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Racial/Ethnic Disparities in Dental Service Utilization for Foreign-Born and U.S.-Born Middle-Aged and Older Adults

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Abstract

This study examines racial/ethnic disparities of dental service utilization for foreign-born and U.S.-born dentate residents aged 50 years and older. Generalized linear mixed-effects models (GLMM) were used to perform longitudinal analyses of five-wave data of dental service utilization from the Health and Retirement Study (HRS). We used stratified analyses for the foreign-born and U.S.-born and assessed the nonlinear trend in rates of dental service utilization for different racial/ethnic groups. Findings indicate that Whites had higher rates of service utilization than Blacks and Hispanics regardless of birthplace. For all groups, the rates of service utilization decreased around age 80, and the rates of decline for Whites were slower than others. The U.S.-born showed the trend of higher rates of service utilization than the foreign-born for all racial/ethnic groups. These findings suggest the importance of developing culturally competent programs to meet the dental needs of the increasingly diverse populations in the United States.

Keywords

dental service utilization; place of birth; racial/ethnic disparities; United States; longitudinal analysis

Oral health is increasingly considered as an essential element of healthy aging as it is closely related to one's general health status and health-related quality of life (Shuman et al., 2017). Regular dental checkups can prevent oral diseases, maintain good oral health (Griffin, Jones, Brunson, Griffin, & Bailey, 2012), and promote cognitive functioning in late life (Han, Wu, & Burr, 2019). However, regularly utilizing dental services is often a challenge for many Americans, especially for older adults, racial/ethnic minorities, and immigrant populations (Wilson, Wang, Borrell, Bae, & Stimpson, 2018; Zhang, 2016). This is mainly due to barriers such as lack of dental insurance coverage, access to quality dental care, and awareness of the importance of oral health (Wu, Liang, Luo, & Furter, 2013). For instance, only 12% of Medicare beneficiaries reported having at least some dental insurance to help

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pay dental expenses (Willink, Schoen, & Davis, 2016). Limited access and utilization of dental services were also well-documented among racial/ethnic minorities (Shelly, Russell, Parikh, & Fahs, 2011; Shi, Lebrun, & Tsai, 2010; Zhang, 2016) and immigrant populations (Luo & Wu, 2016). Focusing on middle aged and older adults (50+) in the United States, the primary goal of the current study is to describe trajectories of dental service utilization as they age and explore variations in the trajectory by race/ethnicity and place of birth, an important immigration-related factor.

Immigration status, place of birth in particular, is closely related to one's dental service use and oral health status (Calvasina, Muntaner, & Quinonez, 2014; Luo & Wu, 2016; Wilson et al., 2018; Wilson, Wang, Stimpson, McFarland, & Singh, 2016). In Canada, it is found that approximately 32% of immigrants reported unmet dental care needs, and lack of dental insurance and low income are major predictors (Calvasina et al., 2014). In the United States, noncitizens and naturalized citizens reported significantly lower rate of dental service utilization than the U.S.-born (Wilson et al., 2016), and noncitizen immigrants reported significantly poorer oral health than natives (Wilson et al., 2018). For racial/ethnic oral health disparities, adults in the United States, especially the uninsured and Blacks, were found to increasingly rely on emergency visits for dental care when access to professional care was limited (Lee, Lewis, Saltzman, & Starks, 2012). Barriers in the utilization of dental services contribute to oral diseases and problems among disadvantaged populations (Manski et al., 2015). Racial/ethnic disparities in edentulism (Wu, Liang, Plassman, Remle, & Luo, 2012), tooth decay (Hybels et al., 2016; Liang, Wu, Plassman, Bennett, & Beck, 2013; Wu, Liang, Plassman, Remle, & Luo, 2012), tooth loss (Luo, Pan, Sloan, Feinglos, & Wu, 2015), as well as oral health-related quality of life (Huang & Park, 2015) remained substantial among older Americans.

To promote oral health and close racial/ethnic gaps in oral health disparities, regular use of preventive dental services is critical. A few studies have examined population-level trends of dental service utilization across racial/ethnic groups in the United States based on nationally representative cross-sectional data (Luo, Bell, Wright, Wu, & Wu, 2018; Wall, Vujicic, & Nasseh, 2012; Wu et al., 2013). These studies found that the racial/ethnic disparities in dental service utilization were persistent for the past two decades. However, these cross-sectional studies are limited in their ability to identifying intrapersonal changes in dental service utilization. Using longitudinal panel data, a couple of studies conducted in Europe have started to reveal patterns of declining use of dental services with increasing age (Åström, Ekback, Nasir, Ordell, & Unell, 2013; Åström, Ekback, Ordell, & Nesir, 2014). Specifically, Åström, Ekback, Nasir, Ordell, and Unell (2013) found a slight decline in dental service utilization with increasing age despite respondents' gender status, marital status, and place of birth. They also found that dental service utilization was most prevalent among the socioeconomically advantaged groups, the dentate individuals, individuals who perceived oral problems, as well as those who enjoyed high-quality dental care in Sweden. Åström, Ekback, Ordell, and Nesir (2014) also revealed that routine dental attendance was negatively related to tooth loss and positively related to oral health-related quality of life over time among Swedish older adults. However, very few studies have been conducted in the United States to describe trajectories of disparities in dental service utilization among older adults using longitudinal data.

Assessing disparities in dental service utilization is particularly important in the context of the United States as it reflects the most salient challenges faced by the disadvantaged social groups with regard to the lack of dental insurance, lack of access to dental care, racial discrimination, and language barriers. Using five waves of longitudinal data from the Health and Retirement Study (HRS) and controlling for a wide range of covariates including socio-demographics, health conditions, and health behaviors, this study aims to examine trajectories of dental service utilization for each racial/ethnic group among middle-aged and older (50+) foreign-born and U.S.-born dentate residents (Anderson, 1995; Manski, Moeller, & Chen, 2014). We chose to focus on middle-aged and older adults primarily due to the following reasons: First, oral health problems are common in older adults. Older adults have less frequent dental visits than most of other age groups (Akinkugbe & Lucas-Perry, 2013). In addition, Medicare does not cover dental insurance. Thus, use of dental service is often a challenge for older adults, those with lower income in particular (Griffin et al., 2019). Third, examining dental care for adults aged 50 and older allows us to examine how the pattern of dental service use changes with the increase of age. Taken together, we propose two hypotheses: First, compared to Whites, racial/ethnic minorities may report significantly lower rate of dental service utilization over time. We further hypothesize that, in comparison to their U.S.-born counterparts, foreign-born minorities report significantly lower rate of dental service utilization over time. By focusing on the underserved populations such as racial/ethnic minorities and immigrants, our study will generate new knowledge on disparities in oral health and dental service utilization in the United States.

Data and Method

Data

This study used the public domain data from the HRS, which is conducted by the University of Michigan. The HRS is a longitudinal cohort study that conducts biennial surveys among individuals over 50 years old in the United States since 1992. The HRS collects data on topics such as income and wealth, health, use of health-care services, and cognition. Data collection was performed using a multimodal approach. Interviews were done via face-to-face, telephone, and through the Internet (Sonnega et al., 2014). HRS contains six birth cohorts that were recruited at different waves. The original HRS (born 1931 to 1941) and the Oldest Old (born 1924 to 1930) cohorts were recruited in 1992. Children of Depression (born 1942 to 1947) and War Baby (born 1942 to 1947) cohorts were recruited in 1998. The last two cohorts, Early Baby Boomer (born 1948 to 1953) and Mid Baby Boomer (born 1954 to 1959) were recruited in 2004 and 2008, respectively. Data regarding Black and Hispanic households were oversampled at about twice the rate of Whites to account for unequal probability sampling. Follow-up data were collected every other year for a random half of the sample (Juster & Suzman, 1995; Sonnega et al., 2014). Patterns of dental service utilization could differ significantly between individuals with and without natural teeth (Luo & Wu, 2016) and the HRS only started to collect data on edentulism since 2006. Therefore, we analyzed five waves of the HRS data from 2006 to 2014. In this study, dentate respondents (having at least one natural tooth) aged 50 and above at the baseline were included. Baseline was defined as the first available data on dental service utilization since 2006. The baselines for the participants could be at different waves because the HRS collects

information on edentulism from a random half sample every wave, and the Mid Baby Boomers were enrolled in 2008. The total sample size for this study was 20,488, including 17,661 U.S.-born and 2,827 foreign-born.

Measures

The binary outcome variable—dental service utilization—was measured by asking respondents whether they had seen a dentist over the past 2 years for dental service including dentures (yes/no). The focal independent variables are race/ethnicity (non-Hispanic White, Hispanic, Black, and Other) and place of birth (U.S.-born vs. foreign-born). Based on the Andersen's Behavioral Model of Health Services Use (Anderson, 1995), we controlled for predisposing characteristics such as age, sex, marital status, and smoking status, enabling resources such as education, household income, and health insurance status, as well as need factors such as self-rated health (SRH; 1 = *poor* to 5 = *excellent*), number of chronic conditions, disabilities in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), and change status of edentulism in the follow-up waves. These factors are known to be related to dental service utilization (Wu, Tran, & Khatutsky, 2005). Age was used as a continuous variable to examine the nonlinear trajectories of dental service utilization by age. The total number of chronic conditions (indicated by self-reported physician-diagnosed history of high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric disorder, and arthritis) ranged from 0 to 8. Continuous variables, ADLs (range: 0–5) included a sum of disabilities in bathing, eating, dressing, getting into/out of bed, and toileting, and IADLs (range: 0–5) were measured as the summed count of disabilities in using telephone, taking medication, handling money, shopping, and preparing meals.

Statistical Methods

Summary statistics were used to describe the baseline characteristics of the overall sample and subsamples by birthplace for dental service utilization, focal independent variables (race/ethnicity and place of birth), as well as the covariates. Next, we reported the summary statistics for focal independent variables and covariates by dental service utilization (yes vs. no) for the entire sample and subsamples by birthplace. Chi-square tests and one-way analysis of variance (ANOVA) were performed to test association for categorical and continuous focal variables and covariates, respectively. We used Poisson model to directly estimate the prevalence ratios (PRs) instead of estimating odds ratio using logistic regression (McNutt, Wu, Xue, & Hafner, 2003; Zou, 2004). Prior research suggests that there are some differences in dental service utilization by birthplace (Åstrøm et al., 2013, 2014; Luo & Wu, 2016; Wu et al., 2005); therefore, we performed Poisson generalized linear mixed-effects model (GLMM) analyses to test statistical difference in dental service utilization for each focal variable and covariate between U.S.-born and foreign-born.

Lastly, Poisson GLMMs were used to perform bivariate and multivariate longitudinal data analysis of dental service utilization (Breslow & Clayton, 1993; Fitzmaurice, Laird, & Ware, 2011; Venables & Ripley, 2002; Wolfinger & O'Connell, 1993). Random intercept was used to account for the within-subject correlations of repeated measures of dental service utilization, and cubic polynomial functions of age (age, age², and age³) were used in the

model to identify a nonlinear trajectory of dental service utilization. The Poisson regression analysis allowed us to directly estimate the PRs of the rates of dental service utilization for all covariates (McNutt et al., 2003; Zou, 2004). PRs and corresponding 95% confidence intervals (CIs) were reported to evaluate factors that are associated with dental service utilization. To examine racial/ethnic disparities across all age spectrums, we assessed the interaction effects between the cubic polynomial function of age and race/ethnicity in the fully adjusted models. Statistical software R (Version 3.3.2) and R libraries “MASS,” “effects,” and “ggplot2” were used for the analyses.

Results

Our calculation (not shown in tables) shows that the average number of visits per participant was 3.7 over five waves (2006–2014), with 54% of the participants having four or five dental visits, 26.6% having three visits, and 19.1% having one or two visits. The average number of visits for the Mid Baby Boomers (recruited in 2008) might be fewer than the rest of the cohorts. The HRS survey response rate ranged between 83% and 89% with an average of 86.7%, which was equivalent to an expected average number of 3.8 repeated measures over five waves.

Sample characteristics are listed in Table 1. The mean prevalence rate of dental service utilization was 70% for the entire sample, whereas the rates for U.S.-born and foreign-born were 71% and 62%, respectively. The U.S.-born respondents were older (mean = 64.8, $SD = 10.7$) than the foreign-born (mean = 61.8, $SD = 9.6$). For socio-economic status, the U.S.-born respondents had higher percentage of college-educated (51.1% vs. 37.4%) and health insurance coverage (67.5% vs. 45.7%) than the foreign-born. The average income was also higher for the U.S.-born than for the foreign-born. In addition, the U.S.-born and foreign-born had different racial/ethnic profiles and mean levels of SRH and chronic conditions. In general, the foreign-born reported better SRH and fewer number of chronic conditions than the U.S.-born. However, both groups had comparable gender profiles, edentulism status, and mean levels of ADLs and IADLs.

Table 2 shows descriptive statistics by dental service utilization and the p values for the tests of differences between the U.S.-born and foreign-born. Statistical differences of dental service utilization were found in race/ ethnicity and most of the covariates. Breaking down the whole sample by race/ethnicity, however, the foreign-born displayed a higher rate of service utilization than the U.S.-born for each racial/ethnic group. For the whole sample and for subsamples, those who were females, who were insured, who had higher levels of education and household income, who were married (except for the foreign-born married), who never smoked, and the dentate respondents at follow-ups reported a higher rate of service utilization compared to their corresponding counterparts. In addition, those utilizing dental services were more likely to report better SRH, fewer chronic conditions, ADLs, and IADLs.

Table 3, 4, and 5 display crude and adjusted PRs along with 95% CIs of service utilization from Poisson GLMMs for the overall sample, U.S.-born, and foreign-born, respectively. Results showed that the foreign-born reported a lower crude rate (PR = 0.85, 95% CI: [0.83,

0.88], $p < .0001$) but a higher adjusted rate (PR = 1.09, 95% CI: [1.06–, 1.12], $p < .0001$) of service utilization across waves than those of the U.S.-born. Compared to Whites, all other racial/ethnic groups including Blacks, Hispanics, and Others showed lower rates of service utilization in both the unadjusted and adjusted models. Results from the foreign-born were generally consistent with those from the U.S.-born sample according to Tables 4 and 5.

The interaction effects between age polynomials and race/ethnicity and birthplace were statistically significant in the U.S.-born ($p < .0001$) and borderline significant in the foreign-born model ($p = .07$). The PRs and 95% CIs for the covariates in the interaction models were not reported in this study because they were similar to the adjusted models with small differences in the second decimal points of the PRs. To illustrate the interaction effects of age polynomials and race/ethnicity (i.e., different trajectories of age by race/ethnicity), we calculated the rates of dental service utilization from age 50 to 100 with the 95% confidence bands in the age range for all racial/ethnic groups (Figure 1). The nonoverlapping 95% confidence bands imply strong statistical significance. The confidence bands for all groups became wider with age because the sample sizes were small for older age groups. In general, the trajectories of dental service utilization tended to decline with increasing age regardless of birthplace. This pattern was true for most racial/ethnic groups with a substantial decline after age 80. Whites had a higher rate of dental service utilization compared to Blacks, Hispanics, and the Others as the confidence bands for Whites were much higher than the other groups. Additionally, the rates of decline for Whites were not as steep as those of other racial/ethnic groups. Figure 1 also shows that the U.S.-born had the trend of higher rates of dental service utilization although the gaps were closing as individuals became older, with an exception that the mean trajectory for the foreign-born Blacks might be distorted by small sample sizes at certain ages.

Discussion

Studies have shown the importance of dental service utilization in improving oral health of older adults (Locker, 2001). Failure to engage in preventive dental care may lead to serious consequences such as tooth decay, tooth pain, tooth loss, and inflammation (Wu et al., 2013). This study was among the first to examine disparities in trajectories of dental service utilization across racial/ethnic groups by comparing middle-aged and older immigrants with their native-born counterparts. Using five waves of the HRS data and Poisson GLMMs, our study revealed significant racial/ethnic disparities in service utilization and these disparities were persistent regardless of one's birthplace and a comprehensive adjustment of covariates. In addition, as people became older, the use of dental services declined. This tendency was more evident for Blacks and Hispanics than for Whites. This study also revealed differences in rates of dental service utilization by birthplace. Descriptive statistics showed that the average rate in the foreign-born was slightly higher than that of the U.S.-born. However, the opposite pattern was found in the multivariate analyses. The contradictory results might due to imbalanced sample sizes and different distribution in age (foreign-born were younger than U.S.-born), number of chronic diseases (foreign-born had lower numbers), and other variables between the two groups. The birthplace-stratified analysis with age–racial/ethnic interaction effects revealed the true distributions in rate of dental service utilization.

So far, only several studies have used repeated cross-sectional study design to examine recent trends of service utilization among older Americans. Using data from the 1995 to 2008 Behavioral Risk Factor Surveillance System, one study revealed that trends in dental visits showed a steady increase for those aged 65 and older in the United States (Akinkugbe & Lucas-Perry, 2013). Using the same data, another study not only found an increase in dental service utilization between the period of 1999 and 2008 among middle-aged and older Americans but also identified racial/ethnic disparities in the improvements (Wu et al., 2013). Beyond the period of economic downturn, one study revealed a decline in utilization for both nonelderly adults and the elderly from 2007 to 2010 (Wall et al., 2012). However, given the cross-sectional nature of these studies, it is difficult to tease out the genuine age effect from the cohort effect. To our knowledge, there are only several studies conducted in Scandinavian nations that specifically examined the trend of dental service utilization using longitudinal data (Åström et al., 2013, 2014). They found a slight decline in utilization rate with increasing age. Our study extends efforts along this line by focusing on middle-aged and older Americans across an extended period of time. Our finding not only confirmed the pattern of decline in service utilization with age at the individual level but also addressed disparities in trajectories by race/ethnicity and by birthplace.

Similar to several studies using cross-sectional data, we found that Blacks, Hispanics, and other racial/ethnic minorities reported a lower rate of service utilization than Whites (Christian et al., 2013; Shelley et al., 2011; Wu et al., 2013; Zhang, 2016). However, the current study went beyond prior research by confirming that racial/ethnic disparities were substantial and persistent as people became older regardless of birthplace while adjusting for a wide range of covariates. This finding is alarming as it indicates that some unmeasured factors beyond the scope of this study such as oral health literacy, perception of need, barriers to access, and dissatisfaction with dental care may possibly play important roles in explaining racial/ethnic disparities in trajectories (Shelley et al., 2011). One study identified racial/ethnic-specific factors that were related to dental service utilization (Wu et al., 2005). Factors such as education, social support, and length of stay in the United States were significantly associated with dental service utilization among Chinese immigrant older adults, whereas income, age, and denture use were significant factors for their Russian counterparts. Their findings indicate that racial/ethnic differences in dental service utilization may contribute to differences in culture-related factors such as levels of acculturation, values, and beliefs that may influence knowledge of and attitudes toward oral health and dental care. Similarly, another study on dental nonattendance across multiple countries in Europe also revealed cultural differences in reasons for not using dental services (Listl, Moeller, & Manski, 2014). Another study found that residential segregation was essential to close or even reverse the Black–White gap in dental service utilization in the United States. Taken together, if conditions permit, future studies should explore these explanatory mechanisms (Eisen, Bowie, Gaskin, LaVeist, & Thorpe, 2015).

The role of birthplace in relation to dental service utilization was found to be quite interesting. When the whole sample was examined, the foreign-born showed a significantly higher rate of dental service utilization than the U.S.-born while adjusting for sociodemographic and health covariates. When stratified analyses were conducted, the opposite pattern was observed. Virtually for all racial/ethnic groups except for Blacks, the

U.S.-born showed a higher rate of service utilization than the foreign-born after adjusting for all covariates. The advantage of the foreign-born using dental services in the whole sample may be largely due to imbalanced samples by race/ethnicity and birthplace as well as correlation among covariates (suggested by our supplementary data analyses). Besides this interesting finding, the disparity by birthplace was found to be closing as respondents became older, regardless of race/ethnicity. These findings suggest that acculturation may play an important role in increasing and decreasing oral health disparities over time. One study conducted in New York City, for instance, found a correlation between English proficiency and dental visits within the past year among Chinese immigrants (Shelley et al., 2011). Another study revealed that length of stay in the United States significantly affected dental service utilization among Asian immigrants (Luo & Wu, 2016). Our findings are consistent with previous studies by confirming the disadvantaged position of immigrants in dental service utilization as well as the importance of higher levels of acculturation in possibly closing the gap. Nonetheless, we need to be keenly aware that, while we are not able to examine some unmeasured factors in this study, racial discrimination or racial prejudice can be an underlying factor that contributes to the persistent disparity of dental service utilization for the racial/ethnic minority populations, especially for Blacks.

This study has several limitations. First, the HRS does not have specific variables to measure dental insurance coverage, so we used insurance coverage as a proxy to measure one's dental coverage. In addition, due to limitation of data, some cultural-related factors as well as social and environmental covariates that may be related to racial/ethnic disparities in dental service utilization were not included in the modeling. Moreover, for the same reason, we were unable to tackle detailed reasons for a dental visit. A couple of recent studies found that receipt of preventive procedures increased while receipt of surgical procedures decreased among working-aged adults and among older adults in the United States (Manski, Cohen, et al., 2014; Manski, Moeller, et al., 2014). Being able to differentiate diagnostic/preventive procedures from restorative/endodontic procedures for older adults in the future may reveal racial/ethnic disparities in utilizing specific type of dental services, which may help policy makers to better address race/ethnicity-specific oral health needs.

Despite these limitations, our study is, perhaps, one of the first to describe long-term trajectories in dental service utilization by birthplace and by race/ethnicity among middle-aged and older Americans while adjusting for a wide range of confounders. As the population in the United States and around the globe is rapidly becoming older and more diverse, our findings are timely and have many policy and practical implications. The interesting finding on dental service utilization by birthplace, for instance, addressed the necessity of using appropriate statistical procedures in revealing the hidden pattern of disparities. Our findings also highlight the importance of identifying racial/ethnic barriers to access dental care and developing race/ethnicity-specific health policy recommendations to reduce disparities in dental care among older immigrants and the native-born. Therefore, it is important to develop public health programs nationally and globally that aim to educate middle-aged and older racial/ethnic minorities to improve oral health outcomes, improve access to dental care, and increase levels of cultural and linguistic competency among dental care providers.

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Figure 1. Predicted rate of dental service utilization estimated from the random intercept Poisson generalized linear mixed-effects models with the interaction effects of age polynomials (age , age^2 , and age^3) and race/ethnicity. The age polynomials account for the nonlinear trajectories and the interaction effects allow the trajectories to differ by race/ethnicity.

Table 1.

Baseline Sample Characteristics for the Overall Sample and Subsamples by Birthplace.

Variables	Overall Sample (N = 20,488)	U.S.-Born (N = 17,661)	Foreign-Born (N = 2,827)	p Value
Dental service utilization				
Yes	N (%) / Mean (SD) 14,327 (69.9)	N (%) / Mean (SD) 12,579 (71.2)	N (%) / Mean (SD) 1,748 (61.8)	<.0001
Predisposing characteristics				
Race/ethnicity				
White	13,630 (66.5)	12,999 (73.6)	631 (22.3)	<.0001
Hispanics	2,597 (12.7)	978 (5.5)	1,619 (57.3)	
Black	3,616 (17.6)	3,342 (18.9)	274 (9.7)	
Other	645 (3.1)	342 (1.9)	303 (10.7)	
Age	64.4 (10.6)	64.8 (10.7)	61.8 (9.6)	<.0001
Sex				
Female	11,497 (56.1)	9,945 (56.3)	1,552 (54.9)	.1665
Married/partnered				
Yes	13,879 (67.7)	11,824 (66.9)	2,055 (72.7)	<.0001
Smoking status				
Never smoked	9,185 (44.8)	7,702 (43.6)	1,483 (52.5)	<.0001
Past smoker	2,972 (14.5)	2,656 (15.0)	316 (11.2)	
Current smoker	8,331 (40.7)	7,303 (41.4)	1,028 (36.4)	
Enabling resources				
Health insurance				
Yes	13,218 (64.5)	11,927 (67.5)	1,291 (45.7)	<.0001
Education				
College	10,088 (49.2)	9,032 (51.1)	1,056 (37.4)	<.0001
Household income				
0–25 K	6,015 (29.4)	4,793 (27.1)	1,222 (43.2)	<.0001
25–50 K	5,383 (26.3)	4,725 (26.8)	658 (23.3)	
50–75 K	3,297 (16.1)	2,930 (16.6)	367 (13.0)	
75–150 K	3,844 (18.8)	3,480 (19.7)	364 (12.9)	
150 K+	1,949 (9.5)	1,733 (9.8)	216 (7.6)	

Variables	Overall Sample (N = 20,488)	U.S.-Born (N = 17,661)	Foreign-Born (N = 2,827)	p Value
Need factors				
Follow-up edentulism				
Yes	878 (4.3)	749 (4.2)	129 (4.6)	.4622
Self-rated health	3.2 (1.1)	2.8 (1.1)	3.0 (1.1)	<.0001
# of chronic conditions	1.8 (1.4)	1.8 (1.4)	1.4 (1.3)	<.0001
Instrumental activities of daily living	0.3 (0.9)	0.3 (.09)	0.3 (0.8)	.8700
Activities of daily living	0.3 (0.9)	0.3 (0.9)	0.4 (0.9)	.0912

Note. N = 20,448. p Values for categorical variables were calculated from χ^2 tests of association with birthplace, p Values for continuous variables were based on two-sample t tests of difference in means between U.S.-born and foreign-born.

Table 2.

Descriptive Statistics of Dental Service Utilization (yes/no) for the Overall Sample, the U.S.-Born, and Foreign-Born: Average Prevalence Rate (%) of Dental Service Utilization for Categorical Variables; Mean and Standard Deviation (*SD*) for Continuous Variables.

Variables	Overall Sample (N = 20,488)		U.S.-Born (N = 17,661)		Foreign-Born (N = 2,827)		p Value
	Yes	No	Yes	No	Yes	No	
	(%) / Mean (SD)		(%) / Mean (SD)		(%) / Mean (SD)		
Predisposing characteristics							
Race/ethnicity							
White	77.0	23.0	76.8	23.2	79.7	20.3	.0026
Hispanics	51.7	48.3	51.3	48.7	52.0	48.0	
Black	52.3	47.7	51.7	48.3	61.0	39.0	
Other	65.9	34.1	61.8	38.2	70.8	29.2	
Age	68 (10)	67 (11)	68 (10)	68 (11)	65 (10)	65 (10)	<.0001
Sex							
Male	66.9	33.1	68.3	31.7	57.8	42.2	.0559
Female	71.8	28.2	72.8	27.2	64.7	35.3	
Married/partnered							
Yes	73.3	26.7	74.9	25.1	63.0	37.0	.0012
No	63.0	37.0	63.5	36.5	58.6	41.4	
Smoking status							
Never smoked	73.5	26.5	75.3	24.7	63.7	36.3	.0031
Past smoker	51.9	48.1	52.2	47.8	49.4	50.6	
Current smoker	70.6	29.4	71.7	28.3	62.0	38.0	
Enabling resources							
Health insurance							
No	55.9	44.1	57.0	43.0	51.0	49.0	.0444
Yes	79.2	20.8	79.5	20.5	76.0	24.0	
Education							
High school	59.6	40.4	60.8	39.2	53.2	46.8	.0316
College	79.9	20.1	80.3	19.7	75.8	24.2	
Household income							

Variables	Overall Sample (N = 20,488)		U.S.-Born (N = 17,661)		Foreign-Born (N = 2,827)		p Value
	Yes	No	Yes	No	Yes	No	
	(%) / Mean (SD)		(%) / Mean (SD)		(%) / Mean (SD)		
0–25 K	51.0	49.0	51.8	48.2	48.0	52.0	.0061
25–50 K	68.2	31.8	69.1	30.9	61.6	38.4	
50–75 K	77.5	22.5	77.9	22.1	74.3	25.7	
75–150 K	84.4	15.6	84.7	15.3	81.5	18.5	
150 K+	90.4	9.6	90.6	9.4	89.3	10.7	
Need factors							
Follow-up edentulism							
Yes	44.7	55.3	45.1	54.9	42.4	57.6	.1628
No	71.0	29.0	72.2	27.8	62.8	37.2	
Self-rated health	3.3 (1.0)	2.8 (1.1)	3.3 (1.0)	2.8 (1.1)	3.1 (1.1)	2.6 (1.1)	.0572
# of chronic conditions	2.0 (1.4)	2.3 (1.6)	2.0 (1.4)	2.4 (1.5)	1.7 (1.4)	1.9 (1.5)	.3578
Instrumental activities of daily living	0.3 (0.8)	0.5 (1.1)	0.3 (0.8)	0.5 (1.1)	0.3 (0.9)	0.5 (1.1)	.9399
Activities of daily living	0.3 (0.9)	0.5 (1.2)	0.3 (0.8)	0.5 (1.2)	0.3 (0.9)	0.6 (1.2)	.6343

Note. The total number of observations of U.S.-born was 66,311 (with an average of 3.75 visits per participant) and the total number for foreign-born was 9,803 (with an average of 3.44 visits per participant). *p* Values were calculated by the interaction effect of birthplace and listed variables in the Poisson generalized linear mixed-effects models, that is, if dental service utilization differs by birth.

Table 3.

Prevalence Ratios (PR) and 95% Confidence Intervals (CIs) of Dental Services Use for the Whole Sample.

Variables	Crude Model		Multivariate Model	
	PR [95% CI]	p Value	PR [95% CI]	p Value
Predisposing characteristics				
Race/ethnicity (reference: White)				
Hispanics	0.62 [0.61, 0.64]	<.0001	0.74 [0.72, 0.77]	<.0001
Black	0.63 [0.61, 0.64]	<.0001	0.73 [0.072, 0.075]	<.0001
Other	0.83 [0.078, 0.87]	<.0001	0.83 [0.79, 0.88]	<.0001
Sex (reference: male)				
Female	1.10 [1.08, 1.12]	<.0001	1.15 [1.13, 1.17]	<.0001
Age polynomials				
Age	0.91 [0.85, 0.97]	.0028	0.91 [0.85, 0.96]	.0020
Age ²	1.002 [1.001, 1.003]	.0008	1.002 [1.001, 1.002]	.0006
Age ³	1.00 [1.00, 1.00]	.0002	1.00 [1.00, 1.00]	.0002
Married/partnered (reference: yes)				
No	0.87 [0.86, 0.88]	<.0001	0.99 [0.97, 1.00]	.1262
Smoking status (reference: never smoked)				
Past smoker	0.73 [0.71, 0.75]	<.0001	0.82 [0.80, 0.85]	<.0001
Current smoker	0.92 [0.90, 0.94]	<.0001	0.97 [0.95, 0.98]	.0003
Birthplace (reference: U.S.-born)				
Foreign-born	0.85 [0.83, 0.88]	<.0001	1.09 [1.06, 1.12]	<.0001
Enabling resources				
Health insurance (reference: no)				
Yes	1.25 [1.23, 1.26]	<.0001	1.15 [1.13, 1.16]	<.0001
Education (reference: high school)				
College	1.48 [1.45, 1.51]	<.0001	1.25 [1.22, 1.27]	<.0001
Household income (reference: 0–25 K)				
25–50 K	1.22 [1.20, 1.24]	<.0001	1.13 [1.11, 1.15]	<.0001
50–75 K	1.35 [1.32, 1.37]	<.0001	1.21 [1.18, 1.23]	<.0001
75–150 K	1.44 [1.42, 1.47]	<.0001	1.25 [1.23, 1.28]	<.0001
150 K+	1.51 [1.48, 1.55]	<.0001	1.27 [1.24, 1.30]	<.0001
Need factors				
Follow-up edentulism (reference: yes)				
No	1.71 [1.63, 1.80]	<.0001	1.35 [1.29, 1.41]	<.0001
Self-rated health	1.09 [1.09, 1.10]	<.0001	1.04 [1.03, 1.05]	<.0001
# of chronic conditions	0.96 [0.95, 0.96]	<.0001	1.00 [0.99, 1.00]	.1296
Instrumental activities of daily living (0–5)	0.94 [0.93, 0.95]	<.0001	0.99 [0.98, 0.99]	.0014
Activities of daily living (0–5)	0.94 [0.93, 0.94]	<.0001	0.98 [0.97, 0.99]	<.0001

Note. (N = 20,488). PRs and 95% CIs were estimated from Poisson generalized linear mixed-effects models. Both crude and adjusted PRs were presented.

Table 4.

Prevalence Ratios (PR) and 95% Confidence Intervals (CIs) of Dental Service utilization for the U.S.-Born.

Variables	Crude Model		Multivariate Model	
	PR [95% CI]	<i>p</i> Value	PR [95% CI]	<i>p</i> Value
Predisposing characteristics				
Race/ethnicity (reference: White)				
Hispanics	0.61 [0.58, 0.64]	<.0001	0.73 [0.70, 0.76]	<.0001
Black	0.61 [0.60, 0.63]	<.0001	0.73 [0.71, 0.75]	<.0001
Other	0.76 [0.70, 0.82]	<.0001	0.85 [0.79, 0.91]	<.0001
Sex (reference: male)				
Female	1.09 [1.07, 1.11]	<.0001	1.14 [1.12, 1.16]	<.0001
Age polynomials				
Age	0.91 [0.85, 0.97]	.0066	0.90 [0.85, 0.97]	.0025
Age ²	1.002 [1.001, 1.002]	.0023	1.002 [1.001, 1.003]	.0009
Age ³	1.00 [1.00, 1.00]	.0006	1.00 [1.00, 1.00]	.0004
Married/partnered (reference: yes)				
No	0.86 [0.84, 0.87]	<.0001	0.98 [0.97, 1.00]	.0699
Smoking status (reference: never smoked)				
Past smoker	0.71 [0.69, 0.74]	<.0001	0.82 [0.80, 0.84]	<.0001
Current smoker	0.91 [0.89, 0.93]	<.0001	0.97 [0.95, 0.99]	<.0001
Enabling resources				
Health insurance (reference: no)				
Yes	1.39 [1.37, 1.42]	<.0001	1.15 [1.13, 1.16]	<.0001
Education (reference: high school)				
College	1.46 [1.43, 1.50]	<.0001	1.26 [1.23, 1.28]	<.0001
Household income (reference: 0–25 K)				
25–50 K	1.22 [1.20, 1.24]	<.0001	1.14 [1.12, 1.15]	<.0001
50–75 K	1.33 [1.30, 1.36]	<.0001	1.20 [1.18, 1.23]	<.0001
75–150 K	1.42 [1.39, 1.45]	<.0001	1.25 [1.22, 1.27]	<.0001
150 K+	1.48 [1.45, 1.52]	<.0001	1.26 [1.23, 1.30]	<.0001
Need factors				
Follow-up edentulism (reference: yes)				
No	1.74 [1.64, 1.84]	<.0001	1.36 [1.30, 1.43]	<.0001
Self-rated health	1.09 [1.08, 1.09]	<.0001	1.04 [1.03, 1.04]	<.0001
# of chronic conditions	0.95 [0.95, 0.96]	<.0001	0.99 [0.99, 1.00]	.1077
Instrumental activities of daily living	0.94 [0.93, 0.95]	<.0001	0.99 [0.98, 1.00]	.0041
Activities of daily living	0.94 [0.93, 0.94]	<.0001	0.98 [0.97, 0.99]	<.0001

Note. (*N* = 17,661). PRs and 95 CIs were estimated from Poisson generalized linear mixed-effects models. Both crude and adjusted PRs were presented.

Table 5.

Prevalence Ratios (PR) and 95% Confidence Intervals (CIs) of Dental Service Utilization for the Foreign-Born.

Variables	Crude Model		Multivariate Model	
	PR [95% CI]	p Value	PR [95% CI]	p Value
Predisposing characteristics				
Race/ethnicity (reference: White)				
Hispanics	0.61 [0.57, 0.65]	<.0001	0.78 [0.73, 0.84]	<.0001
Black	0.73 [0.66, 0.81]	<.0001	0.81 [0.73, 0.89]	<.0001
Other	0.86 [0.78, 0.94]	.0016	0.85 [0.78, 0.93]	.0003
Sex (reference: male)				
Female	1.15 [1.08, 1.21]	<.0001	1.19 [1.13, 1.26]	<.0001
Age polynomials				
Age	0.90 [0.73, 1.12]	.3509	0.93 [0.76, 1.14]	.4842
Age ²	1.00 [1.00, 1.01]	.2911	1.00 [1.00, 1.00]	.3873
Age ³	1.00 [1.00, 1.00]	.2357	1.00 [1.00, 1.00]	.3126
Married/partnered (reference: yes)				
No	0.93 [0.89, 0.98]	.0113	1.01 [0.96, 1.07]	.6952
Smoking status (reference: never smoked)				
Past smoker	0.82 [0.75, 0.90]	<.0001	0.87 [0.80, 0.95]	.0012
Current smoker	0.96 [0.90, 1.01]	.1349	0.98 [0.93, 1.03]	.3531
Enabling resources				
Health insurance (reference: no)				
Yes	1.33 [1.27, 1.38]	<.0001	1.16 [1.12, 1.21]	<.0001
Education (reference: high school)				
College	1.52 [1.44, 1.61]	<.0001	1.18 [1.11, 1.25]	<.0001
Household income (reference: 0–25 K)				
25–50 K	1.20 [1.14, 1.25]	<.0001	1.12 [1.06, 1.17]	<.0001
50–75 K	1.41 [1.33, 1.49]	<.0001	1.24 [1.17, 1.32]	<.0001
75–150 K	1.55 [1.46, 1.64]	<.0001	1.29 [1.21, 1.37]	<.0001
150 K+	1.68 [1.57, 1.81]	<.0001	1.33 [1.23, 1.44]	<.0001
Need factors				
Follow-up edentulism (reference: yes)				
No	1.54 [1.34, 1.77]	<.0001	1.31 [1.16, 1.47]	<.0001
Self-rated health	1.12 [1.10, 1.14]	<.0001	1.06 [1.04, 1.08]	<.0001
# of chronic conditions	0.96 [0.94, 0.98]	<.0001	1.01 [0.98, 1.02]	.7729
Instrumental activities of daily living	0.94 [0.92, 0.96]	<.0001	0.98 [0.95, 1.01]	.1686
Activities of daily living	0.94 [0.92, 0.96]	<.0001	1.00 [0.97, 1.02]	.8715

Note. (N = 2,827). PRs and 95 CIs were estimated from Poisson generalized linear mixed-effects models. Both crude and adjusted PRs were presented.