.org/10.2105/AJPH.2008.149799>.

DuBard, C. A., & Gizlice, Z. (2008). language spoken and differences in health status, access to care, and receipt of preventive services among US Hispanics. *American Journal of Public Health, 98*(11), 2021–2028. <https://doi.org/10.2105/AJPH.2007.119008>.

Finlayson, T. L., Williams, D. R., Siefert, K., Jackson, J. S., & Nowjack-Raymer, R. (2010). Oral health disparities and psychosocial correlates of self-rated oral health in the national survey of American life. *American Journal of Public Health, 100*(S1), S246–S255. <https://doi.org/10.2105/AJPH.2009.167783>.

Flores, G., & Tomany-Korman, S. C. (2008). the language spoken at home and disparities in medical and dental health, access to care, and use of services in US children. *Pediatrics, 121*(6), e1703–e1714. <https://doi.org/10.1542/peds.2007-2906>.

Gilbert, G. H. (2005). Racial and socioeconomic disparities in health from population-based research to practice-based research: The example of oral health. *Journal of Dental Education, 69*(9), 1003–1014.

Huang, D. L., & Park, M. (2015). Socioeconomic and racial/ethnic oral health disparities among US older adults: Oral health quality of life and dentition: Oral health disparities among older adults. *Journal of Public Health Dentistry, 75*(2), 85–92. <https://doi.org/10.1111/jphd.12072>.

Hwang, S. S., Smith, V. C., McCormick, M. C., & Barfield, W. D. (2011). Racial/ethnic disparities in maternal oral health experiences in 10 States, pregnancy risk assessment monitoring system. *Maternal and Child Health Journal, 15*(6), 722–729. <https://doi.org/10.1007/s10995-010-0643-2>.

Joshy, G., Arora, M., Korda, R., John Chalmers, J., & Banks, E. (2016). Is poor oral health a risk marker for incident cardiovascular disease hospitalisation and all-cause mortality? Findings from 172630 participants from the prospective 45 and up study. *BMJ Open, 6*, e012386. <https://doi.org/10.1136/bmjopen-2016-012>.

Kelesidis, N. (2014). A racial comparison of sociocultural factors and oral health perceptions. *Journal of Dental Hygiene, 88*(3), 173–182.

Kim, J. K., Baker, L. A., Davarian, S., & Crimmins, E. (2013). Oral health problems and mortality. *Journal of Dental Science, 8*(2). <https://doi.org/10.1016/j.jds.2012.12.011>.

Lebrun, L. A. (2012). Effects of length of stay and language proficiency on health care experiences among immigrants in Canada and the United States. *Social Science & Medicine, 74*(7), 1062–1072. <https://doi.org/10.1016/j.socscimed.2011.11.031>.

Locker, D. (2002). Changes in chewing ability with ageing: A 7-year study of older adults. *Journal of Oral Rehabilitation, 29*, 1021–1029.

Sanders, A.E. "A latino advantage in oral health-related quality of life is modified by nativity status." *Social Science & Medicine 71*(1), 205–211. <https://doi.org/10.1016/j.socscimed.2010.03.031>.

Tilashalski, K. R., Gilbert, G. H., M.J.B., & Litaker, M. S. (2007). Racial differences in treatment preferences: Oral health as an example. *Journal of Evaluation in Clinical Practice, 13*(1), 102–108. <https://doi.org/10.1111/j.1365-2753.2006.00661.x>.

Wu, B., Liang, J., Plassman, B. L., Corey Remle, R., & Bai, L. (2011). Oral health among white, black, and Mexican-American elders: An examination of edentulism and dental caries: Racial/ethnic disparities in edentulism and dental caries. *Journal of Public Health Dentistry, 71*(4), 308–317. <https://doi.org/10.1111/j.1752-7325.2011.00273.x>.

Yu, S. (2015). Disparities in health care quality indicators among US children with special health care needs according to household language use. *International Journal of MCH and AIDS (IJMA), 4*(1), 51. <https://doi.org/10.21106/ijma.51>.