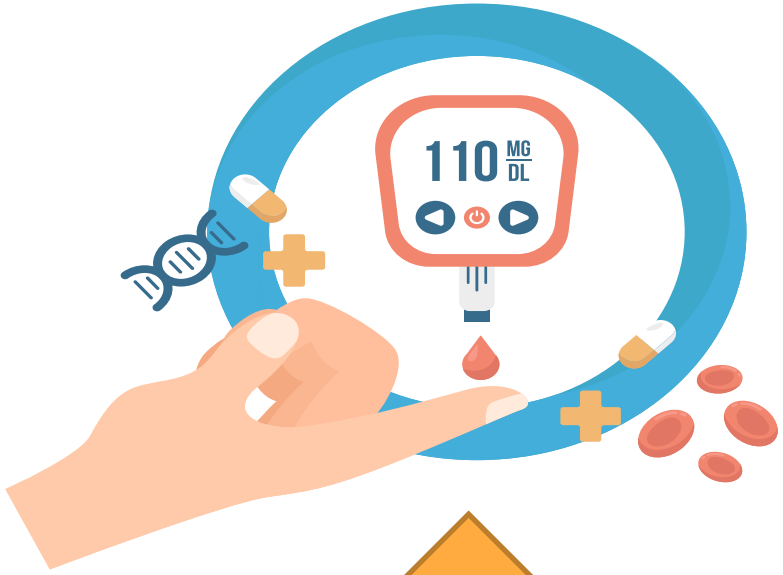

To study the racial differences in the association between poorly-controlled diabetes and periodontitis in the U.S.

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Special Thanks to:
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Introduction – Burden of the disease

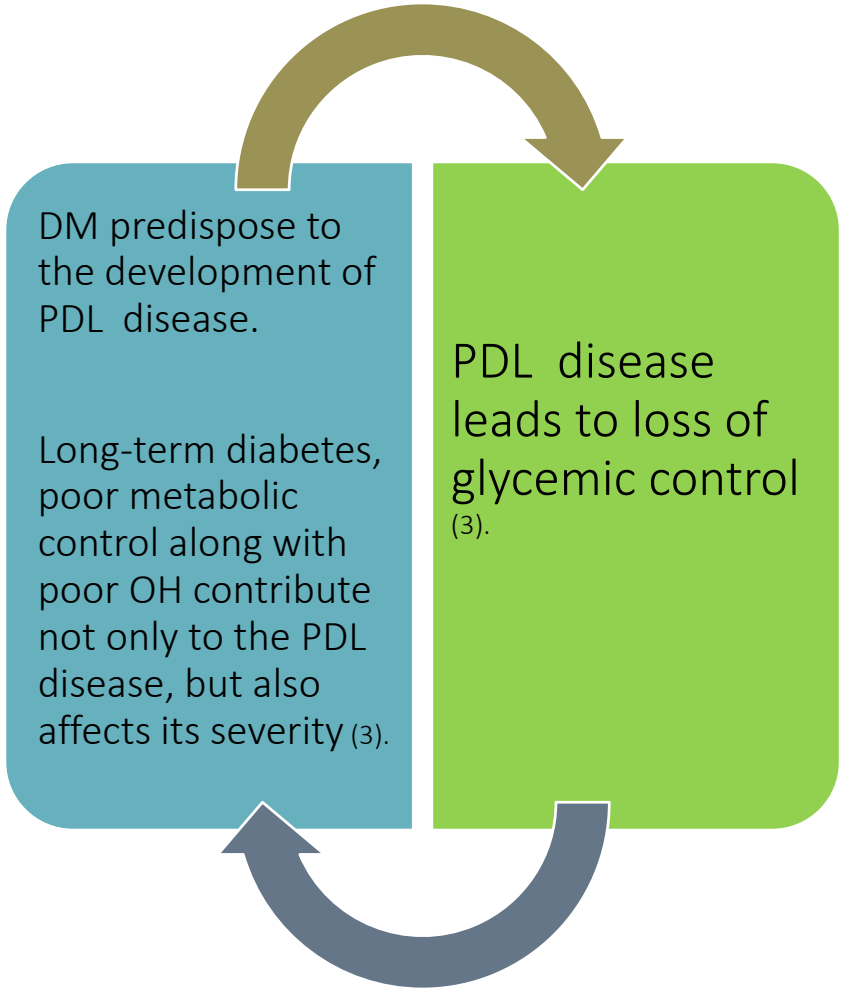
DIABETES MELLITUS

- Diabetes Mellitus (DM) is a heterogeneous group of disorders characterized by hyperglycemia and glucose intolerance.
- More than 34 million Americans have diabetes, accounting for almost 10% of the U.S. population (1).

PERIODONTITIS

- According to the CDC, 47.2% of U.S adults aged 30 years and older have some form of periodontal disease.
- Prevalence of periodontal (PDL) disease increases with age.
- Approx. 2/3 of adults 65 years and older in the U.S. have some form of periodontal disease (2).

Introduction – Inter-relation of DM & PDL Disease



Literature review

- ✓ A review article exploring the results from observational studies supports the consistent evidence of greater prevalence, severity, extent, or progression of at least one manifestation of periodontal disease in diabetics 13/17 reports reviewed (4).
- ✓ A cross-sectional study utilizing NHANES cycles 2009 to 2012 examination for adults older than 30 years demonstrated that glycohemoglobin level is significantly associated with presence of periodontitis (5).
- ✓ A study on Kiriri Indians from Northeast Brazil suggests high prevalence of periodontitis in them, there is an association between periodontitis and diabetes (6).
- ✓ Another study on Gullah African-Americans indicates that health insurance status was associated with periodontal disease progression among Gullah African-Americans with type 2 diabetes mellitus (7).

Introduction – Gaps in the current literature

1. AIM

To examine the relationship between the glycemic control and ***the severity*** of periodontitis, not merely, presence or absence of the disease in the U.S. population.

2. AIM

To examine ***the racial differences*** in the association between poorly-controlled diabetes and periodontitis in the U.S. population.

Methods & Procedures

DATA - Our study analyzed data from the 2009-2014 NHANES (National Health and Nutrition Examination Survey).

STUDY POPULATION -

a. The study sample consisted of 1,276 adults, aged 30 and older, with type-2 diabetes.
b. Race/Ethnicity (Mexican- American, other Hispanic, Non-Hispanic White, Non-Hispanic Black, and Other including multi-racial).

Methods & Procedures

EXPOSURE VARIABLE -

- *As per International Classification of Disease 10th revision, Clinical Modification (ICD 10 CM) code for diabetes (8), participants were categorized based upon their serum HbA1c as:*

a. poorly controlled (HbA1C $\geq$ 8%)

b. well- controlled (HbA1C < 8%) .

- *Another indicator of diabetes severity was assessed by the question "Has a doctor ever told you that diabetes has affected your eyes or you had retinopathy?"*

a. Yes

b. No

OUTCOME VARIABLE -

- *Based on the AAP/CDC case definition proposed for population-based surveillance (2), our outcome variable periodontitis was categorized into: -*

  - No disease/ Mild/ Moderate /Severe periodontitis

- *For the purpose of the study, we re-categorized the periodontal disease variable into:*

  - 'none and mild' OR 'moderate and severe' periodontitis

Methods & Procedures

COVARIATES

I. **Age** : 30-39 yrs.; 40-49 yrs.; 50-59 yrs.; 60-69 yrs., and 70 yrs. & older.

II. **Gender**: Male/ Female

III. **Education**: less than high school education, high school /equivalent, or college graduate or above

IV. **BMI** : 'underweight or normal' (BMI <=24.99 kg/m^2); 'overweight' (BMI >25 kg/m^2 to <=29.99 / kg m^2), and 'obese' (BMI>30 kg/m^2)

V. **Poverty level** : low-income (<1.67), moderate-income (>=1.68 and<=3.33), and high-income (>=3.34)

VI. **Alcohol intake** : No drinks/week, 1-2 drinks/week, 3-7 drinks/week, and 8 or more drinks/week.

VII. **Smoking status** : 'Non-smoker', 'Former-smoker', 'Current-smoker'

Methods & Procedures

DATA ANALYSIS -

- ❑ Statistical analyses using weighted survey procedures performed using the statistical software SAS (Version 9.4).
- ❑ A bivariate analysis using chi-square test done to determine the associations between variables of interest and periodontal outcomes.
- ❑ Multivariable logistic regression models performed to examine the effects of poorly controlled diabetes on the severity of periodontitis (none-mild or moderate-severe) after adjusting for age, gender, poverty level and smoking status .
- ❑ Results reported as odds ratio with 95% CI, and $p(< 0.05)$ was considered statistically significant.

Table 1. Characteristics of Diabetics by Periodontal Disease Status (Weighted frequencies)

Variable	Categories	None- Mild perio	Moderate-Severe perio	P-Value	Variable	Categories	None-Mild perio	Moderate-Severe perio	P-Value
Age	30-39 years	68.45%	31.54%	0.0003 *	***Body Mass Index***	Normal or Underweight	38.64%	61.35%	0.014 *
	40-49 years	55.38%	44.61%			Overweight	40.73%	59.26%	
	50-59 years	47.76%	52.23%			Obese	47.45%	52.54%	
	60-69 years	38.27%	52.23%		***Diabetics***	Poorly controlled Diabetic	36.01%	63.98%	0.005 *
	70+ years	35.03%	64.96%			Well-controlled Diabetic	48.02%	51.97%	
Gender	Male	39.57%	60.42%	0.003 *	***Retinopathy***	Yes	44.50%	55.49%	0.9
	Female	50.70%	49.29%			No	45.13%	54.86%	
Race/Ethnicity	Mexican-American	29.36%	70.63%	<0.0001 *	***Smoking Status***	Non- smoker	52.30%	47.69%	<0.0001 *
	Other Hispanic	43.31%	56.69%			Former-smoker	39.61%	60.38%	
	Non-Hispanic White	51.07%	48.92%			Current-smoker	31.58%	68.41%	
	Non-Hispanic Black	37.75%	62.24%		***Alcohol Intake***	No drinks/week	38.06%	61.93%	0.0003 *
	Others including multi-racial	32.00%	67.99%			1-2 drinks/week	51.68%	48.31%	
Education	Less than High School	29.69%	70.30%	<0.0001 *		3-7 drinks/week	55.97%	44.03%	
	High School/Equivalent	47.35%	52.64%			>8 drinks/week	27.30%	72.69%	
	College Graduate/Above	49.49%	50.50%						
Poverty Level	Low-income Level	35.91%	64.08%	0.0004 *					
	Moderate-income Level	43.21%	56.78%						
	High-income Level	54.29%	45.70%			* *indicates statistically significant*			

Key Findings – Bivariate Analysis

- Age, gender, race/ethnicity, education level, poverty level, BMI, diabetes, smoking status and alcohol level were significantly associated with periodontal outcomes ($p<0.05$).

- Participants with moderate-severe periodontitis were older (70+years), males, Mexican-Americans , poorly controlled diabetics, and current smokers, heavy alcohol drinkers with less than high school education and in the low-income category.

- Participants with retinopathy were less likely to have moderate-severe periodontitis, but these results were not statistically significant with the p-value of 0.9.

Table 2. Multivariable Logistic Regression demonstrating predictors of moderate-severe periodontitis among diabetics *(* - indicates statistically significant)*

Variable	Categories	Odds Ratio(95% CI)	P-Value	Variable	Categories	Odds Ratio(95%CI)	P-Value
Age	30-39 years	reference			Moderate-income Level	1.30(0.75-2.230)	0.34
	40-49 years	1.52(0.63-3.69)	0.34		Low-income Level	1.98(1.13-3.45) *	0.02
	50-59 years	2.17(1.08-4.36) *	0.03	*Body Mass Index*	Normal or underweight	reference	
	60-69 years	3.15(1.50-6.63) *	0.003		Overweight	1.07(0.66-1.75)	0.76
	70+ years	6.32(2.83-14.11) *	<0.0001		Obese	1.18(0.71-1.97)	0.50
Gender	Female	reference		*Diabetics*	Well-controlled Diabetics	reference	
	Male	1.95(1.29-2.93) *	0.001		Poorly controlled diabetics	1.74(1.08-2.80) *	0.02
Race/Ethnicity	Non-Hispanic White	reference		*Retinopathy*	No	reference	
	Mexican-American	2.27(1.35-3.82) *	0.003		Yes	1.04(0.63-1.72)	0.88
	Other Hispanic	1.27(0.64-2.52)	0.49	*Smoking Status*	Non-smoker	reference	
	Non-Hispanic Black	1.64(0.96-2.80)	0.07		Former-smoker	2.19(1.26-3.80) *	0.006
	Others including multi-racial	2.96(1.36-6.45) *	0.007		Current-smoker	2.31(1.34-4.00) *	0.003
Education	College Graduate or Above	reference		*Alcohol Intake*	No drinks/week	reference	
	High School/ Equivalent	0.84(0.53-1.33)	0.46		1-2drinks/week	0.64(1.39-1.02) *	0.06
	Less than High School	1.63 (0.72-3.71)	0.24		3-7 drinks/week	0.45(0.23-0.87)	0.01
Poverty Level	High-income Level	reference			>8 drinks/week	1.26(0.57-2.79)	0.56

Key Findings - Multivariable Regression Analysis

Finding 1

Odds of moderate-severe periodontitis in age group 70+ years is ***6.3*** times the reference group (30-39 years).

Finding 2

Odds of moderate-severe periodontitis was higher in ***males and lower-income*** level group.

Finding 3

Odds of moderate-severe periodontitis is ***higher in Smokers*** Current (OR, 2.19; CI 1.26 -3.80) Former smokers (OR, 2.31; CI 1.34-4.00) **Vs** Non-Smoker diabetics

Finding 3

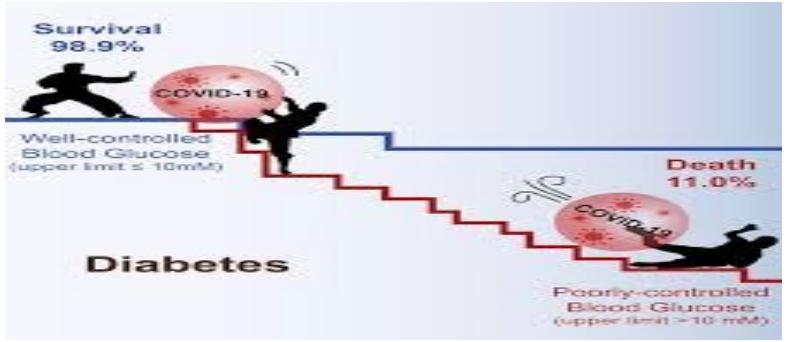
Odds of having moderate-severe periodontitis is 2 times in Mexican- American & 3 times in Other races including **Vs** Non- Hispanic White diabetics.

Table 4.Multivariable Logistic Regression Model demonstrating racial stratified predictors of moderate-severe periodontitis among diabetics.

RACE	PERIODONTAL OUTCOME	ODDS RATIO (95% CI)	P-VALUE
Mexican-American	None-Mild periodontitis	reference	
	Moderate-Severe periodontitis	2.37 (1.14-4.95)*	0.02
Other-Hispanic	None- Mild periodontitis	reference	
	Moderate-Severe periodontitis	3.57(1.09-11.69)*	0.04
Non-Hispanic White	None-Mild periodontitis	reference	
	Moderate-Severe periodontitis	1.64(0.89-3.04)	0.11
Non-Hispanic Black	None- Mild periodontitis	reference	
	Moderate-Severe periodontitis	2.38(1.23-4.60)*	0.01
Other including multi-racial	None-Mild periodontitis	reference	
	Moderate-Severe periodontitis	0.86(0.21-3.46)	0.83

* *indicates statistically significant results*

Key Findings - Multivariable Regression Analysis Stratified by Race



Finding 1

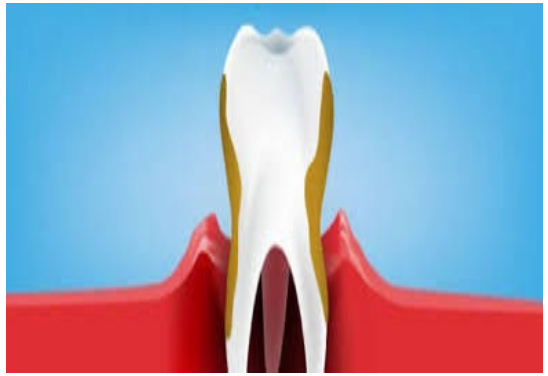
Odds of moderate -severe periodontitis

Poorly controlled diabetics > well-controlled diabetics.

Finding 2

Odds of moderate-severe periodontitis almost 2 times in poorly controlled

Mexican Americans 2.37(95% CI 1.14-4.95),
Other Hispanics 3.57(95% CI 1.09-11.69
Non-Hispanic blacks 2.38 (95% CI 1.23-4.60)
VS
Non- Hispanic White 1.64(0.89-3.04)



Discussion & Conclusion

- Demographic factors such as age, sex, poverty level, smoking status, were significantly associated with odds of moderate-severe periodontitis in poorly controlled diabetics (10).

- Disparities by race
  - Odds of moderate-severe periodontitis in Mex-Americans & Other Hispanics is 2 times as compared poorly controlled Non-Hispanic Whites.
  - Odds of moderate-severe periodontitis in Non- Hispanic Blacks is 3.5 times than poorly-controlled Non-Hispanic Whites.

Conclusion

This cross- sectional study suggests that poorly controlled diabetes is significantly associated with the severity of periodontitis, but this association is not uniform across different racial /ethnic groups in the U.S.

Strengths & Limitations

Strengths

- ❑ NHANES is a nationally representative sample using objectively measured periodontal data and thus is capable of providing accurate estimates of oral conditions for the U.S. population, which increases the external validity of this study.

Limitations

- ❑ This study analyzed cross-sectional data, which limits the ability to establish causal relationships between the variables examined.
- ❑ Second, our study did not take into account medical conditions of the participants other than DM.
  - Conditions like kidney disease, liver disease, hemoglobinopathies, and pregnancy may decrease glycohemoglobin levels.
  - Iron-deficiency anemia may increase glycohemoglobin levels.

Clinical Implications

- ✓ Indicates the need for public health action that includes diabetes prevention and treatment programs targeting high-risk ethnic groups to improve the periodontal status of these populations.

- ✓ Provides additional knowledge for policy makers to focus on addressing oral health inequalities related to other existing medical conditions.

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