EHR Data Mining to Understand Trends in Association of Systemic Health Factors and Tooth Loss

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Background

- Tooth loss is a vital indicator of oral health status and oral health-related quality of life, especially in older adults and is the result of a lifelong accumulation of dental diseases, the interaction of systemic-oral diseases, impacted by social determinants of health.
- Higher tooth loss rate has been seen among older persons with cardiovascular disease (CVD), diabetes, and respiratory diseases with the mean number of teeth below the functional dentition threshold. Retaining at least 20 natural teeth is essential to maintain functional and aesthetic dentition throughout life.
- Income and race/ethnicity are also considered major determinants of oral health status and tooth retention in older adults .
- Colorado ranks 37th in the United States regarding tooth loss in older adults with an average of 18% being edentulous.
- An understanding of population trends related to systemic and oral health is important for healthcare professionals to predict future outcomes, assist in healthcare assessment, service planning, and policy development.

Objectives

- We aim to evaluate the association of systemic health factors, including CVD, diabetes and tobacco use with tooth loss in patients (adults ≥55 years) visiting the University of Colorado School of Dental Medicine (SDM) clinics over four years.
- In addition, we aim to analyze the trends in this association for the four consecutive years, 2017, 2018, 2019, and 2020.

Methods

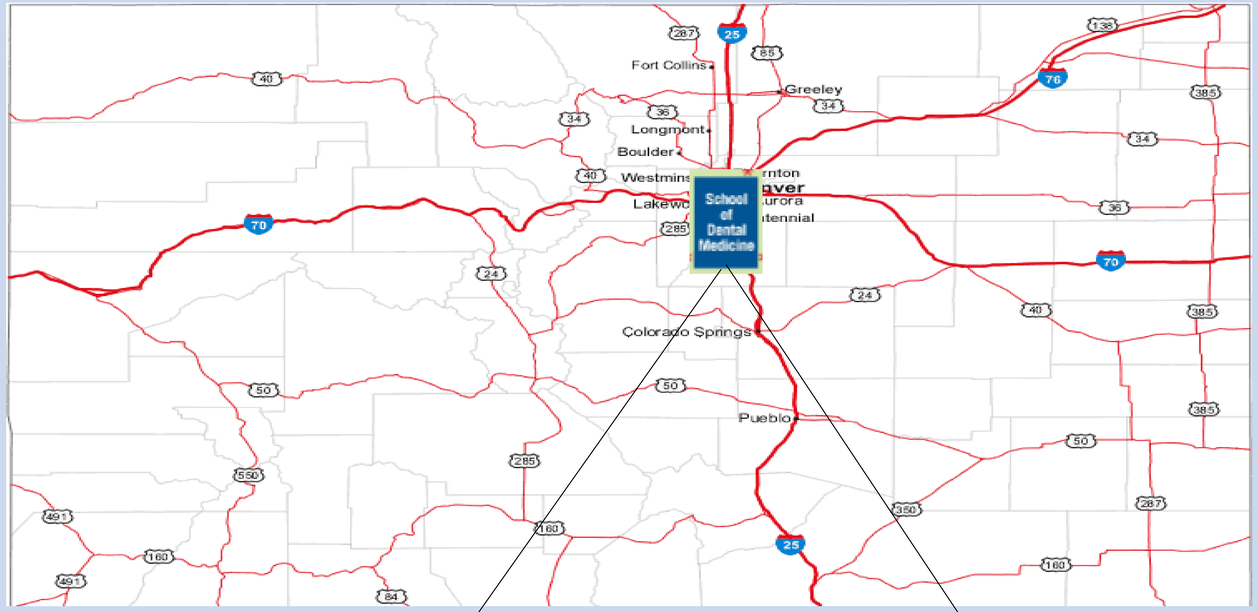
- Data was collected through mining the Electronic Health Records **(EHRs)** by students trained and calibrated each year to use the data extraction methods.
- **2907** new patients' (adults ≥55 years of age) records were included.

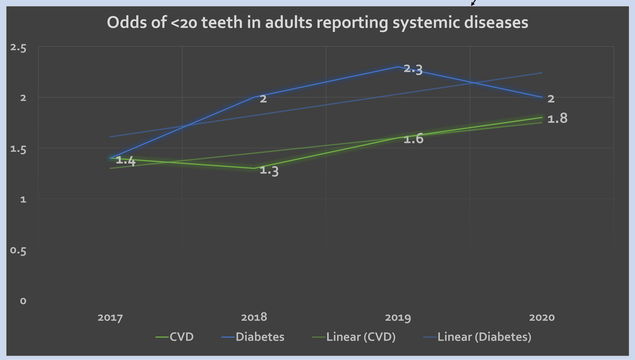
Association between systemic health factors and <20 teeth:

- **Independent variables reviewed using EHRs:** self-reported systemic diseases including, CVD, diabetes, and tobacco use.
- **Outcome:** tooth loss (<20 teeth: yes/no).
- **Additional variables reviewed:** age, gender, ethnicity.
- **Univariate logistic regression** models were performed to test the association between patients having <20 teeth and the self-reported systemic health factors over four years.
- Pearson's chi-square tests were conducted for each of the primary predictors to test any significant differences between the two groups, <20 teeth and ≥20 teeth.

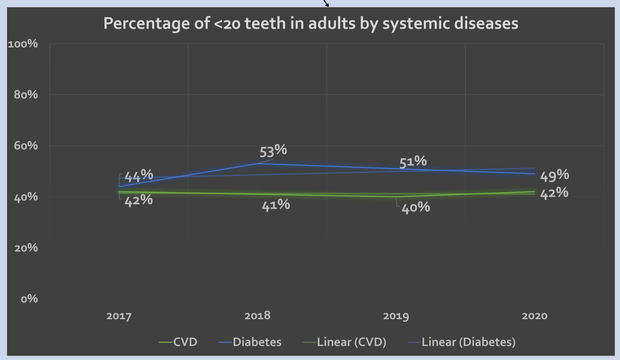
Analyzing the systemic-oral health trends by reported systemic diseases and tobacco use:

- Trends in the **tooth loss (<20 teeth) odds** by systemic diseases and tobacco use were analyzed.
- Trends in the **percentage of adults with tooth loss** (<20 teeth) in the oral cavity as varying by reported systemic diseases and tobacco use were evaluated.

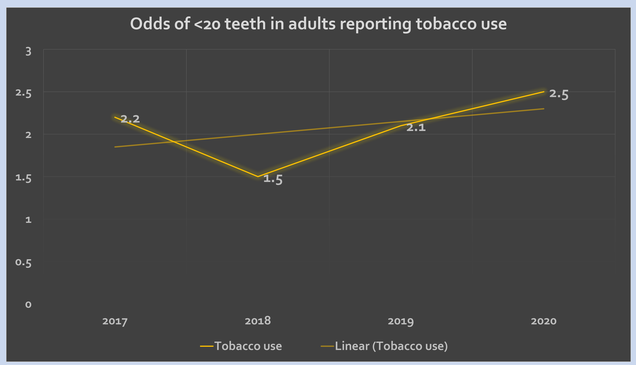




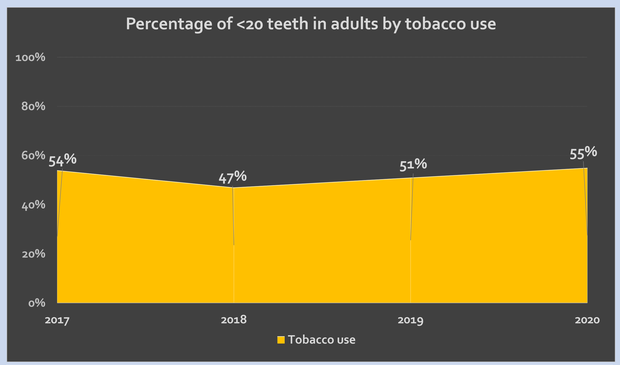
Increased annual trend in the odds of tooth loss (<20 teeth) from the years 2017 to 2019 in adults reporting diabetes, followed by a decrease in 2020. The odds of tooth loss (<20 teeth) increased in adults reporting CVD over the four years.



Increase in the percentage of adults with tooth loss (<20 teeth) reporting diabetes from year 2017 to 2018, followed by a decrease in the next two years. Adults reporting CVD, had a similar percentage of tooth loss (<20 teeth) in all four years.



The tooth loss (<20 teeth) odds had an increasing trend in years 2018, 2019, and 2020 compared to 2017 in adults reporting tobacco use.



Decrease in tooth loss (<20 teeth) percentage in 2018 compared to 2017, followed by an increase in the next two years in adults reporting tobacco use.

Table 1: Descriptive statistics of the School of Dental Medicine patient population over 55 years of age over four years

Categorical Variables	Total sample Frequency (Percentage) N=2907	<=20 Teeth, Frequency (Percentage) 1068 (36.74%)	>20 Teeth, Frequency (Percentage) 1839 (63.26%)	P-Value
Cardiovascular Disease				
Yes	1395 (47.99%)	578 (54.12%)	817 (44.43%)	<0.0001
No	1512 (52.01%)	490 (45.88%)	1022 (55.57%)	
Diabetes				
Yes	536 (18.44%)	262 (24.53%)	274 (14.90%)	<0.0001
No	2371 (81.56%)	806 (75.47%)	1565 (85.10%)	
Tobacco use				
Yes	355 (12.21%)	184 (17.23%)	171 (9.30%)	<0.0001
No	2552 (87.79%)	884 (82.77%)	1668 (90.70%)	
Gender				
Male	1469 (50.53%)	544 (50.94%)	925 (50.30%)	
Female	1438 (49.47%)	524 (49.06%)	914 (49.70%)	
Race/Ethnicity				
Hispanic	315 (10.91%)	142 (13.46%)	173 (9.44%)	
White	2013 (69.73%)	665 (63.03%)	1348 (73.58%)	
African-American	369 (12.78%)	162 (15.36%)	207 (11.30%)	
Asian	109 (3.78%)	55 (5.21%)	54 (2.95%)	

Table 2: Association between systemic health factors and tooth loss in adults 55 years of age over four years (<20 teeth: yes/no)

Variables (yes vs no)	Odds Ratio	95% CI	P-Value
Cardiovascular Disease	1.7	1.3 – 1.9	<0.0001
Diabetes: yes vs no	1.9	1.5 – 2.2	<0.0001
Tobacco: yes vs no	2.4	1.6 – 2.9	<0.0001

- Mean age of study patients: 68 years.
- Odds of tooth loss (<20 teeth) were nearly twice in patients reporting CVD and diabetes compared to patients who did not report CVD and diabetes, respectively.
- Tobacco users had more than two times greater odds of tooth loss (<20 teeth) compared to non-tobacco users.

Conclusion

- This study suggests evidence of systemic-oral connections over four years in older adults visiting the SDM clinics.
- Patients reporting CVD, diabetes, and tobacco use were more likely to have tooth loss, suggesting a need for interprofessional partnerships to address risk factors for poor dentition.
- Longitudinal research is warranted to study the magnitude of these findings, which will aid in educating and training future health care providers to recognize these associations and deliver appropriate treatments to improve overall health outcomes.