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Correlates of Root Caries Experience in Middle-Aged and Older Adults within the Northwest PRECEDENT

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STRUCTURED ABSTRACT

Background—We examined the correlates of root caries experience for middle-aged (ages 45–64 years) and older adults (ages 65+ years) to test the hypothesis that the factors related to root caries are different for middle-aged versus older adults.

Methods—This observational cross-sectional study focused on adult patients ages 45–97 years recruited from the Northwest PRECEDENT (N=775 adults). The outcome variable was any root caries experience (no/yes). Sociodemographic, intraoral, and behavioral factors were hypothesized as potential root caries correlates. We used Poisson regression models to generate overall and age-stratified prevalence ratios (PR) of root caries and Generalized Estimating Equations to account for practice-level clustering of participants.

Results—About 20% of adults had any root caries. Dentists' assessment that the patient was at high risk for any caries was associated with greater prevalence of root caries experience in both middle-aged adults (PR=2.70, 95% CI: 1.63,4.46) and older adults (PR=1.87, 95% CI: 1.19,2.95). The following factors were significantly associated with increased root caries prevalence, but only for middle-aged adults: male sex (P=.02), self-reported dry mouth (P<.0001), exposed roots (P=.03), and increased frequency of eating or drinking between meals (P=.03). No other covariates were related to root caries experience for older adults.

Conclusions—Within a practice-based research network, the factors associated with root caries experience were different for middle-aged and older adults. Future work should identify relevant root caries correlates for adults ages 65+ years.

Clinical Implications—Interventions aimed at preventing root caries are likely to be different for middle-aged and older adults. Root caries prevention programs should address the appropriate aged-based risk factors.

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Keywords

Root caries; dental caries susceptibility; older adults; aged; risk factors

INTRODUCTION

U.S. adults are retaining their teeth longer.¹ Longitudinal data from multiple countries indicate similar increases in tooth retention.^{2–4} While these trends are promising and may lead to overall improvements in oral health-related quality of life⁵, tooth retention is associated with an increased risk for root caries⁶, which is a debilitating disease.⁷

The overall prevalence of root caries in the U.S. decreased between 1988–1999 and 1999–2004.⁸ However, data from 1999–2004 National Health and Nutrition Examination Survey indicate that root caries is a problem for adults. For instance, 21.6% of adults ages 50–64 years, 31.7% of adults ages 65–74 years, and 42.3% of adults ages 75 years and older had decayed or restored root caries.⁸ Furthermore, between 2000–2010, there were large increases in the numbers of adults (a 31.5% increase in adults ages 45–64 years and a 15.1% increase in adults ages 65 years and older)⁹, making adults ages 45 and older the fastest growing U.S. population subgroup. Collectively, these data suggest that increasing numbers of adult patients will present to dental offices with root caries. These trends have generated interest in understanding the factors related to root caries so that appropriate preventive interventions can be developed.

Root caries is a complex and multifactorial disease. A recent systematic review examined risk models¹⁰ and identified the following factors as important correlates of root caries (organized into four domains): sociodemographic (e.g., age, sex, race/ethnicity), systemic health (e.g., dementia), intraoral (e.g., number of teeth, plaque, bacterial species, tooth decay, periodontal attachment loss, gingival recession, salivary flow), and behavioral (e.g., dental care use, toothbrushing, smoking). Subsequent studies have confirmed findings from the systematic review^{11–13} and identified additional factors related to root caries: poor self-reported oral health¹⁴; not being married¹⁵; limitations in basic daily life activities¹⁶; rural residence¹⁷; and genetic susceptibility¹⁸.

Although age is an unequivocal risk factor for root caries in adults¹², few investigators to date have examined root caries risk factors separately for middle-aged and older adults. Another concern is limited generalizability of existing studies to patients within private dental offices – a population that may differ from participants in clinical trials and small studies and those residing in institutions. To address these limitations, we tested the hypothesis that the correlates of root caries would be different for middle-aged (ages 45–64 years) and older adults (ages 65 and older). This study was conducted within the Northwest Practice-based REsearch Collaborative for Evidence-based DENTistry (Northwest PRECEDENT) research network and is the first-step in identifying the factors related to root caries in a practice-based patient population. We expect to use this knowledge to develop relevant policies and interventions aimed at preventing root caries in adults.

METHODS

Conceptual Model

The study was based on a conceptual model that adapted elements from a systematic review on root caries risk models.¹⁰ We focused on individual-level predictor variables as hypothesized correlates of root caries (see Study Variables section).

Study Design, Location, and Procedures

This was a retrospective cross-sectional analysis of baseline data for adult patients enrolled in a longitudinal caries risk study within the Northwest PRECEDENT research network in Idaho, Montana, Oregon, Utah, and Washington. Northwest PRECEDENT was one of the three dental practice-based research networks funded by the National Institute of Dental and Craniofacial Research. Details about the establishment and characteristics of the Northwest PRECEDENT have been published previously.^{19–20} All Northwest PRECEDENT dentists were eligible to participate. Participating practices were responsible for reviewing information about the study; completing training modules; and recruiting, consenting, enrolling, and collecting data on participants. We provided each office with a Manual of Procedures (MOP) that detailed the study procedures. Prior to the start of the study, all study sites participated in a training session with the Northwest PRECEDENT Regional Coordinator to review the MOP. This study was approved by the University of Washington Institutional Review Board.

Participants

The current study focused on adults ages 45 years and older who were patients in participating Northwest PRECEDENT network dental practices. To be eligible, adults were required to have at least four natural permanent teeth at the time of enrollment. Within each practice, adults were randomly selected from the daily patient roster so that no more than one to two patients per practice were selected on any given day. Patients were recruited from 2008–2011 and those agreeing to participate were consented and enrolled. Our study focused on 775 adults across 56 practices.

Data Sources

There were three data sources. The first was a patient survey used to collect sociodemographic (e.g., age, sex, race, education, income), intraoral (e.g., dry mouth), and behavioral (e.g., smoking, alcohol use, diet) data. The second was a saliva test used to measure stimulated salivary pH after chewing on a piece of paraffin wax. Patients were required to refrain from smoking, eating or drinking, toothbrushing, or using mouthwash for at least one hour prior to the saliva test. The third was a clinical dental examination conducted by the PRECEDENT network dental practice dentist blinded to survey and saliva test data (henceforth referred to as the “dentist”). Before the saliva diagnostic procedures were implemented, pre-study reliability testing was conducted and found to be excellent for stimulated salivary pH (Intra-Class Correlation Coefficient=0.80).²¹ The dentist collected data on visible plaque as well as the total number of Decayed, Missing, and Filled Teeth (DMFT), exposed root surfaces, and root caries lesions. At the end of the

examination, the dentist assessed the participant's caries risk by indicating whether he or she believed the patient would develop any caries (coronal or root) in the next 24 months. All clinical measures were subjective and based on how the dentist would assess these outcomes in the course of normal practice. There was no calibration on clinical measures across dentists because this would have interfered with practice and reduced dentist participation. All dentists used the same data collection forms.

Data Management

All data was captured by the web-based system housed at Axio Research (Seattle, WA). All data were de-identified and encrypted during transmission to Axio. Northwest PRECEDENT Regional Coordinators conducted data audits on all study forms for 15% of participating dentists to ensure accuracy. Data were also monitored by the Executive Committee of the Northwest PRECEDENT.

Study Variables

Outcome Variable—The outcome variable was whether the patient had any decayed or filled root caries (no/yes). Root caries experience was assessed by the dentist and defined as any lesion present on the root surface of the tooth (filled or decayed). Decayed was defined as any cavitation.

Predictor Variables—Each hypothesized predictor variable was organized into three domains. There were five variables in the sociodemographic domain: age^{22–26} (45–64 years and 65 years); sex^{26–30}; race^{14,26,29,31,32} (White; other); education²⁶ (less than high school; high school; greater than high school); and household income³³ (<\$25,000; \$25,000 to \$49,000; \$50,000 to \$99,999; >\$100,000).

There were six variables in the intraoral domain: patient-reported dry mouth³⁴ (no/yes); stimulated salivary pH³⁵ (< 7.0; >7.0); any exposed root surfaces^{24,32,36–39} (no/yes); total number of Decayed, Missing, and Filled Teeth (DMFT)^{29,37,38}; heavy plaque visible^{22,40} (no/yes). We included an exploratory variable in our model (caries risk) that was operationalized as the dentists' assessment of whether the patient would develop any caries (coronal or root) in the next 24 months (no/yes). Caries risk is a global measure of risk that accounts for factors beyond DMFT and visible plaque.

There were three variables in the behavioral domain: smoking^{41,42} (never smoked; ever smoked); alcohol use (none; any); and diet^{43,44} (number of times the patient eats or drinks between meals each day, 0 to 2; 3).

Statistical Analysis

After generating descriptive statistics on the study population, we used Poisson regression models to examine bivariate associations between each predictor variable and root caries experience (no/yes) and adjusted for within-practice correlation using Generalized Estimating Equations ($\alpha=0.05$). Next, we ran multiple variable Poisson regression models for the study population and separately for middle-aged adults (ages 45 to 64 years) and older adults (ages 65 years) to generate covariate adjusted Prevalence Ratios (PRs).

Generalized Estimating Equations with robust standard error estimates were used to take into account for clustering of participants within practices (e.g., some practices may be more likely to have patients with certain characteristics). We used STATA 12.0 (StataCorp LP, College Station, TX) to conduct all analyses.

RESULTS

Descriptive Statistics

About 52.5% of participants were ages 45–64 years and 47.5% were ages 65 years or older (Table 1). The mean age of was 63.2 years (SD=11.1; range: 45–97 years). Nearly 95% of participants were White and 89.2% completed at least high school. Most (56.5%) had a household income greater than \$50,000. Most adults did not report dry mouth (62.2%) and had stimulated salivary pH greater than 7.0 (86.7%). Over 78% had exposed root surfaces and 16.9% had visible heavy plaque. The mean DMFT was 9.2 (SD=4.8). Dentists classified one-in-four adults as being likely to develop any caries (coronal or root) in the next 24 months. Over 57% of participants never smoked, 30.8% did not use alcohol, and 69.8% had fewer than three snacks or beverages between meals each day.

Bivariate Statistics

The unadjusted Poisson regression models indicate that there was a significant relationship between root caries experience and the following covariates: age ($P<.001$); household income ($P=.005$); self-reported dry mouth ($P<.0001$); stimulated salivary pH ($P=.01$); exposed root surfaces ($P=.002$); DMFT ($P=.017$); visible heavy plaque ($P<.001$); and eating or drinking between meals ($P=.009$) (Table 1).

Multiple Variable Regression Models

In the covariate-adjusted Poisson regression model for all study participants (ages 45 years and older), four model covariates were significantly associated with root caries experience (Table 2). Adults assessed as being at risk for caries by a dentist had a root caries prevalence ratio that was 2.24 times as high as adults assessed as not being at risk for caries (95% confidence interval [CI]: 1.55, 3.25; $P<.0001$). In addition, adults with exposed roots, dry mouth, and those who ate or drank between meals more than three times each day had significantly greater root caries PRs (PR=2.69, 95% CI: 1.18, 6.09; PR=1.66, 95% CI: 1.21, 2.29; PR=1.44, 95% CI: 1.14, 1.82; respectively).

In the age-stratified models for adults age 65 years and older, the only factor significantly associated with root caries experience was caries risk (PR=1.87, 95% CI: 1.19, 2.95; $P=.01$). For adults ages 45–64 years, in addition to caries risk, there were four factors related to root caries: male sex ($P<.02$); exposed roots ($P=.03$); dry mouth ($P<.001$); and eating or drinking between meals ($P=.03$).

DISCUSSION

This is the first study conducted within a practice-based research network that examined the factors related to root caries experience in adults. We tested the hypothesis that the

correlates of root caries would be different for middle-aged and older adults. Our study supports this hypothesis. We have two main sets of findings.

The first finding is that there was only one factor associated with root caries experience in both middle-aged and older adults: dentist-assessed caries risk. Middle-aged adults classified as being at risk for developing any caries (coronal or root) in the next 24 months had a root caries prevalence that was 2.70 times as high as middle-aged adults not at risk for developing caries ($P<.001$). The prevalence ratio for older adults was 1.87 ($P=.01$). The other two factors in our models that are traditional markers for high caries risk (DMFT and plaque) failed to reach statistical significance, which suggests that a global assessment of caries risk may be an important factor in predicting whether a patient develops root caries. There are no studies available for direct comparisons. While there is the potential for reverse causality (the presence of root caries is causally linked to an assessment of higher caries risk), these findings suggest that Northwest PRECEDENT dentists are making appropriate clinical decisions regarding caries risk. These decisions are likely to be based on factors from formal caries risk assessment tools (e.g., Caries Management by Risk Assessment [CAMBRA], the American Academy of Pediatric Dentistry Caries risk Assessment Tool [CAT]). What is not known are the specific elements from formal risk factor tools that Northwest PRECEDENT dentists use to assess caries risk. Widespread dissemination of formal caries risk assessment tools is unlikely⁴⁵ but necessary to enable detailed tracking of specific changes in caries risk factors over time. There is a need for additional research on factors dentists use to derive general caries risk as well as a need to identify the barriers to dentists' adoption of standardized caries risk assessment systems. Longitudinal studies involving dentists who are calibrated on the use of caries risk assessment tools are also needed to standardize the caries risk assessment process and evaluate whether such tools can be used to reliably manage and prevent dental disease.

The second finding is that there were four factors related to root caries experience (sex, dry mouth, exposed roots, and frequency of eating and drinking) that were significant for middle-aged adults ages 45–64 years but not for older adults ages ≥ 65. Middle-aged male adults had a greater prevalence of root caries than middle-aged female adults, which is consistent with the results of two previous studies^{29,30} but inconsistent with two other studies^{26,28}. The most recent U.S. data from 1999–2004 indicate that slightly larger proportions of men ages 20–64 years had decay or restored root caries than women (15.8% and 12.7%, respectively).⁸ One possible reason is that men may be less likely to participate in preventive oral health behaviors such as toothbrushing and dental visits.^{46–48} Interventions aimed at middle-aged adults need to reinforce preventive oral health behaviors, with an emphasis on additional strategies targeted at middle-aged adult men. While the U.S. data indicate even more pronounced sex-based differences in root caries among older adults ages ≥ 65 (40.9% for males and 33.0% for females)⁸, sex was not a significant risk factor in our study for older adults. In addition, race, education level, and income were not related root caries prevalence in any of our models. While these latter indicators of socioeconomic status measures do not capture an individual's access to financial resources, our findings are consistent with a recent study that found no relationship between financial hardship and self-reported oral health of adults ages 50 years and older.⁴⁹ This other study did provide evidence of sex-based differences in the relationship between

financial hardship and oral health factors, which is a promising avenue for future research on adult root caries. Future studies should continue to examine the roles of sex and socioeconomic factors in root caries prevalence.

Self-reported dry mouth, exposed roots, and increased frequency of eating and drinking were all significantly associated with root caries experience in middle-aged adults but not older adults. The reasons for these age-related differences are not clear and need to be elucidated through additional studies. One potential explanation for the dry mouth finding is that xerostomic patients are likely to be on medications, including those used to treat cardiac dysrhythmia. Previous studies have found associations between cardiac dysrhythmia and root caries.^{50,51} A larger proportion of adults in the middle-aged group may have been on such medications compared to the adults in the older age group where use of dysrhythmia medication may not be as prevalent because some have died while younger. Another possible explanation is residual confounding factors (e.g., mutans streptococci level, hyposalivation dental insurance, employment, stress, food insecurity, financial hardship, social capital, knowledge on how to manage medication side effects) that make middle-aged and older adults in our population different. To address problems with confounding, future studies should identify the medical, social, and behavioral factors related to root caries in adults and examine whether these factors operate differently for middle-aged and older adults.

Broadly, our general model that included adults ages 45 years suggests that intraoral and behavioral factors are more important determinants of root caries experience than sociodemographic factors. In terms of addressing the intraoral factors related to root caries, our findings reinforce the critical role that dentists have in managing and preventing dental disease. Results from a single clinical trial indicate that chlorhexidine-thymol varnish (Cervitec) prevents root caries in institutionalized elders⁵² and could be delivered in dental offices. However, another study found that a 0.12% chlorhexidine mouth rinse used did not significantly reduce development of root caries in older ages ages 60 to 75 years.⁵³ Other chemotherapeutic approaches include diammine silver fluoride, chlorhexidine varnish, sodium fluoride varnish, and dentin bonding agents.^{54–56} In terms of addressing the behavioral factors related to root caries, patients should be encouraged to engage in regular toothbrushing with fluoride dentifrice and to reduce the frequency of carbohydrate intake, particularly in between meals. High fluoride toothpastes (e.g., 5,000 ppm fluoride) and fluoride varnish have been shown to reduce root caries.^{57–59} There are mixed results in regards to the preventive benefit of fluoride rinses among older adults.^{60,61} Numerous studies indicate that older adults benefit from water fluoridation^{22,62,63}, which reinforces the importance of dental health professionals being prepared to speak to patients about the oral health benefits associated with community water fluoridation⁶⁴.

There are a number of study strengths including being the first dental practice-based study focusing on the correlates of root caries experience in adults; recruitment of patients from Northwest PRECEDENT practices throughout a large geographic area; and statistical models that account for differences in root caries prevalence for middle-aged and older adults. However, there are three main limitations. First, we did not adopt a standard measure of root caries (e.g., Root Caries Index).⁶⁵ There was no differentiation between filled and

decayed root caries nor was there standardized procedures for distinguishing root caries from abrasion, which could have led to over identification of root caries.⁶⁶ Second, there were no microbiological measures of mutans streptococci or lactobacilli in our models⁶⁷ and we were not able to include other potentially important social and behavioral measures such as fluoride exposure, insurance status, employment, financial resources, and social capital. This increases the likelihood that our models are incomplete and may be susceptible to residual confounding. Third, there are limitations with external generalizability. Our study focused on dental care utilizers in private practice settings. Most study participants were White and from higher income households. Thus, our findings cannot be generalized to vulnerable adults or those living in institutions. However, root caries prevalence rates for both ages groups in our study were similar to rates from the most recent U.S. National Health and Nutrition Examination Survey from 1999–2004.⁸ Limitations aside, our study is a useful first step in understanding the factors related to root caries in U.S. adults who utilize dental care in private practice settings and how these factors might differ for middle-aged and older adults.

CONCLUSION

Caries risk was the main factor related to root caries prevalence in a population of middle-aged and older adults recruited from the dental practices in the Northwest PRECEDENT network. The correlates of root caries experience were different for middle-aged adults and older adults. Future studies should continue to develop comprehensive adult root caries risk models that account for relevant sociodemographic, intraoral, behavioral, and social factors. This knowledge can then be used to develop chair side interventions and strategies to help dental professionals manage and prevent root caries in patients.

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TABLE 1

Descriptive Statistics for Adult Study Participants (N=775) Stratified by Age Group

Variable	Ages 45 to 64 years n=407		P-value [†]	Ages 65 and older n=368		P-value [†]	All Participants N=775		P-value [†]
	Root Caries No (n= 348) n (%)	Root Caries Yes (n=59) n (%)		Root Caries No (n= 275) n (%)	Root Caries Yes (n=93) n (%)		Root Caries No (n= 623) n (%)	Root Caries Yes (n=152) n (%)	
Sex			0.03			0.39			0.55
Female	135 (38.8%)	32 (54.2%)		127 (46.2%)	37 (39.8%)		262 (42.0%)	69 (45.4%)	
Male	213 (61.2%)	27 (45.8%)		148 (53.8%)	56 (60.2%)		361 (58.0%)	83 (54.6%)	
Race			0.31			0.80			0.59
White	328 (94.2%)	54 (91.5%)		265 (96.4%)	89 (95.7%)		593 (95.2%)	143 (94.1%)	
Other	20 (5.8%)	5 (8.5%)		10 (3.6%)	4 (4.3%)		30 (4.8%)	9 (5.9%)	
Education			0.63			0.77			0.47
< High school	15 (4.3%)	4 (6.8%)		23 (8.4%)	9 (9.7%)		38 (6.1%)	13 (8.5%)	
High school	117 (33.6%)	17 (28.8%)		93 (33.8%)	34 (36.5%)		210 (33.7%)	51 (33.6%)	
> High school	216 (62.1%)	38 (64.4%)		156 (56.7%)	49 (52.7%)		372 (59.7%)	87 (57.2%)	
Missing	0	0		3 (1.1%)	1 (1.1%)		3 (0.5%)	1 (0.7%)	
Household Income			0.13			0.18			0.01
<\$25,000	15 (4.3%)	3 (5.1%)		26 (9.4%)	15 (16.1%)		41 (6.6%)	18 (11.8%)	
\$25,000-\$49,999	56 (16.1%)	11 (18.6%)		78 (28.4%)	25 (26.9%)		134 (21.5%)	36 (23.7%)	
\$50,000-\$99,999	158 (45.4%)	34 (57.6%)		103 (37.4%)	23 (24.7%)		261 (41.9%)	57 (37.5%)	
\$100,000+	91 (26.2%)	7 (11.9%)		15 (5.5%)	6 (6.5%)		106 (17.0%)	13 (8.6%)	
Missing	28 (8.0%)	4 (6.8%)		53 (19.3%)	24 (25.8%)		81 (13.0%)	28 (18.4%)	
Intraoral Factors									
Dry Mouth			<0.001			0.02			<0.001
Yes	112 (32.2%)	34 (57.6%)		102 (37.1%)	44 (47.3%)		214 (34.4%)	78 (51.3%)	
No	236 (67.8%)	25 (42.4%)		173 (62.9%)	48 (51.6%)		409 (65.6%)	73 (48.0%)	
Missing	0	0		0	1 (1.1%)		0	1 (0.7%)	
Stimulated salivary pH			0.25			0.01			0.01
7.0	46 (13.2%)	11 (18.6%)		27 (9.8%)	17 (18.3%)		73 (11.7%)	28 (18.4%)	

Variable	Ages 45 to 64 years n=407		P-value [†]	Ages 65 and older n=368		P-value [†]	All Participants N=775		P-value [†]
	Root Caries No (n= 348) n (%)	Root Caries Yes (n=59) n (%)		Root Caries No (n= 275) n (%)	Root Caries Yes (n=93) n (%)		Root Caries No (n=623) n (%)	Root Caries Yes (n=152) n (%)	
Sociodemographic Factors									
>7.0	302 (86.8%)	48 (81.4%)		247 (89.8%)	74 (80.6%)		549 (88.1%)	123 (80.9%)	
Missing	0	0		1 (0.4%)	1 (1.1%)		1 (0.2%)	1 (0.7%)	
Any Exposed Roots			0.01						0.002
Yes	250 (71.8%)	53 (89.8%)		220 (80.0%)	83 (89.3%)		470 (75.4%)	136 (89.4%)	
No	98 (28.2%)	6 (10.2%)		55 (20.0%)	9 (9.7%)		153 (24.6%)	15 (9.9%)	
Missing	0	0		0	0		0	1 (0.7%)	
DMFT	8.9 (4.2)	10.7 (4.1)	0.001	9.0 (5.0)	10.0 (5.9)		8.9 (4.6)	10.3 (5.3)	0.02
Visible heavy plaque			0.23						0.001
Yes	44 (12.6%)	11 (18.6%)		47 (17.1%)	29 (31.2%)		91 (14.6%)	40 (26.3%)	
No	303 (87.1%)	48 (81.4%)		227 (82.5%)	64 (68.8%)		530 (85.1%)	112 (73.7%)	
Missing	1 (0.3%)	0		1 (0.4%)	0		2 (0.3%)	0	
Will patient develop caries in next 24 months			<0.001						<0.001
Yes	60 (17.2%)	29 (49.1%)		61 (22.2%)	45 (48.4%)		121 (19.4%)	74 (48.7%)	
No	280 (80.5%)	27 (45.8%)		204 (74.2%)	41 (44.1%)		484 (77.7%)	68 (44.7%)	
Missing	8 (2.3%)	3 (5.1%)		10 (3.6%)	7 (7.5%)		18 (2.9%)	10 (6.6%)	
Behavioral Factors									
Smoking			0.02						0.17
Never smoked	223 (64.1%)	28 (47.5%)		142 (51.6%)	51 (54.8%)		365 (58.6%)	79 (52.0%)	
Ever smoked	122 (35.0%)	31 (52.5%)		131 (47.7%)	42 (45.2%)		253 (40.6%)	73 (48.0%)	
Missing	3 (0.9%)	0		2 (0.7%)	0		5 (0.8%)	0	
Alcohol Use			0.52						0.08
None	94 (27.0%)	14 (23.7%)		88 (32.0%)	43 (46.2%)		182 (29.2%)	57 (37.5%)	
Any	254 (73.0%)	45 (76.3%)		187 (68.0%)	50 (53.8%)		441 (70.8%)	95 (62.5%)	
Number Times Eat/Drink Between Meals per Day			0.02						0.01
0-2	239 (68.7%)	33 (55.9%)		208 (75.6%)	61 (65.6%)		447 (71.7%)	94 (61.8%)	
3+	109 (31.3%)	26 (44.1%)		67 (24.4%)	32 (34.4%)		176 (39.3%)	58 (38.2%)	

γ P-values from Poisson Regression adjusted for clustering within site correlation using Generalized Estimating Equations (unadjusted for model covariates).

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TABLE 2

Multiple Variable Poisson Regression Models for Age Strata and All Participants with Corresponding Covariate-Adjusted Prevalence Ratios (N=631)

	Ages 45 to 64 years n=360	95% CI	P-value	Age 65 and older n=271	95% CI	P-value	All Participants N=631	95% CI	P-value
Sociodemographic Factors									
Sex			0.02			0.97			0.24
Female	0.53	0.32, 0.88		0.99	0.53, 1.82		0.77	0.51, 1.18	
Male	ref	-		ref	-		ref	-	
Race			0.60			0.48			0.73
White	0.82	0.40, 1.69		1.97	0.31, 12.67		1.13	0.55, 2.36	
Other	ref	-		ref	-		ref	-	
Education			0.53			0.94			0.84
< High school	ref	-		ref	-		ref	-	
High school	1.19	0.52, 2.73		0.88	0.42, 1.82		0.86	0.53, 1.40	
> High school	1.46	0.70, 3.05		0.87	0.40, 1.92		0.91	0.58, 1.44	
Household Income			0.18			0.87			0.34
<\$25,000	ref	-		ref	-		ref	-	
\$25,000-\$49,999	1.52	0.63, 3.67		0.99	0.51, 1.95		0.99	0.59, 1.67	
\$50,000-\$99,999	1.72	0.76, 3.92		0.91	0.39, 2.13		0.95	0.56, 1.60	
\$100,000+	0.76	0.30, 1.87		1.25	0.53, 2.97		0.59	0.31, 1.15	
Intraoral Factors									
Dry Mouth			<0.001			0.18			0.002
Yes	2.30	1.46, 3.64		1.33	0.88, 2.00		1.66	1.21, 2.29	
No	ref	-		ref	-		ref	-	
Stimulated salivary pH			0.55			0.07			0.09
7.0	ref	-		ref	-		ref	-	
>7.0	0.84	0.47, 1.50		0.65	0.41, 1.04		0.72	0.49, 1.06	
Any Exposed Roots			0.03			0.18			0.02
Yes	3.27	1.11, 9.63		1.88	0.75, 4.70		2.69	1.18, 6.09	

	Ages 45 to 64 years n=360		Age 65 and older n=271		All Participants N=631		P-value	95% CI	P-value
	Prevalence Ratio ^I	95% CI	Prevalence Ratio ^I	95% CI	Prevalence Ratio ^I	95% CI			
No	ref	-	ref	-	ref	-			
DMFT	1.03	0.96, 1.09	1.02	0.98, 1.06	1.02	0.99, 1.05	0.34	0.99, 1.05	0.25
Visible heavy plaque									
Yes	0.81	0.41, 1.59	1.20	0.73, 1.99	1.02	0.66, 1.57	0.47	0.66, 1.57	0.91
No	ref	-	ref	-	ref	-		-	
Will patient develop caries in next 24 months							0.01		< 0.001
Yes	2.70	1.63, 4.46	1.87	1.19, 2.95	2.24	1.55, 3.25		1.55, 3.25	
No	ref	-	ref	-	ref	-		-	
Behavioral Factors									
Smoking							0.96		0.99
Never smoked	ref	-	ref	-	ref	-		-	
Ever smoked	1.13	0.69, 1.84	0.99	0.63, 1.54	1.00	0.70, 1.43		0.70, 1.43	
Alcohol Use							0.14		0.79
None	ref	-	ref	-	ref	-		-	
Any	1.46	0.75, 2.82	0.72	0.47, 1.12	0.95	0.63, 1.45		0.63, 1.45	0.002
Number Times Eat/Drink Between Meals per Day							0.15		
0-2	ref	-	ref	-	ref	-		-	
3+	1.57	1.05, 2.35	1.39	0.89, 2.16	1.44	1.14, 1.82		1.14, 1.82	

^I Adjusted for model covariates and clustering within dental practices using Generalized Estimating Equations.