

Evaluation of Barriers to Access Treatment for Gum Disease: A Cross-sectional Study

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ABSTRACT

This study identified the specific factors which influence the treatment of gum disease. Specifically, the aims are to examine i) the differences in the prevalence of self-reported periodontitis treatment in 2011–2012 and 2017–2018, ii) the association between the background characteristics of respondents and treatment of gum disease, iii) the effects of the background characteristics on the treatment of gum disease and iv) reasons for the lack of access to dental care in 2011–2012 and 2017–2018.

Data from the National Health and Nutrition Examination Survey (NHANES) oral health questionnaires 2011–2012 and 2017–2018 were used. NHANES is a periodic survey conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention. This data represents a stratified, multistage probability sample of the civilian noninstitutionalized population in the 50 United States U.S) and the District of Columbia. Binary multivariable logistic regression was used to examine the socioeconomic predictors of self-reported therapy for gum disease. Compared to 2011–2012, more participants accessed oral health care services during 2017–2018, resulting in fewer people seeking treatment for gum disease. Affordability and lack of dental health insurance were the primary reasons for not receiving treatment for gum disease. Compared with Whites, Asians were more likely to report having had treatment, followed by Hispanics and Blacks. Increasing oral health services for the elderly could improve access to care related to periodontal disease in this cohort of patients. In addition, the expansion of dental coverage with reduced out-of-pocket expenditure could improve access to dental services and overall health.

Keywords

Periodontitis, Periodontal disease, Gum disease, Oral health, NHANES data.

Introduction

Half of American adults aged over 30 have periodontitis. Insufficient dental hygiene is a harbinger of oral bacteria that causes dental caries, calculus, and gingivitis. Inadequate hygiene affects approximately three out of four American adults and can advance to periodontitis, a more severe stage of the disorder [1]. Good oral health significantly contributes to one's overall well-being. Since bi-annual dental visits are the norm for general oral care, dentists should share information on preventing gum disease and associated comorbidities during these visits [2].

Treatment for gum diseases differs across states, races, education, and other subgroups. For example, among numerous studies, Burt and Eklund suggested there is less use of dental services by males, ethnic/racial minorities, those with lower education, and those without dental insurance [3]. Other investigations suggested geographic location as an essential factor [4-6]. People who live in more rural areas, both adults and children, had worse oral health than their urban counterparts [4] and may be less likely to utilize oral health care services [6]. Other studies found that dental care related to anxiety and fear affected dental care utilization [7,8]. Approximately 45% of the population in the U.S. have high levels of anxiety and fear about dental care of sufficient intensity to lead approximately close to 15% to avoid care [8,9]. Elevated dental care-related anxiety or fear levels are associated with canceling dental visits or failing to keep appointments [8]. Anxiety and fear are more prevalent in dental care avoiders than in regulars [10]. These cited studies have impacted the understanding of dental care treatment of periodontitis as a crucial component of improving oral health and well-being [11].

Many studies worldwide have addressed the frequency and determinants of oral healthcare utilization. Age, sex, urbanity, education level, income level, employment, and health status, among others, have been associated with oral healthcare utilization in many studies globally [12-15]. However, published research on associated factors in the treatment of gum disease and differences in ever having had treatment for gum disease across specific year groups in the U.S. is limited. In addition, background characteristics differ in different parts of the world, which influences the treatment of gum diseases differently [16-19].

This study aimed to identify the specific factors that influence gum disease treatment given the following hypotheses statements:

- 1) There is a difference in gum disease treatment between 2011–2012 and 2017–2018.
- 2) There is an association between background characteristics and gum disease treatment.
- 3) There is a relationship between background characteristics and treatment for gum disease.

Understanding what deters people from accessing dental care is essential. Clinicians, researchers, and policymakers should devise ways to improve dental insurance coverage, increase knowledge and awareness of gum disease, and foster collaboration with patients to reduce dental anxiety and fear, which leads to missing dental appointments.

Methods

Dependent variables

The dependent variable was an oral health-related question that asked participants if they had ever had treatment for gum disease (yes/no), such as scaling or root planing. Those who did not know or had missing information were excluded from the study.

Exposure of Interest

As listed in the National Health and Nutrition Examination Survey (NHANES) questionnaire on oral health, 11 reasons respondents could not access dental care when needed were: 1) could not afford it, 2) did not want to spend the money, 3) insurance did not cover, 4) dental office too far, 5) dental office not open at a convenient time, 6) other dentists did not recommend, 7) afraid or did not like the dentist, 8) unable to take time off from work, 9) too busy, 10) expected dental problems to go away, and 11) other. Individuals who responded with "refused" or "do not know" were omitted [19,20].

Race Comparison Group

Hispanics, Whites, Blacks, Asians, or Others were used as the comparison group in this analysis. The interview defined race as, "What race do you consider yourself to be?"

Other Covariates

Following previous research [21-25], the independent variables included age group, gender, annual household income, language, marital status, education level, and 11 reasons participants could not access dental care. The gender classification was either male or female. Annual household income was grouped as \$0–24,999, \$25,000–54,999, or \$55,000 and above. The language was categorized as English or Spanish. Marital status was categorized as married, no longer married, or never married. Education level was categorized as high school (had primary education or completed high school or GED) and some college, which included those identified as having some college, having an associate degree, or being college graduates or above.

Dataset and Design

The study utilized secondary data from the National Health and Nutrition Examination Survey (NHANES) wave of data from the 2011–2012 and 2017–2018. Both surveys used the same methodology. NHANES is an ongoing complex multistage survey that involves a series of cross-sectional surveys conducted every two years [20]. It examines approximately 5,000 persons annually across the United States and is designed to be a nationally representative dataset of the civilian, noninstitutionalized U.S. population. The survey collects data via household interviews of

all the participants, followed by a physical examination of most of them in a mobile examination center (MEC). This survey is approved by the National Center for Health Statistics (NCHS) Research Ethics Review Board (ERB). Detailed information about sampling and procedures is available on the NHANES website [20].

The 2011–2012 cycle consisted of 9,756 participants, including children and adults. For this study, those under the Age of 30 and over 79 (n=4,799) were not analyzed. We further excluded twenty-nine participants with missing data (including "do not know" and "refused") for our primary outcome variable, "Ever had treatment for gum disease." Once these exclusion criteria were applied, the final sample for this study was 4,157. Whereas 2017–2018 had 8,897 participants. Applying the same exclusion criteria (excluding 4156 participants under the Age of 30 and over the Age of 79 and 20 participants who were missing the outcome variable) resulted in 4,299 participants.

IBM® SPSS software (version 26) was used for the analysis [26]. Descriptive statistics were used to describe the respondents' background characteristics. The chi-square test of independence examined the following: i) association between the

sociodemographic variables and the question Ever had treatment for gum disease? Furthermore, ii) the reasons respondents did not access dental care (i.e., affordability, accessibility, proximity, behavioral attitude, dental phobia, and doctor's referral). An Exact McNemar's test was used to assess significant differences in response to Ever had treatment for gum disease? During 2011–2012 and 2017–2018. The binary logistic regression was used to examine the socioeconomic predictors of self-reported gum disease treatment; variables with $p < .05$ were considered significant and included in the model.

Results

Using data from the NHANES oral health questionnaire 2011–2012; 2017–2018, we assessed the association between the sociodemographic variables and the question ever had treatment for gum disease (yes/no)? Table 1 shows the characteristics of the participants by self-reported treatment for gum disease. Significant differences were observed in all races/ethnicity between the 2011–2012 and 2017–2018 groups on those who answered yes to the question Ever had treatment for gum disease? In addition, in 2017–2018, the results showed a 50% decrease in those who needed gum disease treatment.

Table 1: Respondents' Characteristics by Yes/No to self-reported Treatment of Gum Disease.

Background characteristics	2011-2012				2017-2018			
	Yes	No	Total	No. of Persons	Yes	No	Total	No. of Persons
Age	%	%			%	%		
30-39	19	81	100	956	22	78	100	827
40-49	27	73	100	890	28	72	100	869
50-59	25	75	100	905	29	71	100	1,106
60-69	28	72	100	901	29	71	100	780
70-79	22	78	100	505	24	76	100	194
Gender								
Male	23	77	100	2,199	24	76	100	2,282
Female	23	77	100	2,307	26	74	100	2,439
Annual House Income (\$)								
0-24,999	19	81	100	1,380	20	80	100	1,079
25,000-54,999	24	76	100	1,160	23	77	100	1,245
55,000 and over	27	73	100	1,731	29	71	100	1,911
Language								
English	23	77	100	3,952	23	77	100	4,180
Spanish	29	71	100	554	36	64	100	541
Marital Status								
Married	75	25	100	2,751	26	74	100	2,912
No longer Married	79	21	100	1,185	24	76	100	1,270
Never Married	76	24	100	563	19	81	100	533
Education level (20+)								
HS	20	80	100	2,145	22	78	100	2,078
Some college	27	73	100	2,359	27	73	100	2,631
Race								
Hispanic	73	27	100	909	32	68	100	1,022
White	80	20	100	1,717	18	82	100	1,678
Black	77	23	100	1,167	26	74	100	1,102
Asian	72	28	100	606	30	70	100	691
Other including multiracial	79	22	100	107	22	78	100	228

The results suggest fewer respondents were treated for gum disease compared with 2011–2012. For example, in 2011–2012, 80% of 1,717 Whites responded affirmatively to the question compared with 18% of 1,678 in 2017–2018, a difference of 80%. Furthermore, 77% of 1,167 Blacks responded yes in 2011–2012, whereas in 2017–2018, only 26% of 1,102 Blacks responded yes, a 68% difference.

As shown in Table 2, the participants who said yes to Ever had treatment for gum disease, totaled 1,013 in 2011–2012 and 1,108 in 2017–2018. In both groups, there were more women (50.8%, 53.1%) than men (49.2%, 46.9%), and the proportion of married people was higher (64.4%, 66.3%) than unmarried. In addition, most participants had attended some college (59.7%, 62.1%) and had income levels of \$55,000 and above (47.2%, 52.2%); Hispanics constituted 23.9% and 29.0%, compared with Whites (31.0%, 23.6%), Blacks (26.1%, 24.2%), and Asians (16.8%, 18.9%). The chi-square test's Age, annual household income,

marital status, education, and race/ethnicity were all significantly different ($p < .05$) among the self-reported gum disease treatments.

Table 3 shows the predictors of Ever had treatment for gum disease for both the 2011–2012 and 2017–2018 NHANES surveys. The logistic regression model included Age, race/ethnicity, annual household income, education, and language. Gender was excluded from the model because it was not significant. Individuals with an annual income of \$55,000 and above have higher odds of receiving treatment for gum disease. For both groups, i.e., 2011–2012 and 2017–2018, participants who had a household income of \$55,000 and above were more likely (OR=1.46; 95% CI: 1.20, 1.77; 2011–2012; OR=1.46; 95% CI: 1.19, 1.78; 2017–2018) to have reported ever having treatment for gum disease, in contrast to households with income of \$0–\$24,999. Compared with the 30–39 age group, 40–79 was more likely to have ever had treatment for gum disease. For example, in 2017–2018, the 60–69 age group had higher odds (OR=1.71; 95% CI: 1.36, 2.14; 2011–2012; OR=2.06; 95% CI:

Table 2: Respondent Characteristics by Background Characteristics by Self-Reported Gum Disease For 2011-2012, 2017-2018-Year Groups

Background characteristics	2011-2012			2017-2018		
	Yes	No	P-value	Yes	No	P-value
Age	%	%		%	%	
30-39	18.4	24.5		14.6	21.8	
40-49	23.4	20.8		18.3	19.1	
50-59	22.5	21.5		22.2	21.0	
60-69	24.7	20.7		30.3	23.9	
70-79	11.1	12.5		14.5	14.3	
	1013	3,144	0.000	1108	3,191	0.00
Gender						
Male	49.2	49.0		46.9	48.9	
Female	50.8	51.0		53.1	51.1	
N	1013	3,144	0.213	1,108	3,191	0.213
Annual House Income (\$)						
0-24,999	25.3	33.3		20.7	25.8	
25,000-54,999	27.2	26.7		27.1	29.8	
55,000 and over	47.5	40.1		52.2	44.4	
N	969	2,983	0.000	994	2,862	0.000
Language						
English	84.4	88.1		82.8	89.6	
Spanish	15.6	11.9		17.2	10.0	
N	1013	3,144	0.000	1,108	3,191	0.000
Marital Status						
Married	64.4	62.1		66.3	62.3	
No longer Married	22.7	24.5		24.6	24.6	
Never Married	12.9	13.4		9.1	13.2	
N	1,013	3,139	0.001	1106	3,187	0.000
Education level (20+)						
HS	40.3	48.5		37.9	45.0	
Some college	59.7	51.5		62.1	55.0	
N	1,013	3,143	0.000	1,104	3,187	0.000
Race						
Hispanic	23.9	20.1		29.0	20.9	
White	31.0	36.9		23.6	35.4	
Black	26.1	27.3		24.2	24.1	
Asian	16.8	13.2		18.9	14.4	
Other including multi racial	2.3	2.5		4.4	5.3	
N	1,013	3,144	0.000	1,108	3,191	0.000

Table 3: Binary Logistic Regression of Treatment of Gum Disease

Treatment For Gum Disease	2011-2012		2017-2018	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Age Group				
30-39	REF		REF	
40-49	1.471	(1.174, 1.844)	1.352	(1.053, 1.737)
50-59	1.512	(1.205, 1.898)	1.647	(1.296, 2.095)
60-69	1.705	(1.361, 2.136)	2.059	(1.635, 2.592)
70-79	1.388	(1.054, 1.828)	1.871	(1.430, 2448)
Race				
White	REF		REF	
Hispanic	1.208	(0.911, 1.601)	1.713	(1.329, 2.208)
Black	1.193	(0.984, 1.446)	1.536	(1.248, 1.890)
Asian	1.553	(1.238, 1.949)	1.831	(1.457, 2.301)
Other	1.091	(0.665, 1.792)	1.375	(0.957, 1.976)
Annual Household Income				
\$0-\$24,999	REF		REF	
\$25000-\$54,999	1.324	(1.083, 1.619)	1.140	(0.922, 1.410)
\$55,000 and over	1.461	(1.204, 1.773)	1.458	(1.192, 1.783)
Adult Education				
High School	REF		REF	
Some College	1.407	(1.191, 1.663)	1.488	(1.258, 1.760)
Language				
Spanish	REF		REF	
English	0.620	(0.449, 0.857)	0.515	(0.381, 0.697)

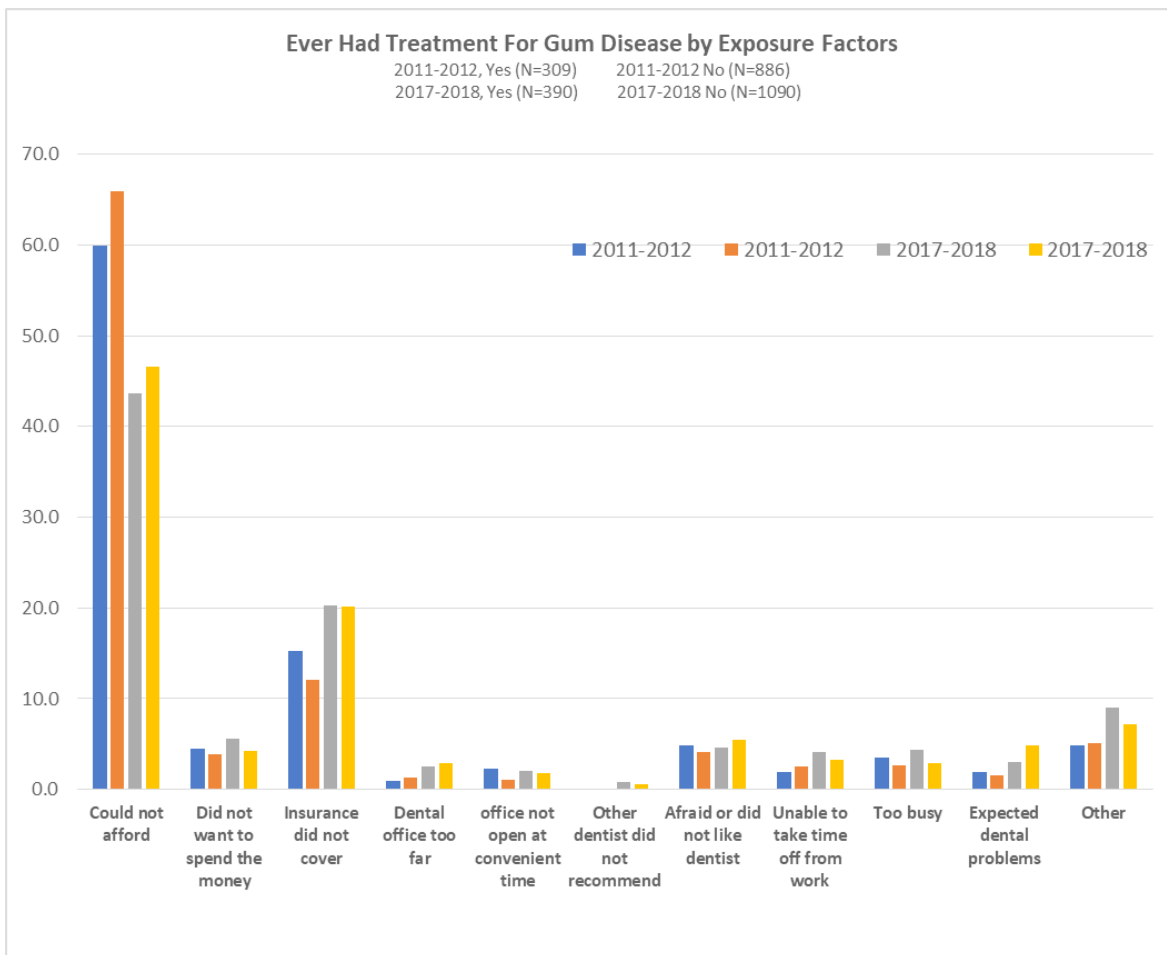


Figure 1: Reasons Why Respondents Could Not Access Dental Care.

Table 4: Reasons Why Respondents Could Not Access Dental Care by Race/Ethnicity

	Hispanic	White	Black	Asian	Other	Hispanic	White	Black	Asian	Other
	2011-2012					2017-2018				
	%	%	%	%	%	%	%	%	%	%
Could not afford	68.4	60.7	57.8	53.8	41.2	44.9	47.5	45.1	30.8	38.3
Did not want to spend the money	3.1	4.9	3.2	4.5	5.9	1.9	6.2	3.6	5.5	7.4
Insurance did not cover	10.4	14.2	13.2	15.2	20.0	19.4	19.0	18.6	22.6	22.2
Dental office too far	1.2	1.5	1.7	0.0	4.7	3.6	2.0	3.6	3.4	3.7
office does not open at convenient time	1.6	1.8	1.7	3.8	7.1	1.9	1.6	2.7	2.7	1.9
Other dentist did not recommend	0.0	0.0	0.0	0.0	0.0	0.9	0.8	0.9	0.0	0.0
Afraid or did not like dentist	3.5	4.7	4.1	3.8	4.7	3.7	6.4	4.7	3.4	3.1
Unable to take time off from work	2.0	3.5	3.6	4.5	5.9	4.9	3.1	5.5	6.2	4.9
Too busy	2.4	2.4	4.0	4.5	3.5	5.0	3.8	2.9	9.6	4.9
Expected dental problems	2.0	1.1	1.5	3.8	2.4	3.9	3.8	5.2	7.5	4.3
Other	5.3	5.3	9.2	6.1	4.7	9.9	5.9	7.3	8.2	9.3
Total	100	100	100	100	100	100	100	100	100	100
Number of Participants	490	550	531	132	85	535	612	559	146	162

1.64, 2.59; 2017–2018) than age group 30-39 to have reported Ever had treatment for gum disease.

Compared with Whites, members of racial/ethnic minority groups (Hispanic, Blacks, Asians, and others) had higher odds of ever having had treatment for gum disease in 2011–2012 and 2017–2018. In all racial groups, the 2017–2018 group odds were slightly higher than those in 2011–2012. Asians had higher odds (OR=1.6; 95% CI: 1.24, 1.95; 2011–2012; OR=1.8; 95% CI: 1.46, 2.30; 2017–2018) than Whites of Ever having had treatment for gum disease. Hispanics had higher odds (OR=1.2; 95% CI: 0.91, 1.60; 2011-2012; OR= 1.7, 95% CI: 1.33, 2.21; 2017-2018) than Whites of Ever having had treatment for gum disease. Blacks had higher odds (OR=1.2; 95% CI: 0.98, 1.45; 2011-2012; OR=1.5; 95% CI: 1.25, 1.89; 2017-2018) than Whites of ever having had treatment for gum disease. Other sociodemographic variables were not included in the model.

Overall, more respondents had treatment for gum disease in 2017-2018 than in 2011-2012. Participants who responded "yes "to having dental care increased from 92.7 percent to 94.1 percent. Participants who had never had treatment decreased from 7.4 percent to 5.9 percent. An exact McNemar's Test determined a statistically significant difference in the proportion of those who said yes to having had gum disease treatment in 2011-2012 and 2017-2018. (p=0.000).

The NHANES oral health questionnaire included 11 reasons the respondents could not access dental care, as displayed in Figure 1. Affordability included traditional barriers to healthcare utilization: 1) could not afford the cost, 2) did not want to spend money, and 3) insurance did not cover recommended procedures. Other barriers included 4) being too busy, 5) the dental office is not open at convenient times, 6) the dental office being too far away, and 7) being unable to take time off work. Dental anxiety or dentophobia was indicated by 8) being afraid or not liking dentists. The doctor's referral meant 9) another dentist recommended not doing it. Finally, low perceived need showed a behavioral attitude

indicated by 10) did not think anything serious was wrong and expected dental problems to disappear. The questionnaire did not elaborate on 11) other reasons.

As illustrated in Table 4, some items related to affordability, anxiety, or fear of the dentist were in the top five out of 11. Table 4 shows the chi-square cross-tabulation results of the variation in access to dental care by background characteristics. Of the 11 surveyed reasons, not being able to afford was key to not accessing treatment for gum disease; could not afford was highly rated (>50%) by respondents across all races/ethnicities, followed by insurance did not cover, other, afraid or did not like dentist, and too busy.

Discussion

When compared with overall well-being, oral health is often undervalued. However, oral health is about much more than just healthy teeth. The mouth links the body to the digestive and respiratory tracts. Research suggests that oral bacteria and the inflammation associated with periodontitis contribute to the following: cardiovascular disease, type 2 diabetes mellitus, rheumatoid arthritis, inflammatory bowel disease, Alzheimer's disease, nonalcoholic fatty liver disease, and certain cancers [19,22,27]. Luckily, gum disease is preventable. Therefore, policymakers should expand dental coverage to improve overall health.

The reviewed NHANES questionnaire on oral health assessed 11 reasons participants could not access dental care. Healthcare utilization barriers on affordability, dentophobia, and others were among the top five. Regardless of ethnicity, could not afford was rated highly by all races/ethnicities, especially in 2011–2012, with approximately 20% decrease in 2017–2018. Interestingly, insurance did not cover, was rated lower in 2011–2012, and increased slightly in 2017–2018. This difference conforms to results from other studies [28]. Respondents answering "other reasons" did not elaborate upon the specific impediments experienced in receiving treatment for periodontal disease. Their answers would

have clarified and identified unknown impediments in receiving treatments.

Oral health disparities are determined mainly by race/ethnicity, Age, and household income [12-15,28]. In their study on oral diseases and social determinants of health, researchers found a consistent association between socioeconomic status (income, occupation, and educational level) and the prevalence and severity of oral diseases [21-25,28,29,30]. Similar to our findings, another study examining the risk factors for treating gum disease between adult Asian and Hispanic groups found that respondents answering, "could not afford" and "insurance was not covered", were impediments rated highly by both racial/ethnic group [25,28].

This study shows the need for affordable dental care coverage and services to ensure increased overall health support across all races/ethnicities in the U.S. Understanding why people cannot access dental care is crucial for preventive care and unmet needs.

Limitations

This cross-sectional study does not deduce causality or temporal relationship. The included population was limited to adults aged 30 years and older. It did not include institutionalized persons, such as older adults in nursing home settings and adults in prisons, which may introduce selection bias. The Centers for Disease Control and Prevention diagnosis of periodontitis—American Academy of Periodontology requires a periodontal examination. Thus, using this definition for self-reported NHANES data could lead to misclassification. While this study examined why respondents could not access dental care when needed, we could not examine the reasons ever to use dental care. Reasons for never using dental care are more likely to capture "preventive" dental visits than needed dental services. Reasons why respondents could not access dental care when dental care was "needed" may reflect more urgent and immediate characteristics of participants unlikely to get dental care. We also examined the two common reasons for not accessing dental care – "cannot afford the cost" and "insurance does not cover." The inability to distinguish between the two was pointed out as a limitation by Marchi et al. [25]. The use of logistic regression controlled the effect of confounding (internal validity).

Conclusion

This study shows the need for affordable dental care coverage and services in ensuring increased overall health and wellness across all races/ethnicities in the U.S. Expansion of dental coverage with reduced out-of-pocket health expenditure could improve access to dental services and overall health.

Ethics Approval for data usage

This article has been prepared per the STROBE statement for reporting observational studies and was determined exempt by the Institutional Review Board at our institution.

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