Association between diabetes mellitus and tooth loss among adults in the United States: Findings from Behavioral Risk Factor Surveillance System (BRFSS) 2022

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Background

- Diabetes mellitus (DM) is a chronic metabolic disease with derangements in insulin secretion leading to imbalances in carbohydrate, protein and fat metabolism.
- A total of 11.6% of individuals (38.4 million) in the US were reported to be afflicted with diabetes.
- Tooth loss (TL) can negatively impact an individual's oral health, general health and quality of life.
- The average number of permanent teeth among adults in the US aged 20-34 years was 27 teeth, which reduced to 25.6, 21.7 and 19.8 at ages 35-49 years, 65–74 years and ≥75 years, respectively.
- DM increases an individual's likelihood of developing chronic inflammation and oral diseases like periodontitis, tooth decay, and tooth loss.
- Prior studies on DM and tooth loss have largely relied on clinically assessed dental data and more recent analyses are limited.
- There is a definite need to ascertain the relationship between DM and tooth loss using more recent nationally sample of US adult.

Objective

To assess the association between diabetes mellitus and tooth loss among adults in the United States and New York State using a nationally representative sample.

Methods

- **Data:** Behavioral Risk Factor Surveillance System (BRFSS) 2022
- **Dependent Variables:** Permanent teeth removed due to tooth decay or gum disease.
- **Primary Independent Variable:** Self-reported diabetes: (Ever told) you had diabetes
- **Statistical analysis:** Pearson Chi-square and multivariable logistic regression models were used. Level of significance was set at 0.05. Data analysis was performed using IBM SPSS.

Table 1: Study characteristics of participants

Variables		Total sample (n=279,629)	Have diabetes (n=39,087)	No diabetes (n=240,542)	*p*-value
Weighted sample size		159,177,377	19,567,821	139,609,557	
Tooth loss		116,643 (41.71%)	25,618 (65.54%)	92,304 (38.37%)	**<0.001**
Age	18-44 years	126,472 (45.23%)	5,241 (13.41%)	119,522 (49.69%)	**<0.001**
	45-65 years	91,688 (32.79%)	16,948 (43.36%)	75,308 (31.31%)	
	≥65 years	61,469 (21.98%)	16,898 (43.23%)	45,712 (19.00%)	
Gender	Male	144,265 (51.59%)	21,467 (54.92%)	122,976 (51.12%)	**<0.001**
	Female	135,364 (48.41%)	17,620 (45.08%)	117,566 (48.88%)	
Race/ethnicity	Non-Hispanic White	174,030 (62.24%)	22,515 (57.60%)	151,266 (62.89%)	**<0.001**
	Non-Hispanic Black	32,106 (11.48%)	6,100 (15.61%)	26,227 (10.90%)	
	Hispanic	44,053 (15.75%)	6,454 (16.51%)	37,640 (15.65%)	
	Non-Hispanic Other/Multiracial	29,441 (10.53%)	4,018 (10.28%)	25,409 (10.56%)	
Marital Status	Married/Living with partner	146,115 (52.25%)	21,704 (55.53%)	124,587 (51.79%)	**<0.001**
	Divorced/Widowed/Separated	54,070 (19.34%)	11,316 (28.95%)	43,270 (17.99%)	
	Single/Never married	79,443 (28.41%)	6,066 (15.52%)	72,685 (30.22%)	
Educational status	College graduate or above	93,692 (33.51%)	9,353 (23.93%)	83,825 (34.85%)	**<0.001**
	Less than high school	25,255 (9.03%)	5,955 (15.24%)	19,633 (8.16%)	
	High school grad/GED	73,033 (26.12%)	11,106 (28.41%)	62,050 (25.80%)	
	Some college or technical school	87,649 (31.34%)	12,674 (32.42%)	75,033 (31.19%)	
Employment status	Employed	145,534 (52.05%)	12,691 (32.47%)	131,791 (54.79%)	**<0.001**
	Self employed	27,381 (9.79%)	2,625 (6.72%)	24,590 (10.22%)	
	Not employed/homemaker/ Unable to work	40,751 (14.57%)	8,676 (22.20%)	32,485 (13.50%)	
	Student	10,716 (3.83%)	182 (0.46%)	10,353 (4.30%)	
	Retired	55,247 (19.76%)	14,914 (38.15%)	41,322 (17.18%)	
Household income	$100K or more	85,082 (30.43%)	7,628 (19.52%)	76,868 (31.96%)	**<0.001**
	Less than $15K	15,797 (5.65%)	3,972 (10.16%)	12,067 (5.02%)	
	15K-Less than $50K	95,304 (34.08%)	17,270 (44.18%)	78,577 (32.67%)	
	50K- Less than 75K	45,126 (16.14%)	5,802 (14.84%)	39,254 (16.32%)	
	75K- Less than 100K	38,320 (13.70%)	4,415 (11.29%)	33,776 (14.04%)	
Insurance type	Private	152,606 (54.57%)	14,061 (35.97%)	137,546 (57.18%)	**<0.001**
	Public	79,954 (28.59%)	18,944 (48.47%)	62,078 (25.81%)	
	VA insurance	10,573 (3.78%)	1,734 (4.44%)	8,874 (3.69%)	
	Other government or state insurance	15,639 (5.59%)	2,615 (6.69%)	13,083 (5.44%)	
	No insurance	20,857 (7.46%)	1,733 (4.43%)	18,961 (7.88%)	
Urban/Rural status	Urban county	261,743 (93.60%)	36,111 (92.38%)	225,567 (93.77%)	**<0.001**
	Rural county	17,886 (6.40%)	2,976 (7.62%)	14,975 (6.23%)	
Smoking status	No	241,842 (86.49%)	33,578 (85.91%)	208,232 (86.57%)	**<0.001**
	Yes	37,787 (13.51%)	5,509 (14.09%)	32,310 (13.43%)	
BMI	Normal	82,043 (29.34%)	5,247 (13.42%)	75,941 (31.57%)	**<0.001**
	Underweight	4,676 (1.67%)	295 (0.75%)	4,332 (1.80%)	
	Overweight/Obese	192,910 (68.99%)	33,545 (85.82%)	160,269 (66.63%)	

Estimates adjusted using BRFSS complex survey design
p-values calculated by Pearson χ^2 test; Significance level: p<0.05

Table 2: Regression analysis of tooth loss among study participants

Variables		aOR (95% CI)	p-value
Diabetes	No Diabetes	Ref	
	Have Diabetes	1.52 (1.43, 1.61)	**<0.001**
Age	18-44 years	Ref	
	45-65 years	2.53 (2.41, 2.66)	**<0.001**
	≥65 years	4.28 (3.98, 4.60)	**<0.001**
Gender	Male	Ref	
	Female	0.93 (0.90, 0.97)	**<0.001**
Race/ethnicity	Non-Hispanic White	Ref	
	Non-Hispanic Black	1.58 (1.49, 1.68)	**<0.001**
	Hispanic	0.99 (0.93, 1.06)	0.799
	Non-Hispanic Other/Multiracial	1.28 (1.18, 1.38)	**<0.001**
Marital Status	Married/Living with partner	Ref	
	Divorced/Widowed/Separated	1.14 (1.08, 1.20)	**<0.001**
	Single/Never married	0.71 (0.68, 0.75)	**<0.001**
Educational status	College graduate or above	Ref	
	Less than high school	2.72 (2.47, 3.00)	**<0.001**
	High school grad/GED	1.85 (1.77, 1.95)	**<0.001**
	Some college or technical school	1.55 (1.49, 1.62)	**<0.001**
Employment status	Employed	Ref	
	Self employed	1.00 (0.94, 1.07)	0.913
	Not employed/homemaker/ Unable to work	1.15 (1.08, 1.23)	**<0.001**
	Student	0.38 (0.33, 0.44)	**<0.001**
	Retired	1.05 (0.99, 1.13)	0.113
Household income	$100K or more	Ref	
	Less than $15K	2.04 (1.83, 2.27)	**<0.001**
	15K-Less than $50K	1.80 (1.70, 1.91)	**<0.001**
	50K- Less than 75K	1.47 (1.39, 1.55)	**<0.001**
	75K- Less than 100K	1.33 (1.25, 1.41)	**<0.001**
Insurance type	Private	Ref	
	Public	1.28 (1.21, 1.35)	**<0.001**
	VA insurance	0.89 (0.81, 0.98)	**0.014**
	Other government or state insurance	1.18 (1.09, 1.28)	**<0.001**
	No insurance	1.23 (1.13, 1.34)	**<0.001**
Urban/Rural status	Urban county	Ref	**<0.001**
	Rural county	1.22 (1.15, 1.30)	
Smoking status	No	Ref	
	Yes	2.05 (1.94, 2.17)	**<0.001**
BMI	Normal	Ref	
	Underweight	1.09 (0.94, 1.27)	0.240
	Overweight/Obese	1.24 (1.19, 1.29)	**<0.001**

Estimates adjusted using BRFSS complex survey design
aOR: adjusted odds ratio, CI: Confidence Interval; Significance level: p<0.05

Results

- The study sample comprised of 279,629 adults, with a majority of 45.23% (126,472) respondents belonging to the age group of 18-44 years.
- A total of 12.29% of US adults and 11.54% of NYS participants reported having diabetes.
- Overall, 41.71% and 45.08% of US and NYS participants reported permanent tooth loss due to tooth decay or gum disease, respectively.
- Among individuals with diabetes, 65.54% of US adults experienced permanent tooth loss, compared to 69.95% of NYS participants.
- After adjusting for potential confounders, US adults with diabetes had significantly higher odds of tooth loss (adjusted OR=1.52; 95% CI: 1.43-1.61, p<0.001).
- Age, gender, race/ethnicity, educational status, employment status, Household income, insurance type, residential status, smoking status, and BMI were associated with tooth loss.

Limitations

- The present study is cross-sectional in nature, which limits arriving at any causal inferences.
- The exposure and outcome variables included in the analysis are self-reported, which might be susceptible to recall and social desirability biases.
- The timing of tooth loss in relation to detection of diabetes cannot be ascertained.
- Eating habits such as snacking which might influence the outcome of the study, has not been included in the analysis.

Conclusions

- Participants with diabetes were more likely to report tooth loss than those without diabetes.
- Our study highlights policy implications related to regular dental examinations of individuals with DM.
- There is a definite need for collaborative efforts to integrate dental and medical services for effective management oral health problems among individuals with diabetes.