

ORIGINAL ARTICLE

# Immigrant Status and Oral Health Disparities among Asian Americans in the United States

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**Objectives:** To explore the roles of household language, foreign-born status, and citizenship on disparities in dental care and oral health status among Asians in the United States.

**Methods:** Based on the National Health and Nutrition Examination Survey (NHANES) 2011–2018, the author applied weighted nested logistic regression to describe the effects of household language, foreign-born status, and citizenship on dentist visits and self-rated oral health. Weighted negative binomial regression was used to explore the effects of immigrant status on the number of missing teeth. Socioeconomic status and demographic characteristics were controlled for.

**Results:** Asians who do not speak English at home present 1.428 times higher likelihood of irregular dentist visits, and 1.487 times higher self-rated fair/poor oral health. Respondents with no citizenship are more likely (Odds Ratio [OR] = 1.752) to present irregular dentist visits. Foreign-born Asians present more missing teeth (OR = 1.361) than their US-born counterparts.

**Conclusions:** Asian Americans with lower immigrant statuses illustrated higher risk for irregular dentist visits and disadvantaged oral health status, controlled for their education and family income levels.

**Keywords:** oral health ■ Asians ■ household language ■ non-US citizen ■ foreign-born status

Immigration is a source of vulnerability.<sup>1</sup> Limited English proficiency and lacking US citizenship, together with lower socioeconomic status (SES) place immigrants at a higher risk of accessibility to needed health care.<sup>1–3</sup> Scholars have reported that, compared to US-born residents, immigrants have reported lower prevalence of health insurance, less access to health care (e.g. lower ratio of doctor visits, mammogram screenings, and less likely to access health-related information), and lower quality of health care.<sup>4–7</sup> There are differences in health care access and health outcomes among different immigrant subgroups. For instance, Mexican Americans presented the lowest rates of health insurance<sup>8,9</sup> and undocumented families lower rates of doctor visits due to lacking of eligible health insurance.<sup>10</sup> Asian Americans are more likely to receive a lower quality of health care,

remain uninsured, and receive fewer health-related suggestions from their doctors compared to Whites.<sup>11</sup> The risk of death from breast cancer is higher among Asian Americans than Whites.<sup>12</sup>

Immigrant status and distinct Asian culture render Asian immigrants and Asian Americans a special minority. In this study, the author intends to explore the relations between immigrant status and oral health disparities among Asian Americans. Immigrant status is conceptualized by household language, lack of US citizenship, and foreign-born status in this study. Household language as one of the immigrant statuses is a main causation to health disparities among immigrants.<sup>13</sup> Bethell and his colleagues have found that children from non-English speaking families are more likely to report lower rates of health insurance and less access to health

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### POPULAR SCIENTIFIC SUMMARY

- Asian Americans with lower immigrant status have higher risks for irregular dentist visits and a disadvantaged oral health status, despite their high education and family income levels.
- Asian Americans who do not speak English at home are more likely to present irregular dentist visits and self-rated fair/poor oral health.
- Foreign-born Asian Americans report more missing teeth than their U.S.-born counterparts. Asian Americans without citizenship in the United States report more irregular dentist visits.

care.<sup>14</sup> When it comes to oral health, adult Hispanics from Spanish-language households are less likely to access health care or preventative dentist visit.<sup>15</sup> Bramlett and his colleagues also found that children from non-English speaking households are more likely to present fair/poor oral health. When parents' income and education were controlled for, the language-related disparities in dental insurance and access to dental care are particularly significant.<sup>16</sup> At present, a limited number of studies had focused on the effects of household language on health outcomes among adults, especially Asians because most of whom immigrated as adults and lack of linguistic language environments.<sup>17</sup>

Immigrants without US citizenship have less access to dental care and worse oral health status. For instance, Liu has found that immigrants of all ethnicities with no citizenship are more likely to report self-rated fair/poor oral health.<sup>18</sup> Noncitizens are at higher risk of periodontal disease than naturalized citizens and native-born citizens.<sup>19</sup> In addition, naturalized citizens and noncitizens are less likely to use dental services.<sup>20</sup> When it comes to Asians, however, scholars report different findings. For instance, based on the sample from the National Health Interview Survey, Luo and Wu have reported that citizenship is not a significant factor in Asians' use of dental services.<sup>21</sup>

Foreign-born immigrants present both advantages and disadvantages in oral health outcomes. On the one hand, previous studies have disclosed that foreign-born African Americans and Hispanics presented a lower prevalence of hypertension, diabetes, and allostatic loads than their US-born counterparts.<sup>22–24</sup> Han revealed the protective role of foreign-born status in oral health among Hispanics.<sup>25</sup> Sanders suggested that compared to the foreign-born first-generation Hispanics, those who were born in the US are more likely to report worse oral health due to low SES.<sup>26</sup> On the other hand, foreign-born status suggests more cultural and language barriers to dental care and higher risk of oral diseases. For instance, foreign-born immigrants are less likely to benefit from improved health

care, such as the treatment of decayed teeth.<sup>27</sup> Scholars have reported both direct and inverse relationships between length of stay in the US and oral health among foreign-born immigrants. Luo and Wu have reported that the length of stay strongly predicts the higher frequency of dentist visits among Asian immigrants.<sup>21</sup> Using data from the PINE study in Chicago, Ge et al. have found that senior Chinese immigrants who stayed in the United States for a longer time report better oral health.<sup>28</sup>

Previous studies on oral health disparities among Asians in the United States are still limited: first, studies that focus on Asian Americans' oral health were mainly based on limited local datasets. In addition, the panorama of oral health disparities among Asians nationwide needs to be described. Second, the effects of immigrant status, in the form of citizenship, foreign-born status, and language barriers of Asians need more attention. Currently, there is only limited exploration of the role of citizenship and foreign-born status on the oral health of Asians. Third, there are particularly limited data of oral health disparities in Asian Americans. In order to bridge the knowledge gap, this study uses national data to (1) describe oral health care utility (e.g. dentist visits), oral health outcomes (self-rated oral health and the number of missing teeth) and immigrant status-related oral health disparities of Asians older than 20 in the US, (2) explore the effects of immigrant status on dentist visits and oral health outcomes for Asians, and (3) identify the effects of immigrant status on dentist visits and oral health outcomes of Asians by controlling the SES and demographic characteristics.

## METHODS

### Data source

This study was a cross-sectional study. The data were drawn from the National Health and Nutrition Examination Surveys (NHANES). Four waves were pooled together in order to obtain a larger sample: the 2011–2012 survey, the 2013–2014 survey, the 2015–2016 survey, and the 2017–2018 survey. In each wave, the demographic data, the questionnaire data, and the examination data were included.

### Sample

This study restricted the analytical sample in several ways. First, only Asians were included and all the other ethnicities were excluded. Second, in this study, only Asian adults older than 20 were included. Third, among all qualified Asian respondents, those whose information included any missing data in outcome variables or independent variables were deleted. The final sample consisted of 2,680 Asian respondents.

## Measurements

Irregular dentist visits were assessed by the question: *when did you last visit a dentist?* Choice of responses referred: 6 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 were recoded as a binary variable: no more than 1 year ago (0) and more than 1 year ago (1).

Self-rated fair/poor oral health was estimated by the question: *rate the health of your teeth and gums.* Responses included: excellent, very good, good, fair, or poor? In this study, the self-rated oral health was recoded as a binary variable: excellent, very good, and good were coded as 0, fair and poor were coded as 1.

The information about the number of teeth was obtained from the examination dataset of NHANES. If a tooth was completely present, it was coded as 0, while all decayed or lost teeth were coded as 1. Then, the values of all missing teeth were added up together except for four third molars.

Immigrant status was measured by household language, citizenship status and country of birth. In this study, people who speak only foreign language at home were coded as no English at home (1), all other categories were coded as some English at home (0). Citizenship status was recoded as non-citizens (1) and citizens (0). Country of birth was coded as foreign-born (1) and born in the US (0).

SES was measured by education and family income. Education was coded as no high school (1), some high school (2), high school (3), some college (4), and bachelor degree (BA) or higher (5). Based on the distribution of income for the analytic sample, the family income was collapsed into four groups: \$0–19,999 (1), \$20,000–44,999 (2), \$45,000–74,999 (3), and \$75,000 and over (4). Demographic characteristics included age, gender, and marital status. Age ranged from 20 to 80 years. Respondents who are older than 80 years were coded as 80 during the survey. In this study, age was recoded as three age groups: 20–39 years (coded as 1), 40–59 years (coded as 2), and older than 60 years (coded as 3). Gender was coded as female (1) and male (0). Marital status was coded as married or live with partners (0), and single that includes divorced, widowed, and those who never got married (1).

## Statistical analysis

The analyses were performed using the STATA software version 14.0. The study sample was first described. The proportions for categorical variables, and the mean and standard deviation (SD) for continuous variables were reported in Table 1. Interview weight provided by NHANES was used as suggested (interview weight/4 for data that pooled by three waves). Second, nested logistic

regression models were applied for the irregular dental visits and self-rated fair/poor oral health, both of which were adjusted by suggested interview weight. In addition, a negative binomial regression model was used to estimate the effects on the number of missing teeth. The examination weight provided by NHANES was applied as suggested (examination weight/4 for pooled data). In each analysis, five models were presented: the first three models examined the effects of household language, non-US citizenship, and foreign-born status on outcomes separately. The fourth model presented the combined effects of all immigrant statuses. Education, annual family income and demographic characteristics were adjusted for in model 5. Chi-square values were reported for each model as a measure of model fit.

## RESULTS

Table 1 described the weighted results of the whole sample, the subsamples of respondents who do not speak English at home, non-US citizenship, and foreign-born respondents (unweighted descriptive result was attached as Appendix). In the whole sample, 37.7% of respondents reported that their last dentist visit occurred more than 1 year ago. The percentage of irregular dentist visits was 45.8% among respondents who do not speak English at home, in the sample of non-US citizenship it was 49.3%, and 38.3% in foreign-born sample. In the whole sample, 22.4% of respondents rated their oral health as fair or poor, and the percentage was 28.1% among those who do not speak English at home, 23.8% in the sample of noncitizens and 23.6% in the foreign-born sample. The average number of missing teeth was 5.44 (linearized standard error [LSE] = 0.18) in the whole sample, 6.35(LSE = 0.28) among those who do not speak English at home, 5.58(LSE = 0.32) in the noncitizen sample and 6.02(LSE = 0.23) in the foreign-born sample. Nearly half of respondents (46.0%) do not speak English at home among all respondents. The percentage of respondents who do not speak English at home was 65.2% among non-citizens and 50.6% among foreign-born respondents. 35.7% of respondents did not have US citizenship, while the percentage in the non-English-at-home sample was 50.6%, and in the foreign-born sample, it was 40.2%. 67.6% of the respondents were foreign-born. Among respondents who do not speak English at home, the percentage of foreign-born was 74.4%, and the percentage is 76.2% in the noncitizen sample.

Table 2 presented the effects of immigrant status on irregular dentist visits among Asians in the United States. Model 1 showed that respondents who do not speak English at home were more likely to report irregular dentist visits (OR = 1.909, 95%CI = 1.616–2.254). Model 2 suggested that people with non-US

**Table 1. Weighted descriptive results of Asians in the United States in NHANES 2011–2018.**

	Whole sample	No English at home	No US citizenship	Foreign born
<b>Number of observations</b>	2,680	1,286	938	1,798
<b>Weighted population size</b>	11,706,908	5,384,556	4,175,764	7,918,816
<b>Irregular dentist visit (more than 1 year = 1 / no more than 1 year = 0)</b>	37.7% <sup>a</sup>	45.8%	49.3%	38.3%
<b>Self-rated fair/poor oral health (good/very good/excellent = 0)</b>	22.4%	28.1%	23.8%	23.6%
<b>The number of missing teeth (0–28)</b>	5.44(8.88) <sup>b</sup>	6.35(9.53) <sup>c</sup>	5.58(9.45) <sup>d</sup>	6.02(9.33) <sup>e</sup>
<b>No English at home (some English or all English = 0)</b>	46.0%	--	65.2%	50.6%
<b>Non US citizenship (US citizen = 0)</b>	35.7%	50.6%	--	40.2%
<b>Foreign-born (US born = 0)</b>	67.6%	74.4%	76.2%	--
<b>Education</b>				
<b>No high school (1)</b>	7.5%	14.2%	11.5%	8.7%
<b>Some high school (2)</b>	6.3%	8.9%	7.6%	6.5%
<b>High school (3)</b>	13.2%	16.9%	12.3%	13.4%
<b>Some college (4)</b>	19.8%	17.6%	15.4%	19.2%
<b>BA or higher (5)</b>	53.3%	42.8%	53.2%	52.2%
<b>Family income</b>				
<b>\$19,999 or less (1)</b>	12.9%	16.7%	16.0%	13.6%
<b>\$20,000–44,999 (2)</b>	22.5%	26.6%	27.6%	23.0%
<b>\$45,000–74,999 (3)</b>	19.6%	21.0%	18.5%	20.2%
<b>\$75,000+ (4)</b>	45.0%	35.7%	37.9%	43.3%
<b>Age group</b>				
<b>20–39 (1)</b>	42.2%	36.4%	54.4%	40.9%
<b>40–59 (2)</b>	37.0%	35.3%	32.0%	38.7%
<b>60+ (3)</b>	20.8%	28.7%	13.6%	20.8%
<b>Female (male = 0)</b>	54.1%	53.1%	54.2%	53.7%
<b>Single (married or live with partner = 0)</b>	28.6%	23.5%	26.0%	27.3%

<sup>a</sup>Weighted percentage.

<sup>b</sup>Weighted mean (standard deviation/SD) and the number of observations ( $n = 2,557$ ). In NHANES, teeth were examined separately from questionnaire and the weight is different. When weight was applied, Stata adjusted the sample size automatically.

<sup>c</sup>Weighted mean (SD) and the number of observations ( $n = 1,229$ ).

<sup>d</sup>Weighted mean (SD) and the number of observations ( $n = 907$ ).

<sup>e</sup>Weighted mean (SD) and the number of observations ( $n = 1,717$ ).

citizenship were more likely to report irregular dentist visits (OR = 2.148, 95%CI = 1.809–2.550). Model 3 indicated that there was no significant relation between foreign-born status and dentist visits. Model 4 presented that when the three immigrant status were nested together, respondents who do not speak English at home (OR = 1.629, 95%CI = 1.367–1.940) and non-US citizens (OR = 1.891, 95%CI = 1.579–2.265) were more likely to report irregular dentist visits. Model 5 suggested that when education, annual family income and demographic characteristics were controlled for, people who do not speak English at home (OR = 1.428, 95% CI = 1.179–1.731), and those who do not have US citizenship (OR = 1.752, 95% CI = 1.443–2.129) were still more likely to report irregular dentist visits.

Table 3 presented the effects of immigrant status on self-rated fair/poor oral health among Asians in the United States. Model 1 presented that respondents who do not speak English at home were more likely to report

fair/poor oral health (OR = 1.838, 95% CI = 1.520–2.224). Model 2 suggested that citizenship was not significantly related to self-rated fair/poor oral health. Model 3 presented that foreign-born respondents were more likely to rate their oral health as fair/poor (OR = 1.253, 95% CI = 1.018–1.541). Model 4 indicated that for respondents of the same citizenship and foreign-born status, those who do not speak English at home (OR = 1.842, 95% CI = 1.504–2.257) were more likely to report self-rated fair/poor oral health. Model 5 suggested that when education, family income, and demographic characteristics were adjusted for; respondents who do not speak English at home were still more likely to report fair/poor oral health (OR = 1.487, 95% CI = 1.195–1.850).

Table 4 presented the effects of immigrant status on the number of missing teeth among Asians. Model 1 presented that respondents who do not speak English at home were likely to report more missing teeth (OR =

**Table 2. Weighted nested logistic regression on irregular dentist visits of Asians in the United States in NHANES 2011–2018.<sup>a</sup>**

Irregular dentist visits	Model 1	Model 2	Model 3	Model 4	Model 5
<b>No English at home</b>	1.909*** [1.616–2.254]			1.629*** [1.367–1.940]	1.428*** [1.179–1.731]
<b>Non US citizenship</b>		2.148*** [1.809–2.550]		1.891*** [1.579–2.265]	1.752*** [1.443–2.129]
<b>Foreign-born</b>			1.091 [0.914–1.301]	0.930 [0.774–1.119]	0.917 [0.756–1.113]
<b>Education (ref = no high school)</b>					
<b>Some high school</b>					0.681 [0.430–1.079]
<b>High school</b>					0.674 [0.451–1.007]
<b>Some college</b>					0.711 [0.481–1.053]
<b>BA or higher</b>					0.449*** [0.310–0.652]
<b>Family income (ref = \$19,999 or less)</b>					
<b>\$20,000–44,999</b>					0.896 [0.669–1.200]
<b>\$45,000–74,999</b>					0.749 [0.554–1.013]
<b>\$75,000+</b>					0.453*** [0.338–0.608]
<b>Age group (ref = 20–39)</b>					
<b>40–59</b>					0.632*** [0.510–0.783]
<b>60+</b>					0.700** [0.545–0.901]
<b>Female</b>					0.672*** [0.563–0.802]
<b>Single</b>					1.221 [0.989–1.506]
<b>Constant</b>	0.443*** [0.393–0.500]	0.453*** [0.407–0.504]	0.569*** [0.492–0.659]	0.395*** [0.334–0.468]	1.713* [1.013–2.897]
<b>Chi-square</b>	58.12	76.13	0.932	103.0	237.4

<sup>a</sup> $P < 0.05$ , <sup>\*\*</sup> $P < 0.01$ , <sup>\*\*\*</sup> $P < 0.001$ .

<sup>b</sup>The number of observations is 2,680; the weighted population is 11,706,908.

<sup>c</sup>Odds ratios and robust 95% CI in parentheses.

1.359, 95% CI = 1.192–1.549). Model 2 suggested that citizenship was not significantly related to the number of missing teeth. Model 3 indicated that foreign-born respondents were more likely to report missing teeth (OR = 1.414, 95% CI = 1.219–1.639). Model 4 presented that when three immigrant statuses were nested together, respondents who do not speak English at home (OR = 1.317, 95% CI = 1.150–1.507) and foreign-born respondents (OR = 1.363, 95% CI = 1.171–1.587) were more likely to report missing teeth. When education, annual family income, and demographic characteristics were adjusted for in model

5, respondents who do not speak English at home were less likely to report missing teeth (OR = 0.802, 95% CI = 0.669–0.961). Foreign-born respondents (OR = 1.361, 95% CI = 1.138–1.627) were more likely to report missing teeth.

## DISCUSSION

This study examined the roles of household language, citizenship, and foreign-born status on dentist visits, self-rated oral health and the number of missing teeth, adjusting for SES and demographic characteristics were

**Table 3. Weighted nested logistic regression on self-rated fair/poor oral health of Asians in the United States in NHANES 2011–2018.<sup>a</sup>**

Self-rated fair/poor oral health	Model 1	Model 2	Model 3	Model 4	Model 5
<b>No English at home</b>	1.838*** <sup>b</sup>			1.842***	1.487***
	[1.520–2.224]			[1.504–2.257]	[1.195–1.850]
<b>Non US citizenship</b>		1.134		0.929	0.962
		[0.933–1.379]		[0.752–1.148]	[0.771–1.199]
<b>Foreign-born</b>			1.253*	1.162	1.118
			[1.018–1.541]	[0.941–1.436]	[0.903–1.384]
<b>Education (ref = no high school)</b>					
<b>Some high school</b>					0.968
					[0.614–1.527]
<b>High school</b>					0.857
					[0.582–1.264]
<b>Some college</b>					0.755
					[0.513–1.111]
<b>BA or higher</b>					0.606**
					[0.423–0.869]
<b>Family income (ref = \$19,999 or less)</b>					
<b>\$20,000–44,999</b>					0.811
					[0.600–1.097]
<b>\$45,000–74,999</b>					0.574***
					[0.417–0.791]
<b>\$75,000+</b>					0.498***
					[0.367–0.675]
<b>Age group (ref = 20–39)</b>					
<b>40–59</b>					1.491**
					[1.168–1.903]
<b>60+</b>					1.281
					[0.973–1.687]
<b>Female</b>					0.976
					[0.803–1.185]
<b>Single</b>					1.022
					[0.812–1.286]
<b>Constant</b>	0.212***	0.275***	0.247***	0.196***	0.392***
	[0.184–0.245]	[0.245–0.309]	[0.207–0.294]	[0.161–0.240]	[0.231–0.667]
<b>Chi-square</b>	39.27	1.595	4.536	40.57	114.3

\* $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

<sup>a</sup>The number of observations is 2,680; the weighted population is 11,706,908.

<sup>b</sup>Odds ratios and robust 95% CI in parentheses.

adjusted for. Three major findings were included in this paper. First, household language played an important role in oral health care and oral health status. In this study, people who do not speak English at home were more likely to have irregular dentist visits and self-rated fair/poor oral health but less likely to report missing teeth. Second, respondents with non-US citizenship were also more likely to report irregular dentist visits. This is consistent with previous studies<sup>18–20</sup> that US citizenship is related to dental care utility, which contradicts Luo and Wu's study on Asians.<sup>21</sup> It is possible

that respondents with non-US citizenship were less likely to have a formal job, through which they can obtain employee health insurance or dental insurance. As a result, they are less likely to visit dentists. Another possibility is that people who do not have a US citizenship are illegal immigrants. Therefore, they are less likely to visit a dentist to avoid being detected. Third, differing from previous studies that present the protective role of foreign-born status among Hispanic and African immigrants,<sup>22–24</sup> foreign-born Asians were more likely to report more missing teeth. Foreign-born Asians also

**Table 4. Weighted negative binomial regression on the number of missing teeth of Asians in the United States in NHANES 2011–2018.<sup>a</sup>**

The number of missing teeth	Model 1	Model 2	Model 3	Model 4	Model 5
<b>No English at home</b>	1.359*** <sup>b</sup>			1.317***	0.802*
	[1.192–1.549]			[1.150–1.507]	[0.669–0.961]
<b>Non-US citizenship</b>		1.040		0.948	1.195
		[0.906–1.194]		[0.820–1.095]	[0.999–1.429]
<b>Foreign-born</b>			1.414***	1.363***	1.361***
			[1.219–1.639]	[1.171–1.587]	[1.138–1.627]
<b>Education (ref = no high school)</b>					
<b>Some high school</b>					0.725*
					[0.536–0.980]
<b>High school</b>					0.723**
					[0.572–0.913]
<b>Some college</b>					0.606***
					[0.470–0.781]
<b>BA or higher</b>					0.490***
					[0.390–0.616]
<b>Family income (ref = \$19,999 or less)</b>					
<b>\$20,000–44,999</b>					1.000
					[0.805–1.243]
<b>\$45,000–74,999</b>					1.089
					[0.857–1.384]
<b>\$75,000+</b>					0.991
					[0.789–1.244]
<b>Age group (ref = 20–39)</b>					
<b>40–59</b>					1.825***
					[1.499–2.221]
<b>60+</b>					3.867***
					[3.178–4.706]
<b>Female</b>					1.217*
					[1.035–1.433]
<b>Single</b>					0.866
					[0.707–1.061]
<b>Constant</b>					0.802*
					[0.669–0.961]
<b>Chi-square</b>	21.12	0.316	20.98	35.41	340.4

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

<sup>a</sup>In NHANES, teeth were examined separately from the questionnaire and the weight is different. Under the examined dataset weight, the number of observation is 2,680, and the weighted population size is 11,810,042. When weight was applied in negative binomial regression, Stata adjusted the sample size of observations is 2,557 automatically.

<sup>b</sup>Odds ratios and robust 95% CI in parentheses.

reported a higher ratio of self-rated fair/poor oral health (model 3 in Table 2); however, when household language and citizenship were controlled, this significant effect was cancelled out. It is possible that there are overlaps in foreign-born status, US citizenships and household language. Those who were born outside of the US are more likely to speak other languages at home and are not citizens of the United States.

This study bears four limitations: first, dental-related variable such as dental insurance was not available in

the database. In addition, covariates such as general health insurance, occupation, and urban-rural were either not available or including too many missing values in the database. Second, foreign-born status would present more information if used together with the length of stay. However, in this study, there are too many missed cases in the length of stay in the United States; thus it was not included. Moreover, it is hard to measure household language, citizenship, and foreign-born status separately due to the overlaps of foreign-born

status and citizenship and household language. Third, chi-squared test for the proportional odds indicated that the main model assumption was violated. Therefore, a binary logistic model was employed to examine the effects on irregular dentist visits and self-rated oral health. It is possible that collapsing a dependent variable to a binary variable associated with missing information. Finally, the age effects were not well controlled for, especially the role of age in the number of missing teeth. In addition, the measures of dentist visits, oral health and other variables except for the number of missing teeth are self-reported data, which may include inaccurate information.

### New contribution to the literature

This study contributes to the present literature in three aspects: first, this study presents that it is necessary to examine the effects of immigrant status on oral health disparities among Asians. It is time to realize the paradoxical fact that although Asians are usually stereotyped by high SES, immigrant status makes Asians vulnerable. Moreover, nested models presented not only the correlation between immigrant status and oral health outcomes (models 1–3 for each dependent variable) and also the combined effects of immigrant status (model 4) and the effects of covariates (model 5). Second, the effects of foreign-born status on health outcomes are more complex among different subgroups of immigrants. Foreign-born status presented a protective role among Hispanics and African immigrants,<sup>22–24</sup> but it is not the case among Asians. Third, other than self-reported English proficiency and interview language, household language can be a potential predictor of a social gradient related to health risk, at least among Asians. This finding added more message to Flores's and Lee's studies<sup>29,30</sup> that suggest interview language would be a better indicator to measure language barrier and health disparities: other than interview language, household language indeed presents disadvantages in accessing dental care and oral health status among Asians. The weighted descriptive results presented that, among respondents who do not speak English at home, 74.4% were foreign-born and more than half of them (50.6%) do not have US citizenship. In addition, respondents who do not speak English at home presented lower education and family income compared to respondents in other subsamples. All these findings indicate that household language should also be considered as an efficient predictor of socioeconomic status and a potential predictor of health disparities, at least for Asians. In sum, this study presented the association of immigrant statuses and health disparities among Asians. It is possible that immigrant status has cancelled out the

advantages of high education attainments of Asians. This hypothesis can be tested by comparative studies among Asians and other racial groups in the future.

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## Appendix

**Table A. Unweighted descriptive results of Asians in the United States in NHANES 2011–2018 (n = 2,680).**

Characteristics	Whole sample (n = 2,680)	No English at home (n = 1,286)	No U.S. citizenship (n = 938)	Foreign born (n = 1,798)
<b>Irregular dentist visit (more than 1 year = 1 /no more than 1 year = 0)</b>	38.32% <sup>a</sup>	46.66%	50.85%	39.04%
<b>Self-rated fair/poor oral health (good/very good/excellent = 0)</b>	23.21%	28.54%	24.20%	24.69%
<b>The number of missing teeth (0–28)</b>	6.84 (10.02) <sup>b</sup>	7.79(10.52)	6.83 (10.38)	7.39 (10.35)
<b>No English at home (some English or all English = 0)</b>	47.99%	--	67.27%	52.67%
<b>Non US citizenship (US citizen = 0)</b>	35.00%	49.07%	--	39.71%
<b>Foreign-born (U.S. born = 0)</b>	67.09%	73.64%	76.12%	--
<b>Education</b>				
<b>No high school (1)</b>	8.25%	15.16%	12.79%	9.45%
<b>Some high school (2)</b>	6.6%	9.25%	8.32%	7.06%
<b>High school (3)</b>	13.06%	17.34%	12.37%	13.96%
<b>Some college (4)</b>	19.55%	17.26%	15.25%	19.47%
<b>BA or higher (5)</b>	52.46%	40.98%	52.28%	50.06%
<b>Family income</b>				
<b>\$19,999 or less (1)</b>	13.66%	18.04%	16.16%	14.68%
<b>\$20,000–44,999 (2)</b>	23.10%	27.53%	28.68%	23.97%
<b>\$45,000–74,999 (3)</b>	20.11%	21.31%	18.87%	20.63%
<b>\$75,000+ (4)</b>	43.13%	33.13%	35.29%	40.71%
<b>Age group</b>				
<b>20–39 (1)</b>	37.69%	32.19%	49.15%	37.37%
<b>40–59 (2)</b>	38.25%	36.08%	34.43%	38.99%
<b>60+ (3)</b>	24.07%	31.73%	16.42%	23.64%
<b>Female (male = 0)</b>	52.16%	51.24%	53.20%	51.61%
<b>Single (married or live with partner = 0)</b>	27.80%	23.09%	26.55%	26.70%

<sup>a</sup>Percentage.

<sup>b</sup>Mean (standard deviation/SD).