Preventive dental care utilization and dental caries experience for Medicaid-enrolled adolescents in Oregon

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Abstract

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Background: Low-income adolescents experience inequities related to oral health and access to dental care. However, there are few studies on the influence of preventive dental care utilization on dental disease outcomes in low-income adolescents, and it is unclear whether having a chronic condition (CC) could moderate the effects of preventive care.

Objective: This study aimed to evaluate the relationship between preventive dental care utilization and dental caries experience for Medicaid-enrolled adolescents and to determine if the relationship is moderated by CC status.

Methods: This was a secondary, cross-sectional analysis of Medicaid claims and survey data for 335 Oregon adolescents (ages 12 to 18 years) who received a dental screening between December 2015 and December 2016. We focused on a subset of adolescents who were enrolled in Oregon Medicaid for at least 11 months in 2015 and/or 2016 (*n*=240). The outcome was

dental caries experience, defined as total decayed, missing, or filled tooth (DMF surfaces). The independent variable was preventive dental care utilization 12 months before the screening exam, which was identified using CDT codes. Chronic conditions were defined using inpatient and outpatient medical claims. Log-linear regression models were used to estimate unadjusted and adjusted prevalence rate ratios (PRR) and 95% confidence intervals (CIs). The same method was used to test for an interaction between preventive dental care utilization and CC status.

Results: The mean age of study participants was 15.3 (SD 1.20) years, 49.2% were male, 49.6% were Hispanic, and 6.7% had chronic conditions. Of the adolescents evaluated, 33.8% utilized preventive dental care and 66.7% had dental caries experience (DMF≥1). There were no significant differences in dental caries experience between adolescents who did and did not utilize preventive dental care (PRR: 0.96, 95% CI: 0.60,1.52; *P*=.85). No significant interaction was found between preventive dental care utilization and chronic condition status (*P*=.27).

Conclusions: Our data failed to show an association between preventive care and caries experience for Medicaid-enrolled adolescents nor did we find evidence for CC status as a modifier. These findings suggest that preventive dental care is an unlikely explanation for poor oral health outcomes in publicly insured adolescents. Continued clinical and policy efforts are needed to improve the oral health of adolescents in Medicaid.

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Chapter 1: Introduction

1.1 Background

1.1.1 *Dental Caries*

Dental caries, also known as tooth decay, is the most prevalent disease in children and adolescents in the United States (US).[1] Although data suggest a decline of dental caries prevalence in the US due to public health prevention efforts such as water fluoridation and increased awareness of oral health, dental caries continues to be highly prevalent among low-income adolescents.[2-5] Dental caries can lead to pain, poor academic performance, missed school days, low quality of life, as well as high healthcare expenditures to families.[6,7] According to the 2015-2016 National Health and Nutrition Examination Survey, 53.8% of adolescents ages 12 to 19 years experienced dental caries in their permanent teeth.[4,8] Low-income adolescents have 1.2 times the prevalence of dental caries than their affluent peers, and many studies point to a positive association between low socioeconomic status (e.g. family income, poverty level) and high dental caries prevalence; these trends are consistent within various marginalized racial and ethnic groups.[4,5,8-12]

1.1.2 *Adolescence and Oral Health*

Adolescence, defined as the period between the ages of 10 to 19 years, is a unique developmental period characterized by physical, social, behavioral, and psychological changes that facilitate a child's transition to adulthood. These changes can negatively impact healthy behavior trajectories, including those related to oral health.[13-15] The eruption of remaining permanent teeth, and behavioral shifts such as the transition from caregiver-supervised to self-performed

oral health hygiene (e.g., infrequent and rushed tooth brushing), poorer diets (e.g., not eating breakfast, consuming sugary drinks), and decline in dental care utilization in this age group (e.g., preventive care) increase dental caries risk for adolescents.[15-19]

1.1.3 *Preventive Dental Care Utilization and Dental Caries*

Dental caries is largely preventable by regular preventive dental care like dental cleanings, topical fluoride application, oral hygiene instructions, pit-and-fissure sealants, and dietary counseling. [2,5,17] Based on evidence from a meta-analysis study, adolescents and children who benefited from fluoride varnish were associated with a 43% reduction of decayed, missing, and filled (DMF) tooth surfaces.[20] Furthermore, sealing the permanent molars of children and adolescents has been shown to reduce dental caries incidence up to 48 months, when comparing to those who did not receive such treatments.[21] Even though regular preventive dental care visits have been recommended for years by the American Dental Association and the American Academy of Pediatric Dentistry disparities remain in access to these services.[17,22] Despite low-income children and adolescents' high rates of dental insurance coverage, being insured does not mean that necessary care is received.[10] Based on 2019 state Medicaid data, the percentage of eligible children ages 1 to 20 who utilized preventive dental services ranged from 32.5% in North Carolina to 67.3% in Texas.[23] Challenges in utilizing preventive dental care among Medicaid-enrolled children have been attributed to the following barriers: (1) personal (e.g. caregivers' perception and literacy of oral health), (2) structural (e.g. transportation, provider availability, low Medicaid insurance acceptability), (3) behavioral (fear and anxiety-related disorders association with dental procedures), and (4) financial (e.g. out-of-pocket costs).[2,5,11,18,19, 24-26]

1.1.4 *Adolescents with Chronic Conditions*

A subgroup of adolescents with special healthcare needs (SHCN), those with chronic conditions (CC), also experience high-risk factors for dental caries: poor diet (e.g. intake of sugar-filled medications), poor hygiene, and behavioral factors (e.g. fear of dental treatment that can lead to dental care avoidance).[27-29] Adolescents with CC battle conditions such as cystic fibrosis, cancer, or neurodegenerative diseases that often require long-term medical care.[29,30] There is the possibility of CC status interfering with preventive dental care utilization, however, there is a lack of literature on this topic. Chi et al. found heterogeneity in dental care utilization among CC subgroups, depending on severity and type of condition.[31] In reviewing academic publications, Carvalho and colleagues concluded that Medicaid-enrolled children with CC may be less likely to utilize preventive dental care due to facing additional barriers.[32]

1.2 Objective and Hypotheses

The goal of this study is to address the knowledge gap on the relationship between preventive dental care utilization and dental caries outcome in Medicaid-enrolled adolescents and to understand whether this relationship is modified with the presence of CC status. We tested the following hypotheses:

1) Preventive dental care utilization is associated with a lower prevalence of dental caries experience for Medicaid-enrolled adolescents.
2) The presence of CC modifies the impact of preventive dental care utilization on dental caries experience.

This study is a continuation of efforts aimed at identifying reasons why some sub-groups of Medicaid enrollees have a higher prevalence of dental caries experience, and whether having a chronic condition can potentially reduce the effectiveness of preventive dental care in reducing caries in publicly insured adolescents. This study's findings may be used to develop clinical interventions and oral health access policies that seek to enhance dental care outcomes for Medicaid-enrolled and CC adolescents.

Chapter 2: Methods

2.1 Study Design

2.1.1 Study Setting

The Oregon Medicaid program, known as the Oregon Health Plan, is administered by the Oregon Health Authority and provides medical, mental health, and comprehensive dental insurance coverage for eligible children under the age of 18 years. Health care services are provided by accountable care organizations (ACO), which enhance efficiency and delivery of care and reduce costs through global budgeting and integrated care delivery.[33] In 2014, Oregon's Medicaid expansion grew the program by 59%, covering nearly 400,000 additional people in a state of almost 4 million.[34] In 2015, children of families with incomes through 305% of the Federal Poverty Level (FPL) were eligible for coverage.[35]

2.1.2 Study Population

Of the 335 adolescents in the primary study, those who could not be located in the eligibility files were excluded (n=23) (Figure 1). From the remaining 312 adolescents with enrollment data, 72 were enrolled in Medicaid for less than 11 months before the screening date. Consistent with previous literature, these adolescents were omitted.[36] The resulting 240 adolescents ages 12 to 18 years included in this study were continuously enrolled in the Medicaid program for 11 or 12 months prior to the dental screenings that took place between December 2015 and December 2016.

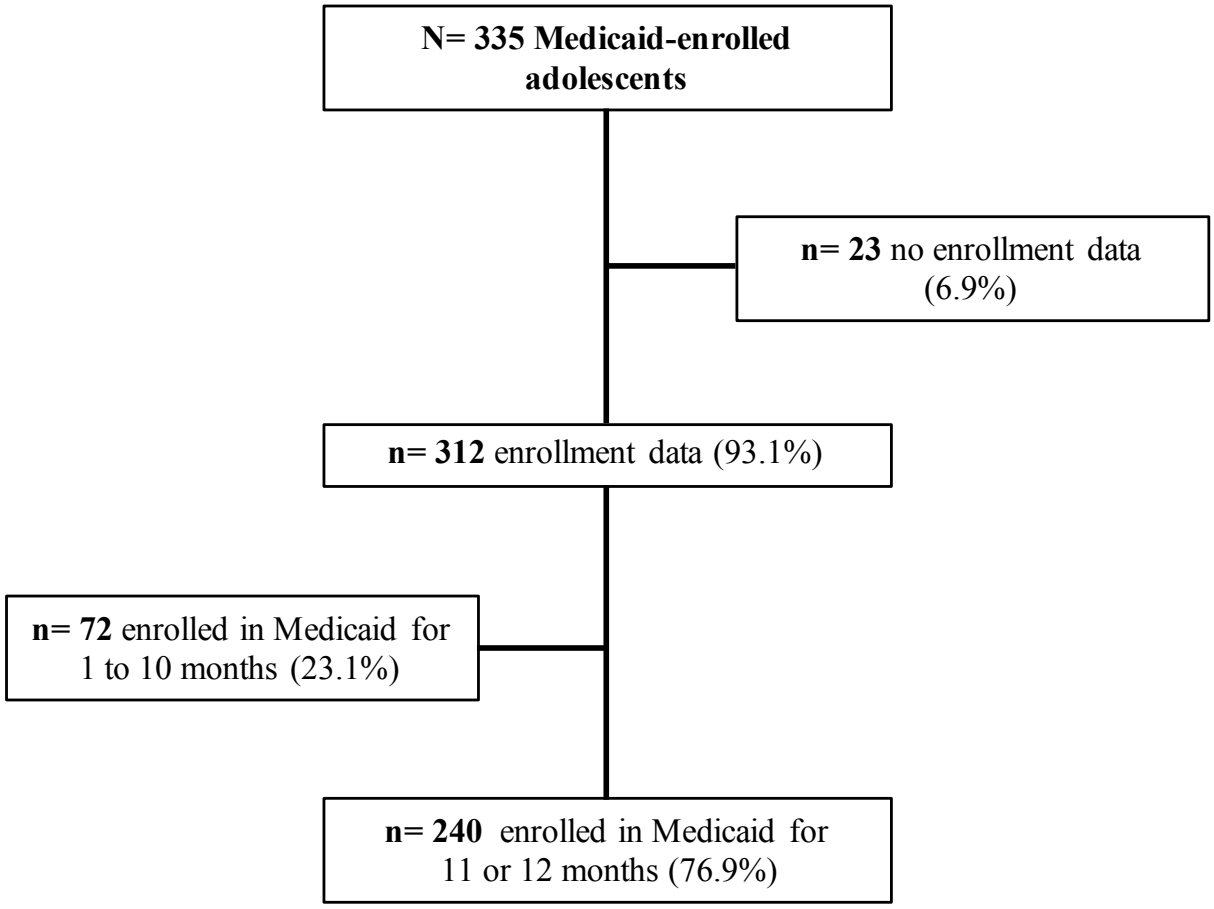

Figure 1. *Study flow-chart describing enrollment for Medicaid-enrolled adolescents in Oregon (determining the study population)*

2.2 Data

2.2.1 Oregon State Medicaid Data

This study is a secondary, cross-sectional analysis of 2015 and 2016 Medicaid enrollee and dental claims files obtained from the Oregon Health Authority. Paper survey and dental disease

screenings were collected from 335 adolescents as part of the primary study.[37] For this study, these data were linked to Medicaid eligibility and claims files. The Medicaid enrollee files were de-identified and included each adolescent's unique identification number, date of birth, sex, ethnicity, race, and the number of days enrolled in Medicaid for each quarter of the year. Each participant's dental claims had an associated date of service and the Current Dental Terminology (CDT) code that described the dental procedure performed. The Medicaid files also included inpatient and outpatient claims, which were used to derive the CC status variable (see the section below).

2.3 Study Variables

2.3.1 Independent Variable

The main independent variable was whether an adolescent utilized preventive dental care. The date of the dental screening was used as the baseline for the one-year look-back period for preventive dental care utilization (e.g. if the screening exam took place in December 2016, adolescent's dental claims were analyzed for the presence of preventive dental care utilization from December 2015 to December 2016). The one-year look-back period was chosen to correspond to the enrollment period; this is consistent with Healthcare Effectiveness Data and Information Set (HEDIS) dental care utilization measure, which is based on annual dental visits. Preventive care was identified using the following CDT codes: D0120 (periodic oral evaluation), D0150 (comprehensive oral evaluation), D1110 (adult prophylaxis), D1120 (child prophylaxis), D1206 (topical fluoride varnish), D1208 (topical application of fluoride), and D1351 (sealant).[38]

Additionally the utilization of any dental care (e.g. presence of any dental claim) was created to differentiate adolescents who did and did not utilize any dental care during the timeline of interest.

2.3.2 Outcome Variable

The main outcome variable was dental caries experience, defined as the total number of decayed, missing, or filled (DMF) tooth surfaces. A secondary outcome was also analyzed, defined as the total of decayed, missing, filled, or white spot lesion (DMFW) tooth surfaces. The clinical data from the dental screenings were our source of dental caries experience measure. For each measure, the primary and permanent tooth surfaces were classified based on National Institute for Dental and Craniofacial Research (NIDCR) Early Childhood Caries Collaborative Centers (EC4) Criteria.[39]

2.3.3 Potential Modifier

The potential effect modifier of interest was CC status. The widely used complex chronic conditions (CCC) system aims to "identify infants, children, and adolescents with complex chronic conditions, with emphasis on examining patterns of mortality and end-of-life healthcare utilization associated with CC. [40] The CCC version 2 system incorporates both ICD-9 and ICD-10 codes and consists of 10 categories. We classified our participants as CC if they had any of the following condition categories: cardiovascular, respiratory, neuromuscular, renal, gastrointestinal, hematologic or immunologic, metabolic, other congenital and genetic diseases, and neonatal and premature conditions. In assigning CC categories to our study population, we

used the *R* package (called pccc) for pediatric CCC classification developed by Feinstein and colleagues.[41]

2.3.4 Other Variables

Three additional variables, conceptualized as potential confounders, were created from the enrollee and claims files: age (continuous), sex, and ethnicity. Adolescent's age was calculated based on their birth date and screening exam date and analyzed both as a continuous variable and as a categorical group variable (12 years, 13-17 years, and 18 years). Sex was categorized as male and female. Ethnicity was categorized as non-Hispanic and Hispanic. To mitigate sparse data across the ethnicity groups from the claims files, caregivers' survey language preference (from the primary study) was used as an indicator of ethnicity for adolescents that had missing ethnicity data on claims. Those that completed the Spanish version of the survey were categorized as Hispanic; as a result, 16 participants' missing data were filled. Consequently, the combined ethnicity variable was used in the analyses. Participants' race was also identified as a potential confounder. The race variable was categorized as white and non-white: categories of white and Caucasian race were collapsed to form "white", and categories of Black, African American, American Indian, Alaskan Native, Asian, Hispanic, Pacific Islander, and Multi-race were combined into "non-white".

2.4 Statistical Analyses

To describe the study population, univariate descriptive statistics (means, standard deviations [SD], counts, and percentages) were generated and stratified for any dental care use for all variables of interest, including age, sex, ethnicity, race, CC status), preventive dental care utilization, and dental caries experience (DMF and DMFW). To compare demographic characteristics of adolescents that utilized any dental care (i.e. had dental claims) and adolescents that did not utilize any dental care (i.e. had no dental claims), bivariate descriptive statistics were used. The two-sample *t*-test was used to test for differences in the mean age, and Fisher's exact test was used to test for differences in the categorical variables (age group, sex, ethnicity, race, and CC status) between participants who did and did not utilize any dental care. Due to the skewed distribution of dental caries, dental caries experience was described by the median and interquartile range (IQR), and the Mann-Whitney test was used to compare dental caries experience by preventive dental care and any dental care utilization.

Generalized estimating equations (GEE) log-linear regression models with robust standard errors were used to estimate unadjusted and adjusted prevalence rate ratio (PRR) and 95% confidence intervals (CIs) of dental caries experience (DMF and DMFW) for adolescents who did and did not utilize dental care (preventive dental care and any dental care).[42] Age (continuous), sex, and ethnicity were included in the regression model. Race was excluded due to missing race identifiers on adolescents' claims data (50.0%). The natural logarithm of the total number of tooth surfaces was entered as an offset in the regression model. To test CC as a potential modifier, a log-linear model that included main effects for dental care utilization and CC, and an

interaction term between dental care utilization and CC was used. All statistical analyses were accomplished using *R Version 3.3.3* and *RStudio Version 1.1.463*. The significance level was α=0.05.

Chapter 3: Results

3.1 Demographic Characteristics

A summary of adolescent demographic characteristics is presented in Table 1. The average age was 15.3 years (SD 1.2 years old). About one-half (49.2%) of study adolescents were male, 49.6% were Hispanic, and 30.4% were white. About 7% of adolescents had CC. Adolescents who utilized dental care did not differ significantly in age compared to adolescents who did not utilize dental care (15.3 SD [1.2 years] vs. 15.2 [SD 1.2 years]; $P = .55$). There were also no significant differences in the proportion of sex ($P = .08$), ethnicity ($P = 0.56$), race ($P = .46$), and CC status ($P = 1.0$) between adolescents that did and did not utilize any dental care.

Table 1. Demographic characteristics of adolescents ages 12 to 18 years old enrolled in Oregon Medicaid for 11 or 12 months in 2015-2016 (*n*=240).

	Total (N = 240)	**Utilized any dental care (N = 96)**	**Did not utilize any dental care (N = 144)**	***P*-value**
	N (%)	**N (%)**	**N (%)**	
Age in years (Mean ± *SD*)	15.3 ± 1.2	15.3 ± 1.2	15.2 ± 1.2	.55[a]
Age group (years)				.10[b]
12	7 (2.9%)	3 (3.1%)	4 (2.8%)	
13-17	226 (94.2%)	92 (95.8%)	134 (93.1%)	
18	1 (0.4%)	1 (1.1%)	0 (0.0%)	
Missing	6	0	6	
Sex				.08[b]
Female	116 (48.3%)	51 (53.1%)	65 (45.1%)	
Male	118 (49.2%)	45 (46.9%)	73 (50.7%)	
Missing	6	0	6	
[1]Ethnicity				.20[b]
Hispanic	119 (49.6%)	46 (47.9%)	73 (50.7%)	
Non-Hispanic	74 (30.8%)	26 (27.1%)	48 (33.3%)	
Missing	47 (19.6%)	24 (25.0%)	23 (16.0%)	
[2]Race				.46[b]
Non-white	47 (19.6%)	21 (21.9%)	26 (18.1%)	
White	73 (30.4%)	25 (26.0%)	48 (33.3%)	
Missing	120 (50.0%)	50 (52.1%)	70 (48.6%)	
Chronic Condition Status				1.00[b]
Yes	16 (6.7%)	6 (6.3%)	10 (6.9%)	
No	224 (93.3%)	90 (93.7%)	134 (93.1%)	
Preventive Dental Care Utilization				-
Yes	81 (33.8%)	81 (84.4%)	0 (0.0%)	
No	159 (66.2%)	15 (15.6%)	144 (100.0%)	

[a]Calculated using two-samples t-test.
[b]Calculated using Fisher's exact test.
[1]Combined Medicaid claims and demographic survey ethnicity data. Spanish language preference in the demographic survey was used as an indicator of Hispanic ethnicity for adolescents with missing claims' ethnicity data.
[2]White and Caucasian classified as "white"; Categories of Black, African American, American Indian, Alaskan Native, Asian, Hispanic, Pacific Islander, and Multi-Race were combined into "non-white". Variable not included in analyses.

***p*-Value <0.05.**

3.2 Dental Caries and Preventive Dental Care Utilization

Of the 96 adolescents who utilized dental care, the majority obtained preventive care (84.4%) (Table 1). Of the 240 adolescents, most participants (66.7%) had at least one DMF surface and (82.5%) DMFW surface (Table 2). Among adolescents that utilized preventive care (*n*=81), 85.2% had at least one DMF surface and all had at least one DMFW surface. Among adolescents that did not utilize preventive care (*n*=159), 57.2% had at least one DMF surface and 73.6% had at least one DMFW surface. The number of DMF surfaces did not significantly differ (*P*=.61) between adolescents who utilized preventive dental care (median 2.5; IQR 0-6) and those who did not (median 3.0; IQR 0-8). The number of DMFW tooth surfaces did not significantly differ by preventive dental care utilization (*P*=.45). There were also no significant differences (*P*=.82) in total surfaces between adolescents who did (median 128.0; IQR 126-128) and did not utilize preventive dental care (median 128.0; IQR 126-128).

Table 2. Comparison of total DMF and DMFW values of Medicaid-enrolled study adolescents who did and did not utilize preventive and/or any dental care in 2015-2016 (*n*=240).

	Total N (%) or Median (IQR)	**Utilized preventive dental care** N (%) or Median (IQR)		[a]***P-value***	**Utilized any dental care** N (%) or Median (IQR)		[a]***P-value***
	N=240	**Yes** N=81	**No** N=159		**Yes** N=96	**No** N=144	
DMF	3.0 [0-8]	2.5 [0-6]	3.0 [0-8]	.61	3.0 [0-8]	3.0 [0-8]	.69
≥ 1 DMF	160 (66.7%)	69 (85.2%)	91 (57.2%)	-	65 (67.7%)	95 (66.0%)	-
DMFW	6.0 [1-14]	5.00 [1-13]	7.00 [2-14]	.45	5.0 [1-15]	6.0 [2-14]	.97
≥ 1 DMFW	198 (82.5%)	81 (100.0%)	117 (73.6%)	-	79 (82.3%)	119 (82.7%)	-
Total surfaces	128.0 [126-128]	128.0 [126-128]	128.0 [126-128]	.82	128.0 [126-128]	128.0 [126-128]	.81
Missing	2	1		-	1		-

IQR, interquartile range
DMF, decayed, missing, filled
DMFW, decayed, missing, filled, and white spot lesions
[a]Mann-Whitney test *P*-value

***P*-value <0.05.**

3.3 Multiple Variable Generalized Estimating Equations (GEE) Log-linear Regression Models

3.3.1 Preventive Dental Care Utilization

In the unadjusted model, adolescents who utilized preventive dental care had a 4% lower rate of dental caries experience (per tooth surface) than adolescents who did not utilize preventive dental care (DMF PRR 0.96, 95% CI: 0.64 to 1.43; *P*= .83). However, this difference was not significant. After adjusting for age(continuous), sex, and ethnicity, results remained nearly the same (DMF PRR 0.96, 95% CI: 0.60 to 1.52; *P*= .85).

3.3.2 Any Dental Care Utilization

In the unadjusted model, adolescents who utilized any dental care had a 10% higher rate of have dental caries experience than adolescents who did not utilize any dental care (DMF PRR 1.10, 95% CI: 0.76 to 1.58; *P*= .62). However, this difference was not significant. In the adjusted model, the association also remained insignificant (DMF PRR 0.89, 95% CI: 0.56 to 1.43; *P*= .64).

Table 3. Prevalence rate ratios (PRR) from generalized estimating equation regression analyses of dental caries experience based on dental care utilization for Oregon Medicaid-enrolled adolescents in 2015-2016 (*n*=240).

	Unadjusted prevalence rate ratio (95% CI)	*P*-value	[a]Adjusted prevalence rate ratio (95% CI)	*P*-value
Preventive dental care utilization				
DMF	0.957 (0.64-1.43)	.83	0.955 (0.60-1.52)	.85
DMFW	1.007 (0.71-1.42)	.97	0.946 (0.65-1.37)	.77
Any dental care utilization				
DMF	1.096 (0.76-1.58)	.62	0.894 (0.56-1.43)	.64
DMFW	1.067 (0.78-1.46)	.69	0.905 (0.62-1.32)	.60

Comparison group: Medicaid-enrolled adolescents who did not utilize that category of dental care (e.g. any dental care, or preventive dental care)
DMF, decayed, missing, filled
DMFW, decayed, missing, filled, and white spot lesions
[a]**Adjusted** for age(continuous), sex, and ethnicity.

***P*-value <0.05.**

3.3.3 Chronic Condition Status as an Effect Modifier

There was not a significant interaction between preventive dental care utilization and CC status, however, the lack of statistical power may have interfered with results. With the model confounders fixed at the reference categories, the PRR for dental caries experience for adolescents who utilized preventive dental care versus adolescents who did not utilize preventive dental among those without CC was 49% smaller than the PRR for dental caries experience for those who utilized preventive dental care versus those who did not utilize preventive dental among those with CC (DMF PRR 0.51, 95% CI: 0.19 to 1.35; *P*= .27). However, these results were non-significant. There was also no interaction between any dental care utilization and CC status (DMF PRR 0.99, 95% CI: 0.40 to 2.67; *P*= .99).

No differences in results were found in all models when considering secondary outcome DMFW, as dental caries experience (Table 3 and Table 4).

Table 4. Interaction terms (chronic condition) in generalized estimating equation log-linear regression analyses of dental caries experience based on dental care utilization for Oregon Medicaid-enrolled adolescents in 2015-2016 (*n*=240).

Interaction term	[a]Ratio of prevalence rate ratios (95% CI)	*P*-Value
Preventive dental care utilization (yes) × chronic condition (no)		
DMF	0.510 (0.19-1.35)	.27
DMFW	0.568 (0.18-1.80)	.42
Any dental care utilization (yes) × chronic condition (no)		
DMF	0.993 (0.40-2.67)	.99
DMFW	1.160 (0.37-3.61)	.84

Comparison group: Medicaid-enrolled adolescents who did not utilize that category of dental care (e.g. any dental care, or preventive dental care) and had CC.
[a]**Adjusted** for age(continuous), sex, and ethnicity. References noted in Table 1.
DMF, decayed, missing, filled
DMFW, decayed, missing, filled, and white spot lesions

***P*-value <0.05.**

Chapter 4: Discussion

4.1 Interpreting Results

To our knowledge, this is the first study to model the association of preventive dental care utilization and dental caries experience for Medicaid-enrolled adolescents and to evaluate whether the association is modified by the presence of CC. We tested two hypotheses. The first was that preventive dental care utilization would be associated with a lower prevalence of dental caries experience for Medicaid-enrolled adolescents. The second was that the presence of CC would modify the association between preventive dental care utilization and dental caries experience. Contrary to our hypothesis, our findings suggested no significant differences between dental caries experience when comparing adolescents who did and did not utilize preventive care, even when considering CC status as a modifier.

4.1.1 Hypothesis One

There are three possible explanations for our primary finding. First, there is a perception of discrimination of Medicaid-enrolled patients, such as negative interactions with dental office staff and inferior delivery and quality of care.[43,44] As the period of adolescence is filled with self-esteem effects and the development of social relations, negative and discriminatory experiences with healthcare providers (including dentists) could discourage adolescents from following oral hygiene recommendations and maintaining their needed oral health treatments.[44] Second, our null results may have been due to a large number of tooth surfaces already being missing or filled, based on the classification of the DMF index. These teeth surfaces would not have

benefited from preventive dental care utilization, and therefore would have not been accounted for in the reduction of dental caries experience. Third, the correlation between high dental caries experience and income disparities has persisted for years, and communities are not equally benefiting from intervention programs.[2,5] For example, school-based sealant programs were implemented as fast and cost-effective solutions to prevent cavities, in particular for low-income communities, and are most commonly used in white adolescents (47%) ages 12 to 19 years.[2,11,45-48] However, a 2015 states report depicted that most state programs have failed to meet the national goals of delivering sealants to at-risk and low-income children.[46] This implies the inequality of dental delivery, particularly with certain regions and underserved communities.

4.1.2 Hypothesis Two

Furthermore, there are two possible explanations for our secondary result of no interaction between preventive dental care utilization and CC status. First, our null findings could have stemmed due to the small proportion of study participants identified as having CC (6.7%.) and the possibility that our study is underpowered.[48,49] Second, adolescents with CC compromise a heterogeneous group that requires precise, sometimes personalized, diagnosis and prevention approach in caries risk and dental care utilization assessment.[50,51] The physical, medical, and social challenges with CC adolescents may require the modification of customary dental practices and well-trained providers who are accustomed to handling complicated behaviors, resources that are not readily accessible.[51] As a result, standard approaches used for all children and adolescents may not benefit adolescents with CC.[53,54]

4.2 Clinical and Policy Relevance

This study's findings have clinical and policy relevance for medical and dental providers who care for low-income adolescents and Medicaid-enrolled adolescents with CC. Policies and clinical interventions should aim to (1) increase reimbursement rates for dental providers as a way to encourage Medicaid insurance acceptability, (2) build more facilities and encourage dentist participation in underserved regions serving low-income and CC adolescents, (3) implement more advanced training in dental schools and postgraduate dental programs regarding treatment and awareness of barriers for patients who are low-income and/or CC, (4) encourage facilitation of the referral process among Medicaid-enrolled adolescents and those with CC, as cost and service coverage are obstacles, (5) ensure standardization of quality and satisfaction of dental care experience, regardless of patients' demographic characteristics and socioeconomic status, (6) promote education in middle and high schools about the importance of preventive dental care and oral health outcomes among adolescents, in particular for those most at risk, and (7) better integrate oral healthcare and preventive dental care into medical facilities serving adolescents with CC.

4.3 Study Strengths and Limitations

4.3.1 Strengths

Our study adds to the literature by including a less-studied subgroup of Medicaid enrollees. Our model included CC as an effect modifier, which is commonly excluded from adolescents' oral health analyses, leading to the possibility of biased results. Our approach of linking dental claims

and enrollment data to dental screening exams is another strength. It allowed us to incorporate clinical oral health measurements that are not typically available to studies evaluating the effectiveness of public insurance for adolescent populations.

4.3.2 Limitations

There are four main study limitations. First, these results are generalizable to Medicaid-enrolled adolescents and adolescents with CC in Oregon, however, the number of adolescents with CC in our sample was relatively small (n= 16). Lager scale studies based on multiple state or national data should be done in the future to quantify more evidence-based trends of SHCN that could help address gaps in Medicaid dental care utilization and national Medicaid policies. Furthermore, prospective studies should also assess preventive dental care utilization and dental caries experience across various types of dental insurance. Second, this analysis was based on secondary data and was cross-sectional. The adolescent study participants were from 3 counties and predetermined from a primary study focusing on neighborhood-level factors impacting recruitment of Medicaid-enrolled participants; adolescents whose caregivers did not pick up recruitment calls or did not reside in those target counties were missed from the analyses. Additionally, cross-sectional designs cannot analyze behavior, such as dental care utilization over time, therefore, findings may be skewed.[55] There was also a lack of temporality as we could not identify when dental caries were developed (e.g. whether dental caries develops before or after dental care utilization).[56] More longitudinal analyses, across multiple years, should be conducted on dental care utilization and dental caries experience among adolescents and adolescents with CC. Third, our analyses only focused on dental care utilization and did not include other factors as potential determinants and mediators of dental caries experience, such as

income level, caregivers' education level, and diet. Future studies could collect lifestyle factors data as well as caregivers' information (such as income and education level), link these data with Medicaid claims, and generate a more complex model of dental care utilization and dental caries experience. Forth, consistent with other studies, race is associated with dental caries outcome.[57,58] This variable was excluded from our analyses due to a large number of missing data on adolescents' Medicaid files; the race variable was also not included in the primary study's survey findings.

Chapter 5: Conclusions

Contrary to the hypotheses, Medicaid-enrolled adolescents who utilized preventive dental care did not have lower dental caries experience than adolescents who did not utilize preventive dental care. This relationship also did not differ when modifying for CC status. Additional research is needed to clearly understand factors associated with dental caries experience and preventive dental care utilization among low-income and CC adolescents. This information could help develop comprehensive and targeted inventions at improving oral health outcomes for low-income and special needs adolescents and provide an opportunity for optimal oral health over their life course.

Chapter 6: References

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