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A Study to identify the factors associated with Gum Disease and Poor Periodontal Health Outcomes

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Abstract

Background: This study investigated factors linked to gum disease and poor periodontal health outcomes in the United States population over 18 years old. It evaluated the literature using the National Health and Nutrition Examination Survey (NHANES) 2017-2018 dataset to identify risk factors for gum disease and periodontitis. **Methods:** A cross-sectional study on oral health among adults aged 18 and over in the US was conducted using the NHANES with a 2017-2018 dataset. The surveys were conducted through participant interviews and standardized oral health examinations, and which was publicly available for study. The data were analyzed and documented by using appropriate statistical methods. **Results:** With a sample (N) study population of 1360 individuals, around 96% of people with bone loss worry about the cost and affordability. The percentage of people whose insurance does not cover dental treatment is 60.26. Around 55.05% have received treatment for gum disease. After adjusting for the area, AFFORD, INSURANCE COVERAGE, FLOSS, TREAT the results of our logistic regression analyses reveal that for AFFORD is (OR=0.767; CI=0.756-0.778; p-value <0.0001), for insurance is (OR=4.038; CI= 0.435-0.442; p-value <0.0001), for FLOSS three times a week is (OR=10.011; CI = 9.898 -10.126; p-value = 0.0001), two times a week is (OR=2.16; CI = 2.147- 2.189; p-value = 0.0001), and once a week shows (OR=2.73; CI = 2.705-2.75, p-value = 0.0001), and for TREAT is OR=0.158; CI=0.157 0.159; p-value= <0.0001), which shows that all the variables AFFORD, INSURANCE COVERAGE, FLOSS, and, TREAT are significantly associated with bone loss. **Conclusion:** Our study result suggested that tooth loss is caused by various factors, such as affordability, insurance coverage not covered by companies, the number of flosses in a week, and the prior treatment for gum.

Keywords: Periodontal, Gum, Dental diseases, Oral cavity, NHANES.

INTRODUCTION

The World Health Organization (WHO) cites gum and periodontal disease as the most common causes of tooth loss worldwide [1,2]. Many people in the United States suffer from gum disease and periodontal disease, which can significantly negatively impact one's health. According to statistics provided by the Centers for Disease Control and Prevention (CDC), 47.2% of adults aged thirty years and older have some form of periodontal disease in the USA. Periodontal disease increases with age, with 70.1% of adults 65. This condition is more common in men (56.4%) than women (38.4%), who are living below the federal level of poverty (65.4%), people with less than an HSE (66.9%), and current smokers (64.2%) [3]. The cost of treating gum disease in the United States tops \$14 billion annually [4].

The CDC is collaborating with important partner organizations, such as the American Academy of Periodontology and the American Dental Association, to enhance and maintain surveillance of periodontal diseases in the United States adult population. In addition, CDC is working to improve the validity of prevalence estimates derived from the National Health and Nutrition Examination Survey (NHANES) by enhancing the accuracy of the clinical examination protocols used in this national survey. Additionally, the CDC is working to develop simple screening measures for periodontal disease that can be used in clinical settings. These three initiatives are part of the CDC's efforts [3,5].

Public Health Importance

According to the World Health Organization WHO, gum and periodontal disease are among the most

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common reasons for tooth loss worldwide [2]. Gum disease and periodontal disease affect many Americans. Untreated gum disease also impacts public health more, raising the risk of other health issues like cardiovascular disease, diabetes, and respiratory disease. CDC estimates that half of Americans over 30 have periodontal disease.³ Gum and periodontal disease are more common in low-income and minority communities [6]. To lower health disparities and promote health equity in the US, these illnesses' causes must be addressed. In addition, the treatment expenses top \$14 billion annually. Periodontal disease and poor periodontal health are major US public health issues with serious health and economic consequences. Public health measures and education can lower the cost of gum disease and poor periodontal health [7].

Stakeholder

The study's goals coincide with this group's interest in oral health and disease prevention. The external stakeholder group for my study is American Dental Association (ADA). This stakeholder may encourage preventative oral health care practices such as daily brushing and flossing, routine dental checkups, and avoidance of tobacco use. This can help reduce the risk of gum disease and other negative outcomes for periodontal health. In addition, engaging with this stakeholder organization increases the awareness of the study, advocates for the impact of policy changes, provides information and resources, supports research, develops new products and technologies, and increases the probability that communities will embrace them [8].

METHODS

The cross-sectional study examined US adult and children's oral health and nutrition, and utilized National Health and Nutrition Examination Survey (NHANES) 2017–2018 data. NHANES collected data from participant interviews and mobile oral health screenings. Study datasets are publicly open for study. NHANES is a national initiative sponsored by The National Center for Health Statistics (NCHS); it collects national health information for the CDC.

Demographic and oral health files were used in this study. The sorted files were then merged and exported. Variables FLOSS 1, 2, 3, 4, and 5 represent the number of times an individual floss a tooth. Variable BONE LOSS was chosen as the outcome variable. The other variables are AFFORD, SPEND, INSURANCE COVERAGE, and TOO FAR. The value of the variable is a primary predictor denoted by TREAT. The sample size (N) 1360 studied further on these variables. No responses or missing values were deleted.

In this study, methods of statistical analysis, such as descriptive statistics, are utilized to describe the variables. A chi-square test was employed to examine the association between the outcome variable BONE LOSS and other variables such as AFFORD, SPEND, INSURANCE COVERAGE, and TOO FAR, with a p-value of 0.05 considered statistically significant. We also employed simple and multiple logistic regression to predict the BONE LOSS around the tooth. The odds ratios, CI, and p-value are deliberated for the analysis. SAS software 9.4 was used for the analysis.

Data description

As per data outlined the population with and without bone loss were approximately 17% and 83%. The majority of participants (94%) were unable to attend dental treatment and surgery because of affordability, and 74% of respondents were inattentive due to long travelling distance to the dental clinic. A significant portion of patients also claim that the primary reason they underwent dental treatment was because their insurance did not cover the operation. Nonetheless, compared to those with healthy bones, 24% of patients received a diagnosis from their dentist indicating they were losing bone.

RESULTS

Table 1: Data distribution

Variable	Frequency (N)	Percentage (%)
Cannot afford the cost		
Cost not problem	56	6
Cost not affordable	878	94
Dental office is too far.		
Distance not problem	159	74.3
Office too far	55	25.7
Insurance does not cover the treatment.		
Insurance is no reason for treatment	167	31.75
Insurance does not cover treatment	359	68.25
How many times a week do you floss		
Once a week	283	19.96
Twice a week	392	27.64
Thrice a week	368	25.95
Four times a week	219	15.44
Five times a week	156	11
Bone loss		
No Bone loss	3908	83.15
Bone loss	792	16.85
Previous gum disease treatment done		
Yes	1174	24.87
No	3547	75.13

Descriptive Analysis

Table 02 depicts the distribution of various characteristics of the sample population in the context of variable bone loss around the teeth. First, around 96% of people with bone loss worry about the cost and affordability. Although, the p-value for the afford is 0.8186, which is not statistically significant. Secondly, the percentage of people whose insurance does not cover dental treatment is 60.26%. The p-value for insurance coverage is 0.9793, which is not statistically significant. Finally, 55.05% have received treatment for gum disease. In addition, the p-value for treatment for gum disease is 0.0001, so we can say that there is an association between bone loss and treatment for gum disease.

Table 2: Describing the variables of Bone Loss

	No Bone Loss	Bone Loss	
Variable	N (%)	N (%)	p-value
Cannot afford the cost			0.8186
Cost not problem	9 (4.67)	3 (3.92)	
Cost not affordable	147 (95.32)	46 (96.0737)	
Dental office is too far.			0.0200
Distance not problem	29 (88.24)	5 (55.14)	
Office too far	6 (11.75)	4 (44.85)	
Insurance does not cover the treatment.			0.9793
Insurance is no reason for treatment	32 (40.13)	7 (39.73)	
Insurance does not cover treatment	63 (59.86)	20 (60.26)	
How many times a week do you floss			0.5966
Once a week	230 (22.94)	41 (20.15)	

Twice a week	321 (27.40)	52 (26.73)	
Thrice a week	299 (22.64)	48 (19.06)	
Four times a week	171 (15.39)	42 (22.15)	
Five times a week	122 (11.61)	28 (11.89)	
Previous gum disease treatment done			0.0001
Yes	251 (18.63)	130 (55.05)	
No	889 (81.36)	81 (44.94)	

Bivariate Analysis

Table O2 shows that the bivariate analysis indicates that the odds of bone loss are 5.67 times higher in the population that has undergone treatment for gum disease (OR=5.678; CI = 4.184–7.706; p-value=0.0001). In addition, the odds of bone loss are 1.076 times higher in the population that flosses four times a week (OR=1.076; CI=0.638–1.817; p-value=0.783).

Table 3: Simple and Multiple Logistic Regression of Predictor of Bone Loss

Variable	Unadjusted			Adjusted		
	Odds Ratio	95% CI	p-value	Odds Ratio	95% CI	p-value
Cannot afford the cost						
Cost not problem	0.876	0.377, 2.037	0.7590	0.767	0.756, 0.778	<.0001
Cost not affordable	Ref	Ref	Ref	Ref	Ref	Ref
Insurance does not cover the treatment.						
Insurance is no reason for treatment	0.698	0.269, 1.811	0.4598	0.438	0.435, 0.442	<.0001
Insurance does not cover treatment.	Ref	Ref	Ref	Ref	Ref	Ref
How many times a week do you floss						
Once a week	0.745	0.442,1.255	0.2688	2.731	2.705, 2.757	<.0001
Twice a week	0.704	0.429,1.155	0.1644	2.167	2.147, 2.189	<.0001
Thrice a week	0.709	0.430,1.169	0.1778	10.011	9.898, 10.126	<.0001
Four times a week	1.076	0.638,1.817	0.7831	0.833	0.824, 0.842	<.0001
Five times a week	Ref	Ref	Ref	Ref	Ref	Ref
Previous gum disease treatment done						
Yes	5.678	4.184, 7.706	0.0001	0.158	0.157, 0.159	<.0001
No	Ref	Ref	Ref	Ref	Ref	Ref

Multivariate analysis

Table O3 shows the multivariate analysis suggests that the odds of the afford are occurring less than one, indicating the event less likely to occur (OR=0.767; CI=0.756-0.778; p-value <0.0001), similarly odds of the gum treatment are occurring less than one, indicating the event less likely to occur (OR=0.158; CI=0.157-0.159; p-value= <.0001). The odds of bone loss are 10.01 higher in those who floss three times a week (OR=10.011; CI = 9.898 -10.126; p-value = 0.0001). The odds of bone loss are 2.16 higher in the population who floss twice a week (OR=2.16; CI = 2.147- 2.189; p-value = 0.0001). The odds of bone loss are 2.731 higher in the population who floss once a week (OR=2.73; CI = 2.705-2.75, p-

value = 0.0001). After adjusting, we can say that an association between bone loss and flossing is significant.

DISCUSSION

The results of the current study match those of considerable previous research, according to the provided information. Oral microbiota dysbiosis may promote persistent periodontitis and inflammation [9]. This study found that gum disease treatment increased bone loss risk. These findings suggest gum disease causes bone loss. Gram-negative periodontopathogens can damage periodontal tissue, and this study found a connection between flossing frequency and bone loss [10]. To be more specific, less frequent flossing may have allowed periodontopathogens to grow and destroy surrounding tissue, resulting in bone loss. Halitosis in the saliva and oral cavity is brought on by the microbiological degradation of sulfur-containing and sulfur-free amino acids. The latest study found a connection between flossing frequency and bone loss but not halitosis. However, bad breath from poor dental hygiene may indirectly cause halitosis [5]. The current study did not explicitly examine smoking but found that non-compliant, diabetic, and tooth-loss-prone adults were at higher risk. The current study did not examine smoking, although it found a substantial link between smoking and advanced periodontitis [11]. A recent study found that flossing frequency affects bone loss. In addition, the author found that long-term periodontal care lowers tooth loss [5]. The new study supports prior studies on periodontal disease and tooth loss causes and risk factors. This study found that gum disease therapy and flossing frequency can promote bone loss around the teeth. Gum disease patients had 5.67 times the risks of bone loss, suggesting a link between the two conditions. As flossing frequency decreased, bone loss odds ratios increased. The study also found that dental treatment costs and insurance coverage were not statistically significant factors in tooth-bone loss. These findings suggest that additional factors like poor dental hygiene may accelerate bone loss. This study used univariate and multivariate analysis to examine the links between various factors and tooth bone loss [12]. Adjustments to potential confounding variables made multivariate findings more reliable. This study shows that frequent flossing and gum disease therapy help reduce bone loss around the teeth. The findings also suggest that addressing concerns about dental treatment costs and insurance coverage may not be the best approach. Future research could examine these causes, tooth bone loss, and ways to prevent it.

Strengths

The importance of the study lies in its in-depth analysis of the many factors connected to poor periodontal disease and gum disease. In addition, the study has behavioral analysis of the sampled group improved risk factor understanding. The study also used bivariate and multivariate analyses to examine factors affecting bone loss. This led to a deeper study of variable relationships.

Limitations

Cost and insurance coverage was not statistically significant, which limits this study. Determining how these factors affect gum disease and periodontal health is hard. In addition, the study is flawed since it is cross-sectional. It collects data at once and cannot demonstrate causal relationships between variables. The long-term effects of risk variables on gum disease and periodontal health studies may require further research.

One of the few drawbacks of this study is that it is conducted on data from the NHANES, which is said not to represent the actual US population. For example, due to the NHANES data's complex sampling scheme, homeless and institutionalized people may be underrepresented. In addition, NHANES data were self-reported so they can be biased and inaccurate. Another disadvantage is that only a few

variables were investigated, so other essential factors that cause gum disease and worse periodontal health outcomes may have been missed. Finally, due to the study's cross-sectional design, we cannot reach definitive conclusions regarding the relationship between cause and effect.

Conflicts of Interest

The author reports no conflicts of interest.

Funding

None declared.

CONCLUSION

The analytical result of this study highlights several factors that have been connected to bone loss around teeth. These include gum disease treatment and flossing frequency. The multivariate study found that less regular flossers were more likely to lose bone, whereas those who lost were less likely to receive gum disease therapy. However, bone loss was not associated with treatment cost or insurance availability. These findings can help dental professionals and public health regulators establish prevention and control strategies for tooth-bone loss. To avoid bone loss and dental issues, people should floss every day. To understand these links and devise effective treatments, more research is needed.

Recommendations/ public health implications

A study on periodontal disease risk factors and adverse outcomes will majorly impact public health. This research could inform public health policies and guidelines, particularly those promoting oral health and disease prevention. Dental experts and other healthcare providers can use the data to create personalized treatment plans for gum disease patients with poor periodontal health. The knowledge will help the public understand gum disease and its prevention. This study could educate people about how lifestyle factors like smoking, diet, and oral hygiene affect gum disease and periodontal health outcomes. Finally, this study can help create successful public health solutions. These strategies aim to prevent gum disease, improve oral health, and improve general health and well-being.

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