

ABSTRACT

Dental caries remains the most prevalent chronic disease of childhood and disproportionately affects children from low-income and racial and ethnic minority populations. Northern Virginia is a socioeconomically diverse region, yet local practice-level data on pediatric oral health disparities are limited. This 12-month retrospective study analyzed de-identified records from 2,966 pediatric patients aged 0–21 years who received care at a large pediatric dental practice in Northern Virginia between October 2024 and September 2025. Caries-related treatment was defined as restorative, pulpal, or extraction procedures due to dental caries. Associations between caries-related treatment and insurance status, race/ethnicity, and age group were evaluated using chi-square tests, p-value test, standard deviations and odds ratios. Medicaid-insured children had more than three times the odds of receiving caries-related treatment compared with privately insured children. Hispanic children exhibited the highest treatment prevalence among racial and ethnic groups. Children aged 6–10 years experienced the greatest disease burden. These findings highlight significant pediatric oral health disparities and support the need for early, targeted, and culturally responsive preventive interventions.

INTRODUCTION

Northern Virginia is a socioeconomically and ethnically diverse region, making it a valuable setting for examining pediatric oral health disparities. The population includes wide variation in income, race/ethnicity, age, and insurance coverage, including a substantial proportion of children enrolled in Medicaid. While national data demonstrate clear disparities in pediatric dental caries by socioeconomic status and race/ethnicity, these patterns remain underexplored at the local practice level in Northern Virginia.

This retrospective study analyzed patient-level data from a large pediatric dental practice in Northern Virginia between October 2024 and September 2025 to assess caries-related treatment patterns. The study focused on differences by age group, race/ethnicity, and insurance status, with the goal of identifying locally relevant disparities and informing targeted preventive strategies within the context of national pediatric oral health trends.

Why This Study Is Important?

- Dental caries is a highly preventable yet common chronic disease in children.
- Caries risk is strongly influenced by socioeconomic status, age and race/ethnicity.
- Local patterns of pediatric caries in Northern Virginia are not well understood.
- Identifying disparities helps recognize at-risk populations.
- Local data can inform targeted prevention strategies and resource allocation.
- Addressing disparities can improve access to care and reduce long-term pediatric oral health inequalities.

Research Question

If we were to examine a group of pediatric patients with Hispanic ethnicity, higher age range and of lower socioeconomic status in Northern Virginia, will we find an increase in prevalence of dental caries?

BACKGROUND RESEARCH

Dental caries remains the most prevalent chronic disease of childhood in the United States and worldwide, affecting a substantial proportion of both children and adults. Although largely preventable through proper oral hygiene and regular dental care, approximately 46% of U.S. children aged 2–19 years have experienced dental caries, and roughly 13% exhibit untreated decay (NCHS, 2021). Despite advances in preventive dentistry, disparities persist according to socioeconomic status (SES), insurance coverage, and race/ethnicity, reflecting systemic inequities in access to care (ADA, 2023). Lower SES is strongly associated with higher caries risk due to multiple factors, including limited access to preventive dental services, dietary patterns high in fermentable carbohydrates, and reduced oral health knowledge. Over time, these disparities compound, as early-onset caries increases the likelihood of future decay in both primary and permanent teeth.

Educational and knowledge-based factors further influence oral health outcomes. Studies show that children with lower parental education levels or limited oral health knowledge are more likely to develop dental caries (Almajed, 2024). School-based oral health education and parental involvement have been shown to mitigate caries risk, emphasizing the importance of behavioral interventions. Cultural and environmental factors associated with race and ethnicity also shape oral health behaviors, including hygiene routines, dietary practices, and utilization of preventive services. While genetics may contribute to caries susceptibility, evidence indicates that social, behavioral, and environmental determinants exert a stronger influence on pediatric oral health (ADA, 2023).

Early childhood caries (ECC) exemplifies the cumulative impact of these intersecting factors. National survey data indicate that ECC remains highly prevalent among poor and near-poor U.S. preschool children, with the proportion of severe ECC cases increasing over time (AAPD, 2025). Beyond oral health, ECC contributes to higher treatment costs, emergency visits, nutritional deficiencies, school absenteeism, and reduced quality of life. These findings underscore the need for early, targeted, and culturally responsive preventive strategies to reduce disparities and improve oral health outcomes among vulnerable pediatric populations.

MATERIALS

- Patient’s de-identified records from Dentrix
- Computer (Microsoft Word, Excel, Presentation)
- Printer
- Paper
- Pencil

PROCEDURES

- Gather data from the clinic only from 10/01/2024 to 9/30/2025*
 - Gather from each patient ONLY their race, socioeconomic status (insurance data) and age at the time of treatment in order to accurately gain results and maintain HIPAA guidelines without personally identifiable information (such as name, chart number, SSN, photo, address)
 - Compile data and categorize by race and socioeconomic status
 - Race categories are White, Hispanic, Black and Asian
 - Socioeconomic categories are Medicaid and Private insurance (and cash)
 - Divide patients into age groups are 0-5, 6-10, 11-15, 16-21+ years of age
 - Within each category, divide the # of patients present for caries-related treatment vs. routine visits**
 - Analyze Data using statistics
 - This includes but is not limited to standard deviation, chi-square test with p-values, odds ratio and % findings.
- *This time frame represents the most recently collected complete data set and was selected to capture the most current patterns of pediatric oral health and caries-related treatment in the region.
- **Caries-related treatment was defined as restorative or surgical dental procedures performed to treat dental caries.

Statistical Analysis
Descriptive statistics were calculated to determine the prevalence of caries-related treatment across demographic subgroups. Inferential analyses were performed using chi-square (χ^2) tests to evaluate associations between caries-related treatment and insurance status, race/ethnicity, and age group. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the strength of association between key exposure variables (Medicaid insurance, race/ethnicity, and age group) and receipt of caries-related treatment. A p-value < 0.05 was considered statistically significant. Results were compared qualitatively with national pediatric oral health data reported by National Health and Nutrition Examination Survey (NHANES) Centers for Disease Control and Prevention (CDC), and National Institute of Dental and Craniofacial Research (NIDCR).

DISCUSSION

Caries-related treatment patterns in this Northern Virginia pediatric dental practice varied significantly by insurance status, race/ethnicity, and age. Medicaid-insured children, Hispanic children, and those aged 6–10 years bore the greatest disease burden. These findings demonstrate that clinic-level analyses can uncover meaningful disparities and identify opportunities for targeted intervention, offering actionable insights for both local and broader strategies to advance pediatric oral health equity. Consistent with national pediatric oral health trends, the results highlight the need for targeted, culturally responsive, and age-specific preventive approaches. Prioritizing early, culturally sensitive prevention may help reduce disease burden among the most vulnerable populations.

Caries Prevalence & Oral Health Disparities among Pediatric Patients in a Diverse Community Setting in Northern Virginia: A 12-Month Retrospective Study

Author: William Pham

METHODOLOGY 1 (Experimental Design)

Independent Variables:

- Insurance status: Medicaid vs. private insurance, cash payments
- Race/Ethnicity: White, Black, Hispanic, Asian
- Age categories: 0-5 yrs, 6-10 yrs, 11-15 yrs, 16-21+ yrs
- Over 200 repeated trials per race with repeated trials ranging up to 1067
- Over 931 repeated trials per insurance status with repeated trials ranging up to 2035
- Over 30 repeated trials per age group with repeated trials ranging up to 1085

Dependent Variable:

- Receipt of caries-related treatment (any restorative, endodontic, surgical procedures due to caries)

HYPOTHESES

H1: Race/Ethnicity

If pediatric patients are from racial or ethnic minority groups, then they will incur a higher rate of caries-related dental treatment compared with non-minority patients. This is hypothesized to result from structural and social determinants of health, including lower average household income, reduced access to preventive dental services, limited availability of healthy food options, systemic barriers within the healthcare system, and potential language barriers.

H2: Insurance Status (Socioeconomic Status)

If pediatric patients are covered by Medicaid, then they will incur a higher rate of caries-related dental treatment compared with patients with private insurance. This is hypothesized to reflect socioeconomic disparities such as reduced access to healthcare and oral health education, limited availability of hygiene products, and increased consumption of lower-cost, sugar-dense diets.

H3: Age Group

If pediatric patients are in the higher age range (16–21+ years), then they will incur a higher rate of caries-related dental treatment compared with younger patients. This is hypothesized to be due to decreased parental supervision of oral hygiene, increased autonomy in dietary choices, more frequent snacking, and greater access to sugar-containing foods and beverages.

RESULTS

Figure 1. Demographic Characteristics of the Study Population (N = 2,966)

Characteristics	n	%
Age Group		
0–5 years	520	17.5%
6–10 years	1,085	36.6%
11–15 years	736	24.8%
16–21+ years	625	21.1%
Race/Ethnicity		
White	1,066	35.9%
Black	244	8.2%
Hispanic	685	23.1%
Asian	987	33.3%
Insurance Status		
Medicaid	931	31.4%
Private	2,035	68.6%

Figure 2. Prevalence of Patient Receiving Caries Treatment by Insurance Status (N=2966)

Insurance	Caries (n)	W/o Caries (n)	Total	% Caries	Odds Ratio (95% CI)
Private (ref)	214	1,821	2,035	10.5	1.00
Medicaid	252	679	931	27.1	3.17 (2.60–3.86)

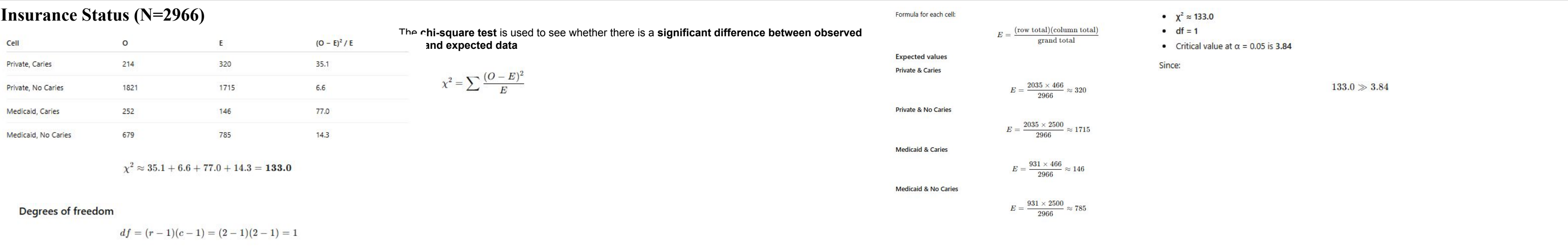
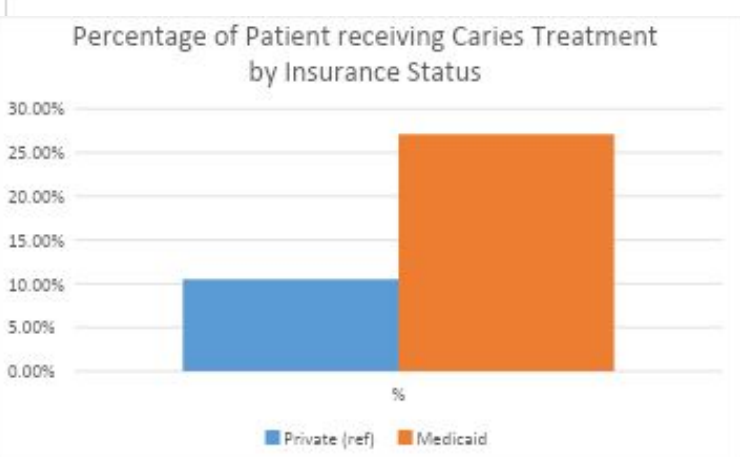


Figure 3. Prevalence of Patient Receiving Caries Treatment by Race/Ethnicity

Race	Caries n/N	%	Odds Ratio (95% CI)
White (ref)	102/1066	9.6%	1
Black	38/244	15.6%	1.75
Hispanic	167/685	24.4%	3.04
Asian	159/987	16.1%	1.81

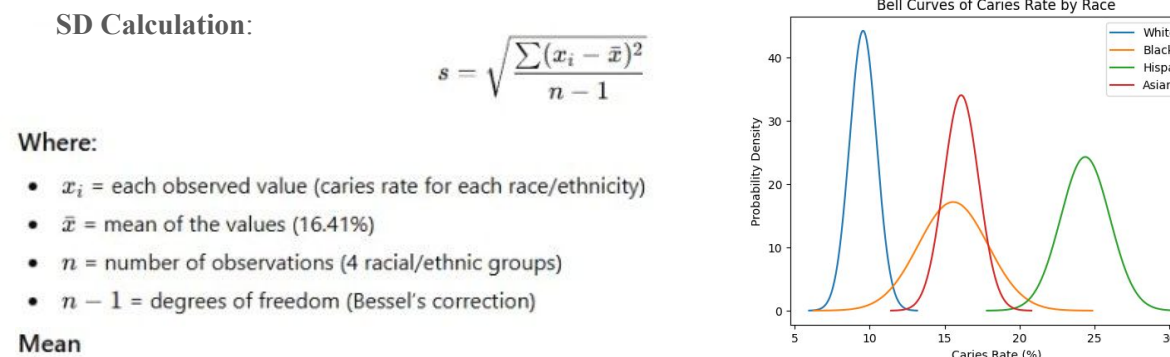
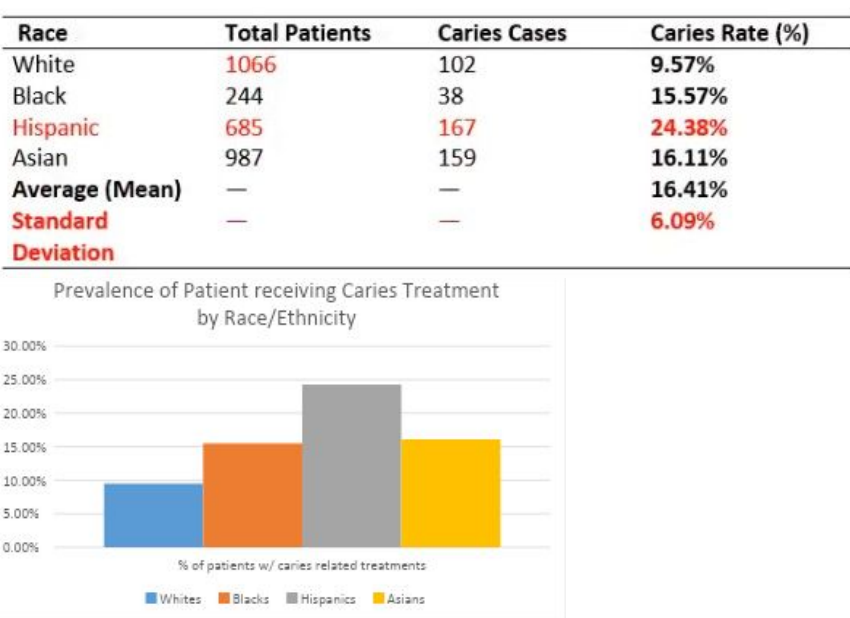


Figure 4. Age-Specific Prevalence of Caries-Related Treatment

Age Group	Caries n/N	%	Odds Ratio (95% CI)
0-5 years	98/520	18.8%	4.57
6-10 years	243/1,085	22.4%	5.77
11-15 years	95/736	12.9%	2.96
16-21+ years (ref)	30/625	4.8%	1.00

Age	0-5 yrs	5-10 yrs	11-15 yrs	16-21+ yrs
% of patients in this study	17.5%	36.6%	24.8%	21.30%
number of patients	520	1085	736	625

Chi-Square Test

- Chi-square statistic (χ^2): 99.79
- Degrees of freedom (df): 3
- Significance level (p): 0.05
- Critical value ($\chi^2_{critical}$): 7.815

Statistical Appendix: Chi-Square Analysis

Chi-square (χ^2) tests were used to evaluate whether the observed differences in caries-related treatment across demographic groups were greater than would be expected by chance alone. For all primary comparisons (insurance status, race/ethnicity, and age group), χ^2 values were large and p-values were < 0.001, indicating statistically significant associations. *In all tests of significance, if $p < 0.05$, we can say that there is a statistically significant relationship between the two variables.*

CONCLUSION 1

Race/Ethnicity study

Claim: If children are from a racial minority, then they will incur a higher rate of dental treatment for caries.

Evidence: The total study population included 2,966 patients. Caries rates by race were:

- White:** 102 out of 1,066 patients → **9.57%**
- Black:** 38 out of 244 patients → **15.57%**
- Hispanic:** 167 out of 685 patients → **24.38%**
- Asian:** 159 out of 987 patients → **16.11%**

The average caries rate across races was 16.41%, with a standard deviation of 6.09%, showing clear variation between racial groups. **Hispanic patients had the highest caries rate**, while White patients had the lowest.

Racial and ethnic disparities were also pronounced. Hispanic children exhibited the highest prevalence and odds of caries-related treatment, followed by Asian and Black children, while White children experienced the lowest burden. These findings mirror national surveillance data.

Reasoning: These numbers support the claim because racial minority groups showed higher rates of caries-related dental treatment than White patients. This makes sense scientifically and socially because racial minorities often face barriers such as reduced access to preventive dental care, fluoride exposure, language barriers, fewer routine checkups, and delayed presentation for treatment. Higher caries rates indicate that dental issues may go untreated for longer periods, resulting in the need for more treatment when care is finally received.

CONCLUSION 3

Age group study

Claim: If the children are of a higher age range (11-15 years), then they will incur a lower rate of dental treatment

Evidence: Caries-related treatment by age group showed the following distribution:

- 0–5 years:** 18.8%
- 6–10 years:** 22.4%
- 11–15 years:** 12.9%
- 16–21+ years:** 4.8%

The 6–10 year age group demonstrated the highest proportion of caries-related treatment, contradicting the expectation that older children would require more treatment. Age-specific analyses further indicated that children aged 6–10 years had nearly six-fold higher odds of caries-related treatment compared with adolescents aged 16–21+ years. This pattern is consistent with established epidemiologic evidence showing that caries risk peaks during the mixed dentition period, when newly erupted permanent teeth are particularly susceptible to decay.

Notably, children aged 0–5 years exhibited a disproportionately high prevalence of treatment relative to their representation in the patient population, highlighting the persistent burden of early childhood caries.

Reasoning: The data contradict the original hypothesis, as the highest treatment rates occurred in the 6–10 year age group rather than among individuals aged 16–21+ years. This suggests that caries-related dental treatment is more strongly associated with developmental stages—such as the eruption of permanent teeth and inconsistent oral hygiene habits—than with increasing age alone. Moreover, variations in treatment rates may reflect differences in access to care and timing of intervention rather than true differences in oral health status. Lower treatment rates among older age groups may indicate earlier preventive care or fewer opportunities for treatment, rather than a complete absence of dental disease. Overall, the findings indicate that dental treatment rates are influenced more by developmental vulnerability and access to dental services than by age alone.

LIMITATIONS

This study is limited by its retrospective design and reliance on data from a single pediatric dental practice in Northern Virginia, which may restrict the generalizability of the findings. The analysis reflects treatment prevalence rather than true disease prevalence, as untreated caries among children who did not seek care could not be captured. Additionally, socioeconomic factors beyond insurance status were unavailable (such as education, language barrier, family dynamics, systemic discrimination, etc.), limiting a more comprehensive assessment of social determinants of oral health. Future multi-site, prospective studies incorporating broader socioeconomic data are warranted to address these limitations.

PRACTICE & PUBLIC HEALTH IMPLICATIONS

Practice-level surveillance represents a valuable tool for identifying at-risk pediatric populations and informing targeted preventive strategies. Expanding early preventive care, improving access for publicly insured children, and strengthening community-based oral health education initiatives may help reduce persistent disparities in pediatric dental caries. Targeted prevention programs focused on Medicaid-insured and minority children have the potential to substantially reduce the burden of early childhood caries, while culturally tailored oral health education may further mitigate racial and ethnic disparities in treatment and outcomes. Additionally, ongoing clinic-level monitoring is essential for evaluating the effectiveness of interventions over time and ensuring progress toward oral health equity. These findings also highlight the importance of interdisciplinary collaboration between dental and medical health care professionals to ensure that all infants and toddlers receive timely dental screenings, anticipatory guidance, and preventive services delivered through a consistent, unified message. Supporting community water fluoridation as a primary preventive measure remains critical for reaching underserved and vulnerable populations. Furthermore, educating legislators, policymakers, and third-party payors about the consequences of early childhood caries and evidence-based preventive strategies is essential, with emphasis on ensuring equitable access to care. Advocacy efforts should also focus on reimbursement structures that facilitate access for all children and on educational reforms that prioritize comprehensive, evidence-based prevention and management of early childhood caries⁸. From a social justice perspective, developing policies that address other societal factors (such as poverty level, education, language, discrimination, smoking status, etc.) is essential to achieving improved oral health outcomes and reducing inequalities for children from historically disadvantaged groups².

FUTURE RESEARCH

If this project were continued, future research should extend beyond a single clinic to include multiple dental practices across different communities in order to improve how well the results represent the overall population. Collecting additional socioeconomic data, such as household income, parental education level, access to fluoridated water, and frequency of preventive dental visits, would help clarify whether higher treatment rates are caused by limited access to care or delayed intervention rather than demographic factors alone. Future studies should also include both treated and untreated caries to better reflect true oral health outcomes. These improvements would strengthen the overall study by addressing current limitations and allow researchers to better understand how access, prevention, and early intervention influence dental health trends, ultimately supporting more effective public health strategies to reduce dental disparities.

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