COLORADO
Department of Public Health & Environment

Tooth Be Told...

Colorado's Basic Screening Survey

Children's Oral Health Screening: 2016-17

Renee Calanan, PhD; Gabrielle Elzinga-Marshall, MPA;
Dahsan Gary, MPH; Emily Payne, MPH; Katya Mauritson, DMD
Colorado Department of Public Health and Environment
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COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

Feb. 26, 2018

Dear oral health partners,

Nearly two decades ago, U.S. Surgeon General Dr. David Satcher identified cavities, especially in children from disadvantaged communities, as a "silent epidemic." While cavities in childhood still meet the definition of an epidemic as a widespread infectious disease, this report shows that many Colorado children enjoy significantly better oral health than a decade ago. As public health officials, we don't often get the chance to spread such good news.

These survey results confirm that preventive oral health interventions implemented in Colorado over the past 10 years are working. But to prevent future generations from the needless suffering and lifelong health consequences of cavities, we need to continue the work we've begun, always striving to provide access to cavity prevention for all Colorado children.

Many of us are fortunate to have grown up with fluoridated water, early and regular dental treatment, and access to preventive services like fluoride varnish and dental sealants. We had an oral health system that worked for us. When we had a toothache, there was someone there to fix it quickly and at a reasonable cost.

But there are children who still suffer from this "silent epidemic." The chronic and acute pain of cavities experienced by too many infants, toddlers and children can cause impaired speech development, lower self-esteem and lower academic achievement. For the thousands of children in chronic oral pain, cavities are a ***silencing epidemic***, their potential silenced when adults don't listen or the day-to-day pain becomes normal to them. The oral health disparities documented in this report are a result of systemic access issues and oral health inequities compounded over generations, making it more likely for children in some communities to continue to suffer from cavities and chronic pain.

We know how to prevent that pain from happening. The Colorado Department of Public Health and Environment will continue working with community partners to maintain the gains made during the past decade and expand oral health access to even more children. Programs such as Cavity Free at Three, Community Water Fluoridation and school-based sealant programs need to thrive so that our children enter school healthy and ready to learn.

If you would like to support efforts to increase access to community-based preventive efforts, please contact your local public health agency or oral health coalition, the Cavity Free at Three program or the Smart Mouths Smart Kids program.

Sincerely,

Larry Wolk, MD, MSPH
Executive Director, Chief Medical Officer
Colorado Department of Public Health and Environment

Katya Mauritson, DMD
Dental Director, Oral Health Unit Manager
Colorado Department of Public Health and Environment

4300 Cherry Creek Drive S., Denver, CO 80246-1530 P 303-692-2000 www.colorado.gov/cdphe
John W. Hickenlooper, Governor | Larry Wolk, MD, MSPH, Executive Director and Chief Medical Officer

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This survey and report were made possible by grant number 1U58DP004904-01 from the U.S. Centers for Disease Control and Prevention (CDC). Most data from this report will be made available through CDPHE's Visual Information System for Identifying Opportunities and Needs (VISION) and the CDC's National Oral Health Surveillance System, which allows comparisons of disease burden with other states.

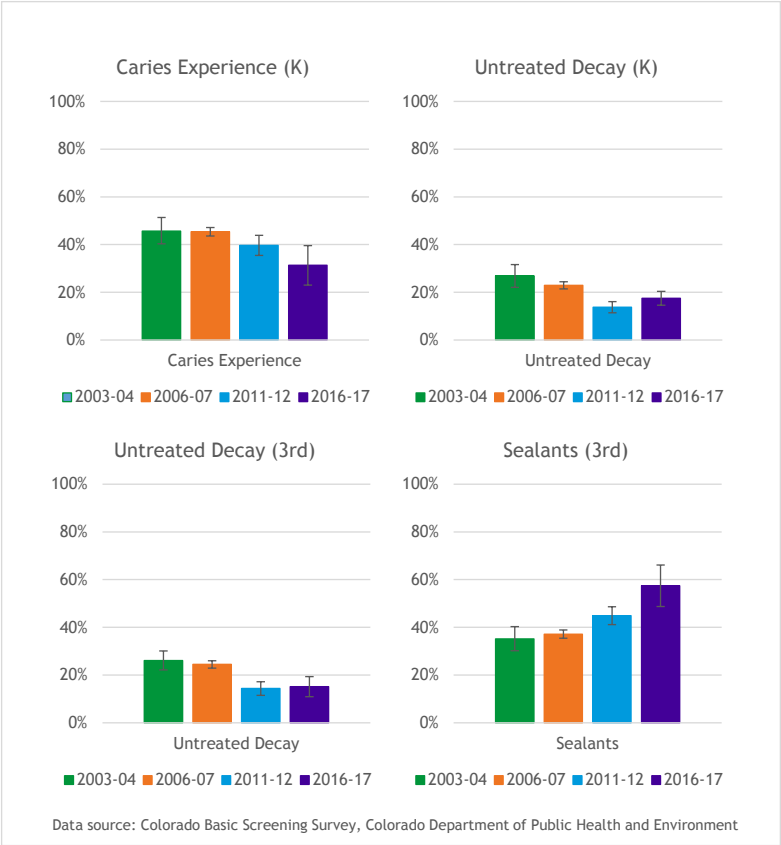
Executive Summary

While cavities remain the number one chronic disease of childhood both nationally and locally, Colorado has made great strides in improving oral health outcomes for children across the state. Cavities, also defined as caries or decay in the data below, can lead to chronic and acute pain. This can negatively affect children's ability to learn, sleep and thrive.

CDPHE conducted a survey of kindergarten and third grade students that included an in-mouth dental screening during the 2016-17 school year. The sample was selected to be representative of all kindergarten and third grade students in Colorado. In general, caries experience, untreated decay and need for dental treatment have all declined since the first Colorado Basic Screening Survey (BSS) was conducted during the 2003-04 school year. In this same timeframe, the prevalence of sealants has steadily increased. Despite these gains, challenges remain.

In general, the prevalence of oral health outcomes did not change significantly from 2003-04 to 2006-07. However, from 2006-07 to 2016-17, the prevalence of caries experience significantly decreased for kindergarten students, the prevalence of untreated decay significantly decreased for both kindergarten and third grade students, and the prevalence of sealants significantly increased for third grade students.

Figure E.1: Oral Health Outcomes Over Time, by Grade Level, Colorado.



Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment

Fewer children are entering elementary school having experienced caries.

- The prevalence of caries experience among kindergarten students has decreased significantly, from 45.4 percent in 2006-07 to 31.3 percent in 2016-17.

Dental decay remains a significant public health problem for children in Colorado.

- 31.3 percent of kindergarten students and 47.3 percent of third grade students had caries experience.

The percentage of children with unidentified and untreated caries has decreased but needs improvement.

- 17.5 percent of kindergarten students and 15.2 percent of third grade students had untreated decay – more than 21,000 students in these two grades alone.

There is an unmet need for oral health care in Colorado.

- 3.0 percent of kindergarten students and 3.3 percent of third grade students had an urgent need for dental treatment – approximately 2,000 students in each of these two grades alone.

Dental sealants are recommended by the American Dental Association to prevent decay, but almost half of Colorado third grade students do not have sealants.

- The prevalence of third grade students having a sealant on at least one permanent molar has increased significantly over the past decade, from 37.1 percent in 2006-07 to 57.4 percent in 2016-17.
- However, 42.6 percent of third grade children still do not have sealants on their permanent molars – almost 28,000 third grade students could benefit from this effective preventive treatment.
- Among students at the type of schools targeted by CDPHE for school-based sealant programs (50 percent or more students eligible for the free and reduced-price lunch (FRL) program), the prevalence of third grade students having a sealant on at least one permanent molar significantly increased from 32.4 percent in 2006-07 to 51.3 percent in 2016-17.

Oral health outcomes have improved since 2006-07, but disparities remain pervasive.

- Students at the lowest socioeconomic status (SES) schools (75 percent or more FRL eligibility) were more likely to have tooth decay and less likely to have preventive sealants than students at the highest SES schools (less than 25 percent FRL eligibility).
  - This difference in caries experience was 45.4 percent compared with 14.9 percent, respectively, among kindergarten students and 63.9 percent compared with 35.1 percent, respectively, among third grade students.
  - Students at the lowest SES schools had about twice the prevalence of untreated decay: 21.9 percent of kindergarten and 17.7 percent of third grade students compared with 13.6 percent of kindergarten and 8.1 percent of third grade students at the highest SES schools.
  - Students at the lowest SES schools had a significantly lower prevalence of having dental sealants than students at the highest SES schools: 49.8 percent compared with 72.3 percent, respectively.
- Students of color had a significantly higher burden of tooth decay, in general, compared with White students.
  - Kindergarten students of “other” and Hispanic/Latino(a) race/ethnicity had higher burden of caries experience (41.5 percent and 40.9 percent, respectively) compared with White students (23.4 percent). The difference was 54.5 percent and 57.9 percent compared with 37.9 percent, respectively, among third grade students.
  - Kindergarten students of “other” and Hispanic/Latino(a) race/ethnicity had higher burden of untreated decay (31.2 percent and 18.5 percent, respectively) compared with White students

(13.8 percent).
    - Third grade students of "other" and Black/African American race/ethnicity had higher burden of untreated decay (27.2 percent and 25.0 percent, respectively) compared with White students (12.5 percent).
    - Black/African American third grade students had lower prevalence of sealants on at least one permanent molar (45.1 percent) compared with White third grade students (61.2 percent).
- Third grade students at urban schools had a higher burden of caries experience than those at rural schools: 52.3 percent compared with 36.8 percent, respectively.

Although disparities persist, there have been some improvements since 2003-04.

- Disparities between Hispanic/Latino(a) students and White students have improved for caries experience among kindergarten students, untreated decay among both kindergarten and third grade students, and dental sealants among third grade students.
- Disparities between students in the highest SES schools and those in the lowest SES schools has improved for untreated decay among both kindergarten and third grade students.
- However, at the same time, caries experience disparities worsened for both Hispanic/Latino(a) third grade students and those at the lowest SES schools.

It is important to note that this survey only captured the oral health status of White, Black/African American, and Hispanic/Latino(a) students, and a combined group of students of "other" races and ethnicities. Furthermore, the trend analyses were even more limited to comparisons among White and Hispanic/Latino(a) students only. The oral health disparities of other races, such as Native Americans, were not able to be assessed in this survey due to the small sample size. These disparities could be large and require more targeted interventions to solve.

The Colorado Department of Public Health and Environment acknowledges that generations-long social, economic and environmental inequities result in adverse health outcomes. They affect communities differently and have a greater influence on health outcomes than either individual choices or one's ability to access health care. Reducing health disparities through policies, practices and systems-level changes can help improve opportunities for all Coloradans.

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Colorado's Basic Screening Survey, 2016-17

Introduction

Tooth decay is the most common chronic infection of childhood.[1] While Colorado has made great strides in children's oral health care in recent years, challenges remain. Despite Medicaid coverage and an increasing ability for young children to access preventative dental services from their primary care providers, many children continue to lack access to a dental home.[2] Pervasive racial, ethnic and socioeconomic disparities in oral disease and access to oral health care continue.

Many children lack access to preventive and restorative dental care, which leads to higher risk of painful toothaches, missing school and decreased academic achievement, all of which can lead to lifelong achievement gaps. These data highlight differences in oral health outcomes and can be used to target high-risk populations with policies, practices and organizational systems to improve outcomes and reduce disparities.

Children who experience cavities at a very young age may suffer from undiagnosed chronic pain, which at times becomes acute. These children are often unable to sleep, eat or learn as easily as children without cavities. Decreasing the number of children experiencing cavities can have a direct effect on school readiness and is an important tactic in decreasing academic disparities.

Data are a vital component in understanding and addressing our most pressing oral health issues. To better understand the needs of Colorado's children, the Colorado Department of Public Health and Environment (CDPHE) conducted a statewide oral health screening of kindergarten and third grade children enrolled in Colorado's public elementary schools during the 2016-17 school year. Forty schools participated and 3,559 children were screened for oral health outcomes, such as tooth decay and sealants. Results were statistically weighted to be representative of the general population of children in kindergarten or third grade in Colorado. These data serve CDPHE and its partners by illuminating dental health needs and outcomes amongst Colorado's children and demonstrating the need for school oral health programs across the state, especially in the most at-risk communities.

The data in this report describe some oral health disparities among Coloradan children by demographic characteristics, including socioeconomic status, race and ethnicity, and geography. CDPHE acknowledges that generations-long social, economic, and environmental inequities result in adverse health outcomes. They affect communities differently and have a greater influence on health outcomes than either individual choices or one's ability to access healthcare. Reducing health disparities through policies, practices, and organizational systems can help improve opportunities for all Coloradans.

1 US Department of Health and Human Services. Oral health in America: A Report of the Surgeon General. DHHS, Rockville, MD. 2000.

2 The American Academy of Pediatric Dentists defines "dental home" as "the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way." www.aapd.org/media/policies_guidelines/d_dentalhome.pdf

Methodology

Sample Selection

The 2016-17 Basic Screening Survey (BSS) utilized probability proportional to size sampling to select 59 schools from the 2015-16 list of all public elementary schools in Colorado. Schools were stratified explicitly by health statistics region (HSR),[3] and implicitly by the percent of students eligible for the free and/or reduced-price school meals program (FRL). If a school refused to participate, a replacement school was selected from the same HSR strata. The final sample included 40 participating schools. Note that in previous years the BSS sampling used explicit stratification by four categories FRL eligibility and implicit stratification by eligibility for FRL (continuous variable) without stratification by HSR.

Screening and Data Entry

Active and passive consent forms were used for student participation. Consent method varied by school; of the 40 schools that participated, eight (20.0%) used active consent, and 32 (80.0%) used passive consent.

Dental hygienists performed the BSS using the manual provided by the Association of State and Territorial Dental Directors (ASTDD).[4] Screeners used gloves, flashlights and disposable mouth mirrors to screen for caries experience (i.e., fillings or untreated decay), untreated decay (number of quadrants with untreated decay), treatment needs (urgency of need), and dental sealants. Treatment needs were categorized as "urgent" if care was recommended within 24-48 hours for signs or symptoms that include pain, infection or swelling; "early" if care was recommended within the next several weeks or before their next regularly scheduled dental appointment for caries without accompanying signs or symptoms or other oral health problems; or "no obvious problems" if care was recommended at the next regular checkup. Upon screening completion, each child was given a toothbrush, notification of current oral health status and a timeline for recommended dental treatment. For urgent dental care needs, the school nurse was asked to follow up with the child's parents or care providers.

Dental hygienists, school nurses, school volunteers and CDPHE staff also collected children's height and weight using standardized procedures. These results are not included in this report but will be included in a separate publication.

Screeners also collected data on sex, race and ethnicity, and child age from school rosters. Race and ethnicity was indicated using a standard form which included the following categories: White, Black/African American, Hispanic/Latino(a), Asian, American Indian/ Alaska Native, multi-racial, unknown/missing and a field for other values. Only one option could be selected. Only the month and year of the child's birth was collected in order to preserve anonymity and follow the minimum necessary standard for data required to calculate age and body mass index.

Using the diagnostic criteria outlined in the BSS manual, screeners completed the screening

3 Health statistics regions (HSRs) are 21 aggregations of Colorado's counties developed by CDPHE's Health Statistics and Evaluation Branch in partnership with state and local public health professionals using statistical and demographic criteria.

4 The ASTDD Basic Screening Survey Toolkit is available at www.astdd.org/basic-screening-survey-tool

and entered data onto paper forms. These data collection forms were compiled and members of CDPHE's Oral Health Unit staff double entered the forms into a Google Sheet via a Google Form. Entered data was thoroughly checked for quality and consistency. Where a birthdate was absent, age was estimated with a randomly selected birth month and year: March 2011 for kindergarten students and March 2008 for third grade students.

Data Analysis

Data analyses were completed using SAS Version 9.3. To ensure BSS estimates were representative of the kindergarten and third grade students in Colorado and to reduce non-response bias, data were weighted following the Behavioral Risk Factor Surveillance System (BRFSS) iterative proportional fitting or "raking" methodology.[5] The procedure used categories of rural or urban county designation, sex, FRL eligibility category and race/ethnicity, and iterated until the sample proportions approached those of Colorado's population. Note that in previous years, a different weighting methodology was used. Previously, the probability of child and school selection were multiplied to calculate sampling weights that account for non-response bias.

This improved weighting methodology accounts for the different sampling methodology that was incorporated beginning in 2016-17. With the additional stratification of the sampling frame by HSR, there was, by design, a larger representation of rural students in the sample. The non-response rates needed to be "raked" to adjust for the differences between the sample and the general student population, which was not necessary in previous years. Although this introduces new methodology and trends should be interpreted with caution, the authors believe that the results of the trend analyses are valid.

The American Dental Association (ADA) recommends sealants be placed on all permanent molars for children and adolescents to prevent 80 percent of cavities in those teeth.[6] Because the first permanent molars do not typically erupt until a child is 6 or 7 years of age, and sealants on permanent teeth would not be recommended for most kindergarten-aged children, analyses of the prevalence of having a sealant were only conducted for third grade students.

School-level data from the Colorado Department of Education on percent FRL eligibility was added to the finalized dataset. FRL eligibility is used in this study as a proxy indicator of socioeconomic status. It indicates an overall measure of the socioeconomic status of the school community. To be eligible for FRL during the 2016-17 school year, annual income for a family of four could not exceed $44,955.[7]

Students were sorted into four categories based on the percent FRL eligibility at their school: less than 25.0 percent (the highest socioeconomic status group of schools), 25.0-49.9 percent, 50.0-74.9 percent, and 75.0 percent or more (the lowest socioeconomic

5 Centers for Disease Control and Prevention. 2012. "Behavioral Risk Factor Surveillance System: Improving Survey Methodology". Available at: https://www.cdc.gov/surveillancepractice/documents/dbs_brfss-improvements_12_232372_m_rem_5_25_2012.pdf

6 Center for Scientific Information, American Dental Association Science Institute. 2016. Available at: www.ada.org/en/member-center/oral-health-topics/dental-sealants

7 Colorado Benefits Guidelines: School Breakfast and Lunch Program, 2016. Available at: www.benefits.gov/benefits/benefit-details/1954

status group of schools). Because school-based sealant programs in Colorado recommend participating schools have a minimum of 50 percent of students eligible for FRL, analyses are also presented that compare FRL eligibility of 50.0 percent or more with lower eligibility levels. This stratification is recommended by the Centers for Disease Control and Prevention.

Students were also described as attending an urban or a rural school based on Colorado Department of Education's school district designations. A Colorado school district is determined to be rural based on the size of the district, distance from the nearest large urban/urbanized area, and student enrollment of 6,500 students or less.[8]

The Rao-Scott likelihood ratio chi-square test was used to test for statistical association between oral health outcomes and demographic variables, including race/ethnicity, school-level FRL eligibility category, and school-level urban or rural designation. Specific differences in those associations were assessed using logistic regression analysis. Trends were tested statistically using Joinpoint Trend Analysis Software.[9] Log-linear trend tests were run to test whether estimates changed at a constant percentage change per school year from the 2003-04 school year to the 2016-17 school year. For all statistical testing, a p-value less than 0.05 was considered statistically significant. The p-values are provided in Tables A.3, A.4, A.4b, A.5, A.6, A.7, and A.8 in the appendix.

Absolute disparities were calculated as the difference in prevalence between two groups (absolute disparity = prevalence1 – prevalence2). Relative disparities were calculated as the ratio of the prevalence of two groups (relative disparity = prevalence1/prevalence2), with prevalence2 being the prevalence in the reference group. White students and students in schools with less than 25 percent FRL eligibility were selected as the reference because they represented the group with the lowest prevalence of adverse oral health outcomes and the highest prevalence of preventive measures (i.e., sealants).

Results

Sample Overview and Response Rates

The Oral Health Unit contacted school districts and individual schools from the original selected sample of 59 schools to obtain participation approval. Many replacement schools needed to be selected due to school districts or individual schools declining to participate. In the end, a total of 40 schools participated in the 2016-17 BSS. Overall, 3,559 students participated, including 1,770 in kindergarten and 1,789 in third grade. The overall student response rate was 74.7 percent for kindergarten students and 74.0 percent for third grade students. As research from CDPHE and others suggests, the student response rate was considerably lower for schools that employed active consent (58.9 percent for kindergarten and 49.5 percent for third grade) than for those that employed passive consent (78.6 percent for kindergarten and 79.2 percent for third grade).

8 Colorado Department of Education. Rural and Small Rural Designation, 2017. Available at: https://www.cde.state.co.us/ruraledcouncil/rural_definition_spreadsheet

9 National Cancer Institute, Division of Cancer Control & Population Sciences. Joinpoint Trend Analysis Software. More information available at: https://surveillance.cancer.gov/joinpoint

Sample Demographics

Table A.1, in the appendix, details the demographics and geographic designation (urban or rural school) of the weighted sample.

The ages of students sampled in the BSS ranged from 4 to 7 years for kindergarten students (mean age of 5.9 years) and from 7 to 11 years for third grade students (mean age of 9.0 years). Among kindergarten students, 49.5 percent were male and 50.5 percent were female. Among third grade students, 53.5 percent were male and 46.5 percent were female. This was similar to the October 2016 statewide average of 51.4 percent male and 48.6 percent female for all of Colorado's public school children (kindergarten through 12th grade).

By race/ethnicity, the weighted sample of kindergarten students was 54.1 percent White, 31.5 percent Hispanic, and 4.8 percent Black while third grade students were 53.2 percent White, 35.1 percent Hispanic, and 4.3 percent Black. These were both similar to race/ethnicity of all students (grades K-12): 53.8 percent White, 33.5 percent Hispanic, and 4.6 percent Black. Due to small sample sizes, data for all other races were combined into an "other" category due to the inability to report statistically reliable estimates of oral health outcomes for those races as separate categories. Almost 10 percent (9.7 percent) of kindergarten students and 7.5 percent of third grade students were categorized as "other" race.

It is important to acknowledge that, although this survey did not capture the oral health status of other non-White students, such as Native Americans, disparities within these "other" populations might be large and might require more targeted interventions to solve. Health disparities research shows that an inability to measure these disparities can increase poor health outcomes because the impact of interventions on these populations is not being evaluated.

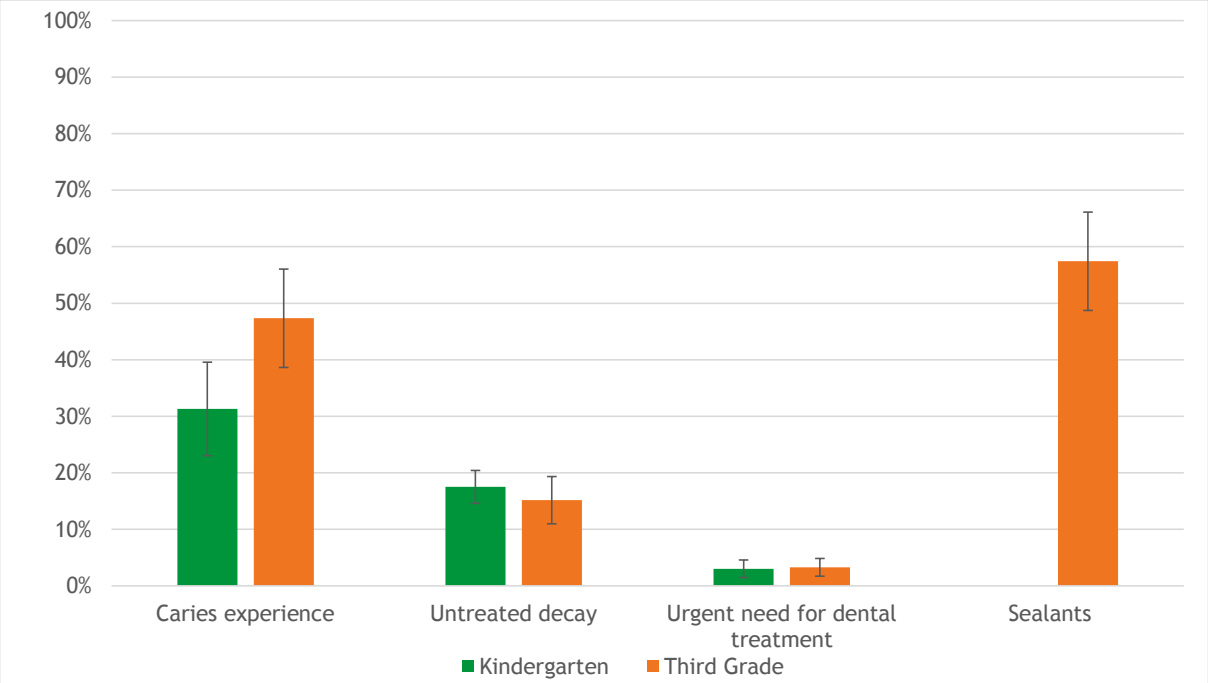
Slightly less than half of the weighted sample, 43.4 percent of kindergarten students and 44.5 percent of third grade students, attended schools with 50 percent or more FRL eligibility, indicating they attend the type of schools targeted for school-based sealants programs. These percentages were on par with the state of Colorado's kindergarten and third grade students overall: statewide, 43.9 percent of kindergarten and third grade students attend schools with 50 percent or more FRL eligibility.

Among kindergarten students surveyed in BSS, 67.2 percent were from urban school districts and 32.8 percent were from rural school districts. Among third grade students screened, 68.1 percent were from urban school districts and 31.9 percent were from rural school districts. School districts that comprised two Health Statistics Regions (HSRs) declined to participate in the 2016-17 BSS: HSR 3, Douglas County, and HSR 21, Jefferson County. Four other HSRs had only one participating school: HSR 4 (El Paso County), HSR 14 (Adams County), HSR 15 (Arapahoe County), and HSR 19 (Mesa County). Participation rates by HSR were dependent on sample selection and participation approval.

Oral Health Outcomes

The 2016-17 prevalence of caries experience, untreated decay, and urgent need for dental treatment among kindergarten and third grade students and the 2016-17 prevalence of dental sealants among third grade students are presented in Figure 1.

Figure 1: Oral Health Outcomes by Grade Level, Colorado, 2016-17.



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Caries Experience

The percent of students with caries experience was significantly higher among the older students. Almost a third (31.3 percent) of kindergarten students had caries experience compared with almost half (47.3 percent) of third grade students (Figure 1). Substantial differences existed between both kindergarten (Figure 2) and third grade (Figure 3) students by school-level socioeconomic status (SES, as measured by percent of students eligible for FRL) and by student's race/ethnicity, but the difference between students from urban schools and those from rural schools was only statistically significant among third grade students.

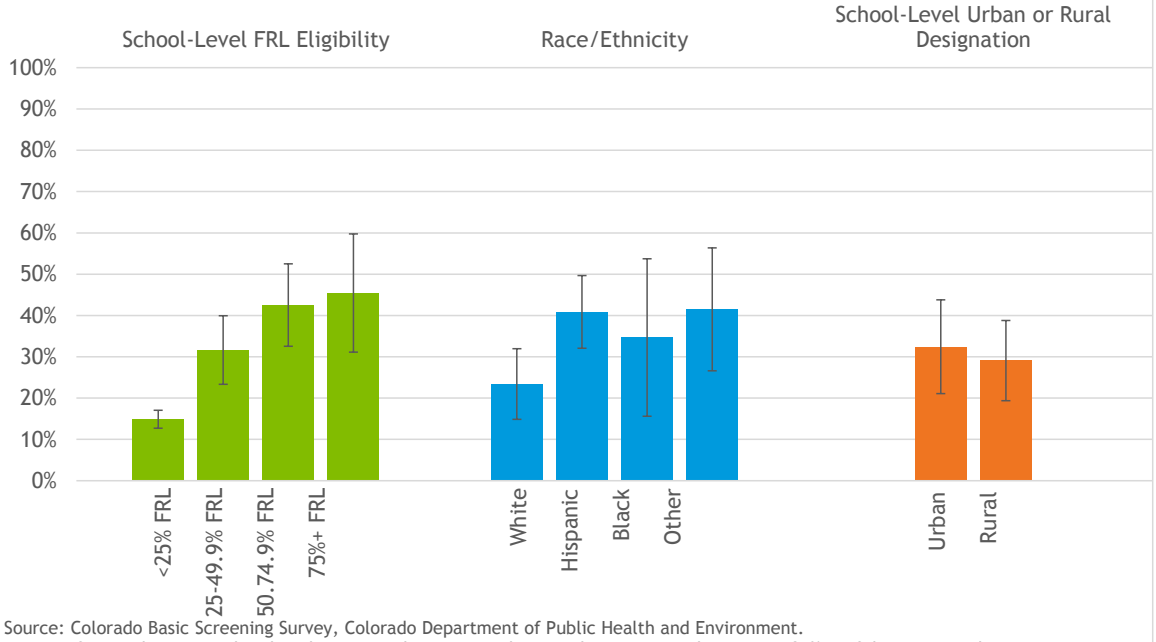
In general, caries experience increased as school-level SES decreased. This finding also occurred in previous BSS years (see Figures 10 and 11). Among kindergarten students, those in the highest SES schools (less than 25 percent FRL eligibility) had a significantly lower burden of caries experience (14.9 percent) than those in all lower SES schools: 31.6 percent of students at schools with 25-49.9 percent FRL eligibility, 42.5 percent of students at schools with 50-74.9 percent FRL eligibility, and 45.4 percent of students at schools with 75 percent or more FRL eligibility had caries experience. Among third grade students, those

at the lowest SES schools had a higher burden than those at the highest SES schools: 63.9 percent of students at schools with 75 percent or more FRL eligibility had caries experience compared with 35.1 percent of students at schools with less than 25 percent FRL eligibility. Among students at the type of schools targeted for school-based sealant programs (50 percent or more FRL eligibility), 44.0 percent of kindergarten students and 56.7 percent of third grade students had caries experience, both significantly higher than among students in schools with less than 50 percent FRL eligibility.

For both kindergarten and third grade, Hispanic/Latino(a) and students of "other" race/ethnicity had a significantly higher burden of caries experience than White students: 40.9 percent and 41.5 percent compared with 23.4 percent, respectively, among kindergarten students and 57.9 percent and 54.5 percent compared with 37.9 percent, respectively, among third grade students. Caries experience among Black/African American students was also significantly higher than among White students, but among third grade students only: 67.9 percent compared with 37.9 percent, respectively.

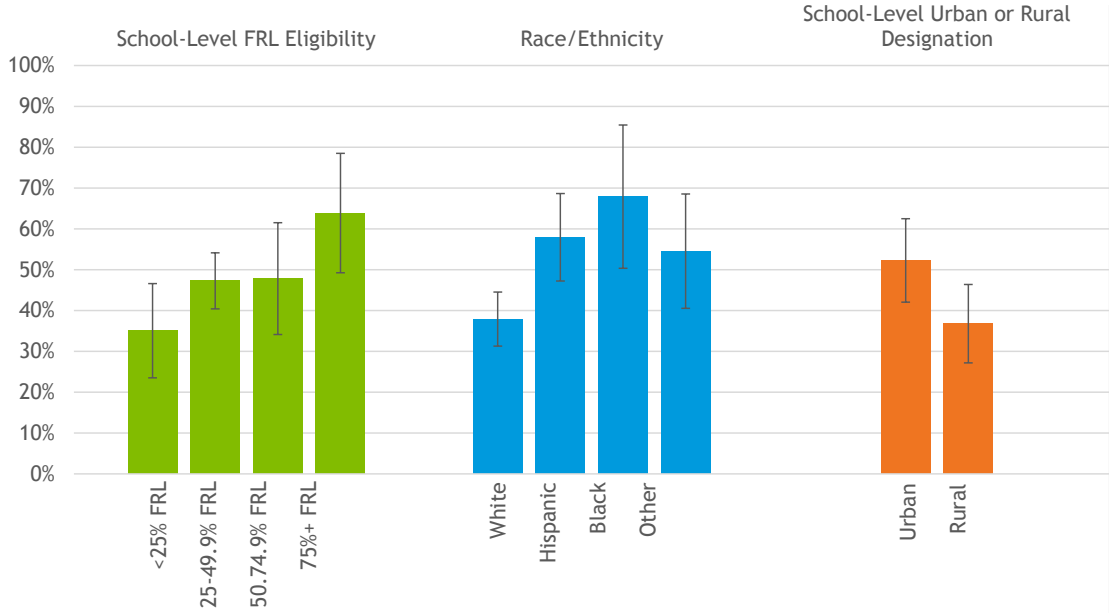
Third grade students in urban schools had a higher burden of caries experience (52.3 percent) compared with those in rural schools (36.8 percent).

Figure 2: Percentage of Students with Caries Experience, Kindergarten, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 3: Percentage of Students with Caries Experience, Third Grade, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Untreated Decay

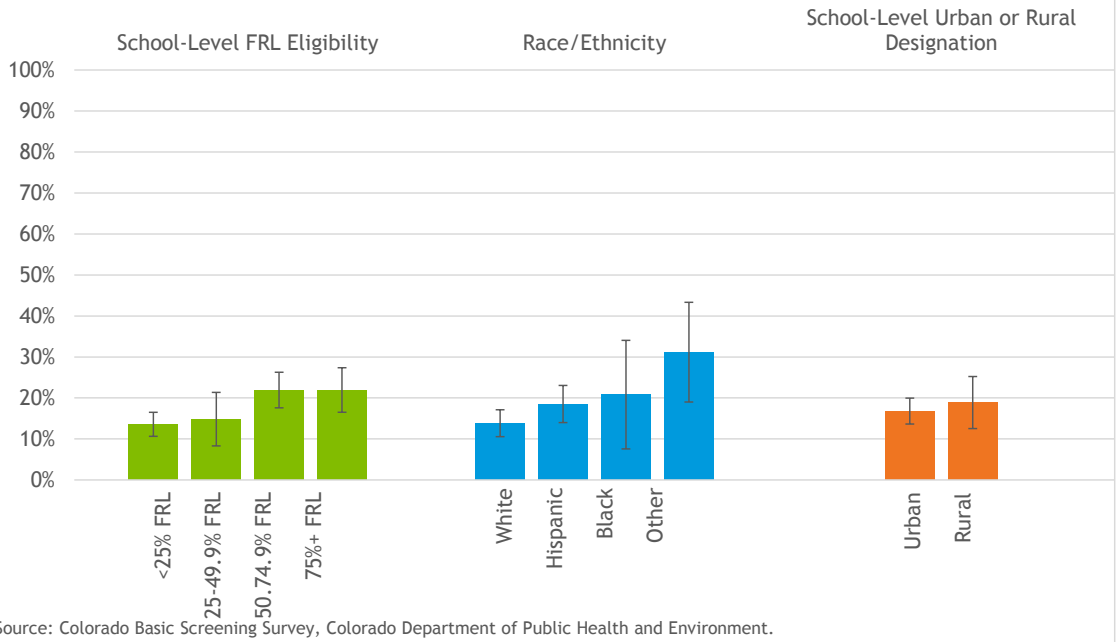
Students in kindergarten and third grade had similar burden of untreated decay (17.5 percent and 15.2 percent, respectively) (Figure 1). There were statistically significant differences among both kindergarten (Figure 4) and third grade (Figure 5) students by school-level SES, as measured by percent FRL eligibility and race/ethnicity. There was no statistically significant difference in burden of untreated decay among students in urban compared with rural schools.

Twenty-two percent (21.9 percent) of kindergarten students at both the lowest and second lowest SES level schools (50-74.9 percent and 75 percent or more FRL eligibility) had untreated decay, significantly higher than among kindergarten students at the highest SES schools (less than 25 percent FRL eligibility), 13.6 percent. Among third grade students, those in schools with the middle two levels of school SES (25-49.9 and 50-74.9 percent FRL eligibility) had significantly higher burden of untreated decay compared with students at the highest level SES schools (less than 25 percent FRL eligibility): 18.8 percent and 20.2 percent compared with 8.1 percent, respectively. Among students at the type of schools targeted for school-based sealant programs (50 percent or more FRL eligibility), 21.9 percent of kindergarten and 18.8 percent of third grade students had untreated decay, which were both significantly higher than among students in schools with less than 50 percent FRL eligibility.

Kindergarten students of “other” and Hispanic/Latino(a) race/ethnicity had higher burden of untreated decay (31.2 percent and 18.5 percent, respectively) compared with White students (13.8 percent). Third grade students of “other” and Black/African American race/ethnicity had a higher burden of untreated decay (27.2 percent and 25.0 percent,

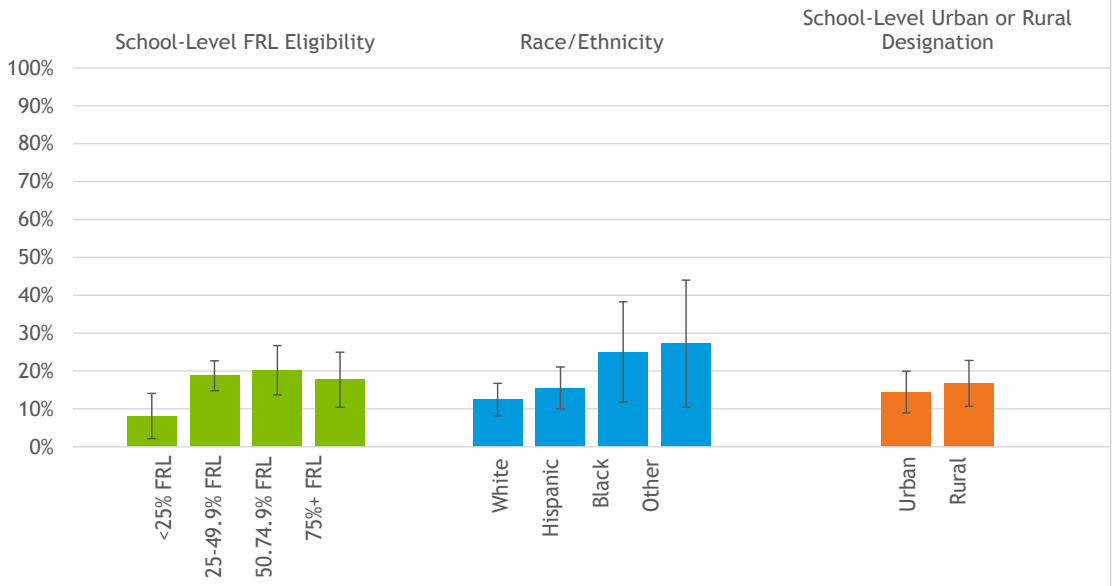
respectively) compared with White students (12.5 percent).

Figure 4: Percentage of Students with Untreated Decay, Kindergarten, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals.
A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 5: Percentage of Students with Untreated Decay, Third Grade, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals.
A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Treatment Urgency

Overall, almost one in six kindergarten students (17.5 percent) and about one in seven third grade students (14.7 percent) had either an early or urgent need for dental treatment. Treatment is important for those with early treatment needs, because needs can progress to urgent if left unchecked. Within this group of students with dental care needs, 3.0 percent of kindergarten students and 3.3 percent of third grade students had an urgent need for care (Figure 1). This difference by grade was not significant.

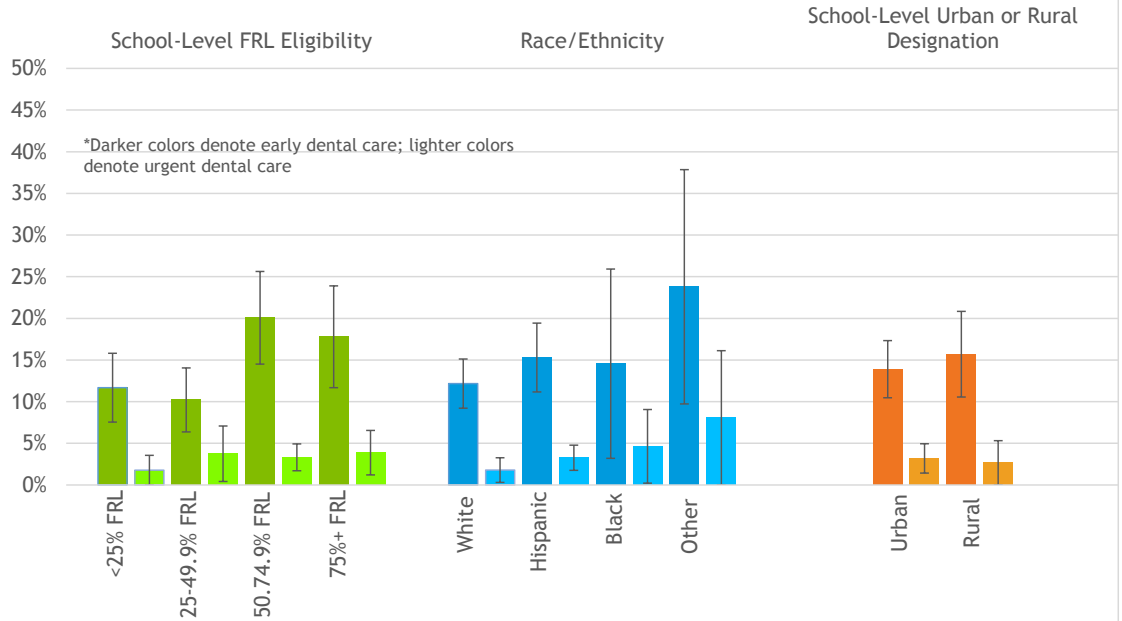
Kindergarten students in the type of schools targeted for school-based sealant programs (50 percent or more FRL eligibility) had a higher burden of early dental care needs (19.0 percent) compared with students in schools with less than 50 percent FRL eligibility (11.1 percent) (Figure 6). Overall dental care needs (early needs and urgent needs) were 22.6 percent and 13.7 percent, respectively. Urgent care needs alone were not significantly different between the groups. Looking at all four categories of school-level SES, kindergarten students in the two lowest SES schools levels (50-74.9 percent and 75 percent or more FRL eligibility) had a higher need for dental treatment (23.4 percent and 21.7 percent, respectively) compared with students in the highest SES schools (less than 25 percent FRL eligibility), 13.5 percent.

Similarly, third grade students in the type of schools targeted for school-based sealant programs (50 percent or more FRL eligibility) had a higher burden of early dental care needs (15.8 percent) compared with students in schools with less than 50 percent FRL eligibility (7.9 percent) (Figure 7). Overall dental care needs (early needs and urgent needs) were 19.4 percent and 10.9 percent, respectively. Urgent care needs alone were not significantly different between the groups. Looking at all four categories of school-level SES, 6.7 percent of third grade students at schools with the highest SES (less than 25 percent FRL eligibility) had some need for dental treatment compared with 17.6 percent of students at schools with 25-49.9 percent eligibility, 20.9 percent at schools with 50-74.9 percent FRL eligibility, and 18.3 percent of students at schools with 75 percent or more FRL eligibility.

Additionally, kindergarten students and third grade students had significant differences in treatment needs with regard to race/ethnicity (Figure 5 and Figure 6). Fourteen percent (14.0 percent) of White kindergarten students needed early or urgent dental treatment compared with 31.9 percent of kindergarten students with “other” race/ethnicity and 18.6 percent of students with Hispanic/Latino(a) race/ethnicity. About two percent (1.8 percent) of White kindergarten students had an urgent dental treatment need compared with 8.1 percent of kindergarten students with “other” race/ethnicity. For third grade students, only Black/African American students (26.2 percent) had a significantly higher need for dental treatment compared with their White counterparts (11.8 percent). No significant differences were found among third grade students for urgent dental treatment need.

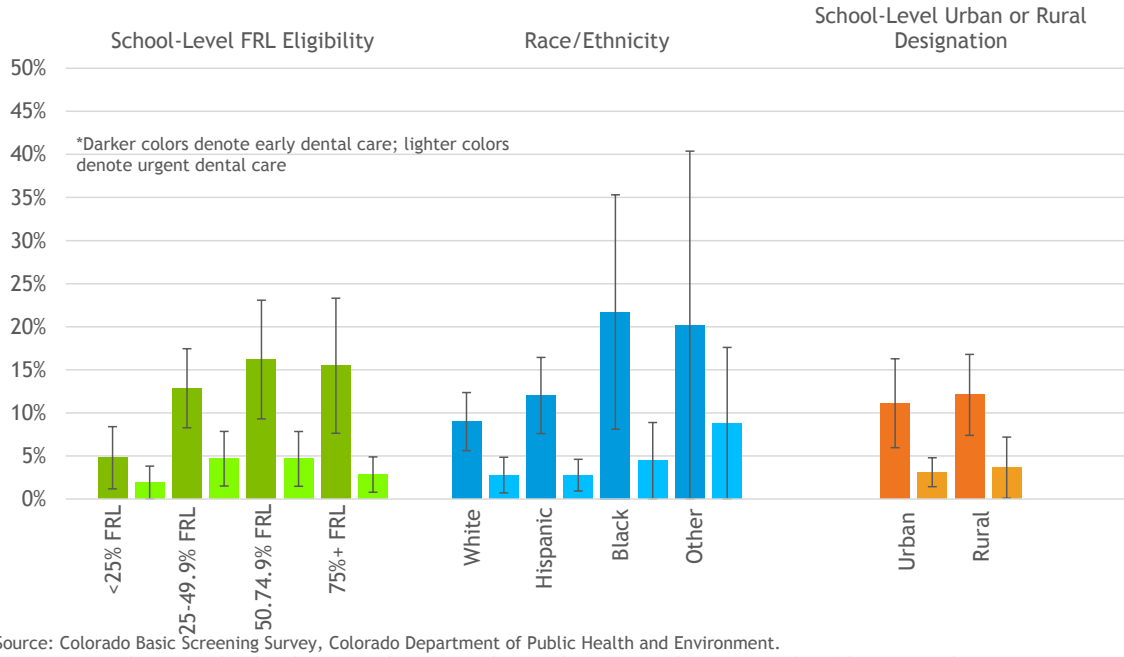
There were no significant differences in dental treatment needs between students at urban or rural schools for either grade.

Figure 6: Percentage of Students with Dental Treatment Needs by Urgency of Need, Kindergarten, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals.
A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 7: Percentage of Students with Dental Treatment Needs by Urgency of Need, Third Grade, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals.
A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

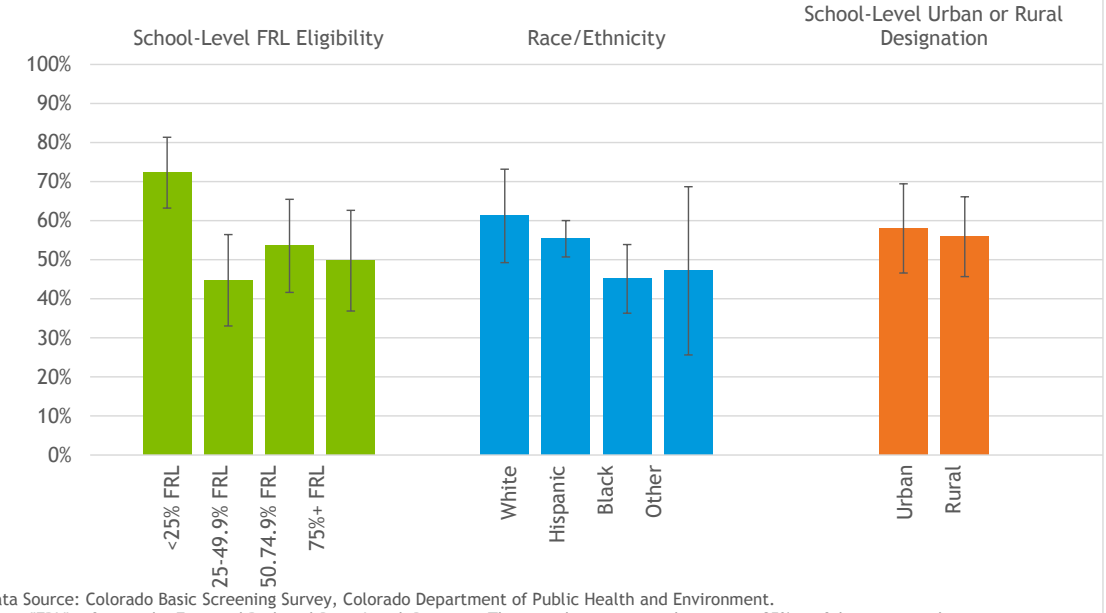
Sealants

Fifty-seven percent (57.4 percent) of third grade students had at least one dental sealant on a permanent molar (Figure 1). This was significantly higher among students at the highest SES schools: 72.3 percent of third grade students at schools with less than 25 percent FRL eligibility had sealants compared with 44.7 percent of students at schools with 25-49.9 percent FRL, 53.6 percent of students at schools with 50-74.9 percent FRL, and 49.8 percent of students at schools with 75 percent or more FRL eligibility. Among the type of schools targeted for school-based sealant programs (50 percent or more FRL eligibility), 51.3 percent of third grade students had a sealant on at least one permanent molar; this was not significantly different than among students at schools with less than 50 percent FRL eligibility, 62.1 percent (Figure 8).

Furthermore, Black/African American third grade students had lower prevalence of sealants on at least one molar (45.1 percent) compared with White third grade students (61.2 percent).

There were no statistically significant differences in sealants among students in urban or rural schools.

Figure 8: Percentage of Students with Dental Sealants, Third Grade, Colorado, 2016-17



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program. The error bars presented represent 95% confidence intervals.
A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Trends in Oral Health Outcomes

Overall Trends in Oral Health Outcomes

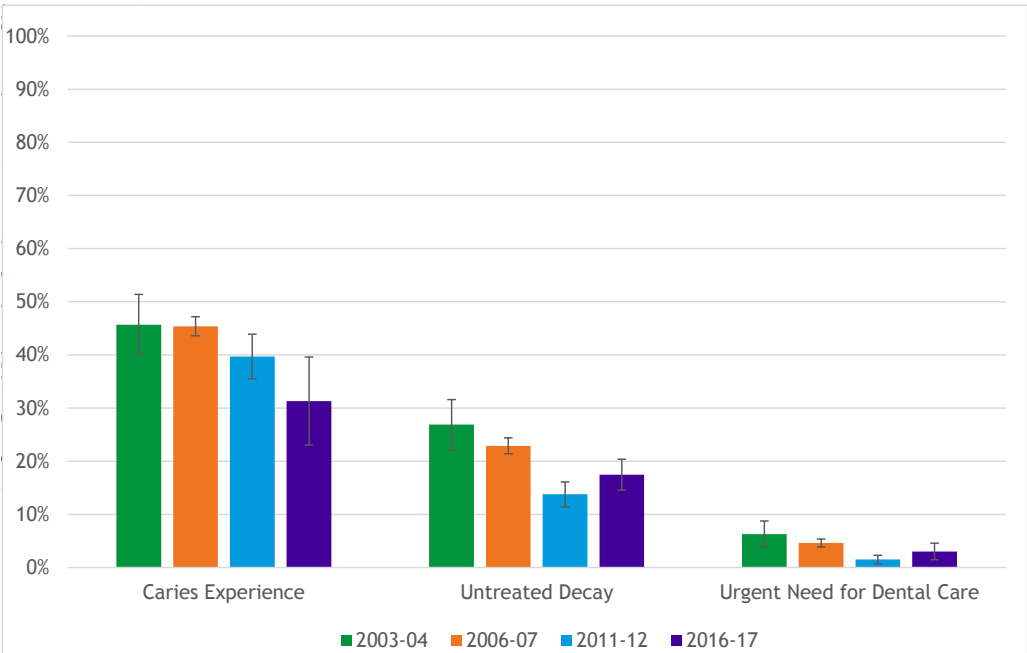
First looking at changes since the last BSS in 2011-2012 (Figures 9 and 10), there was a statistically significant increase in prevalence of having sealants among third grade students in 2016-17. The prevalence of having sealants did not change significantly among third

grade students from 2003-04 (35.2 percent) to 2006-07 (37.1 percent), then increased in 2011-12 (44.9 percent) and further increased in 2016-17 (57.4 percent), which was a significant increase from 2003-04 and 2006-07. The burden of caries experience, untreated decay, and urgent need for dental treatment did not change significantly overall from 2011-12 to 2016-17 among either kindergarten or third grade students.

There were several long-term significant changes since the BSS was first conducted. Although there were no significant overall differences in oral health outcomes from 2003-04 to 2006-07, there were many significant changes in prevalence of outcomes from 2006-07 to 2011-12 and from 2006-07 to 2016-17. Among kindergarten students, caries experience, untreated decay and urgent need for care did not change from 2003-04 to 2006-07, but then decreased in 2011-12. These burden estimates did not change significantly from 2011-12 to 2016-17, but the estimates in 2016-17 were significantly lower than in 2003-04 for caries experience and untreated decay. The 2003-04 to 2016-17 decrease was from 45.7 percent to 31.3 percent for caries experience and from 26.9 percent to 17.5 percent for untreated decay. The test of whether estimates changed at a constant percentage change per school year from the 2003-04 school year to the 2016-17 school year was significant only for caries experience, which decreased from 45.7 percent to 45.4 percent to 39.7 percent to 31.3 percent across the four administrations of this survey.

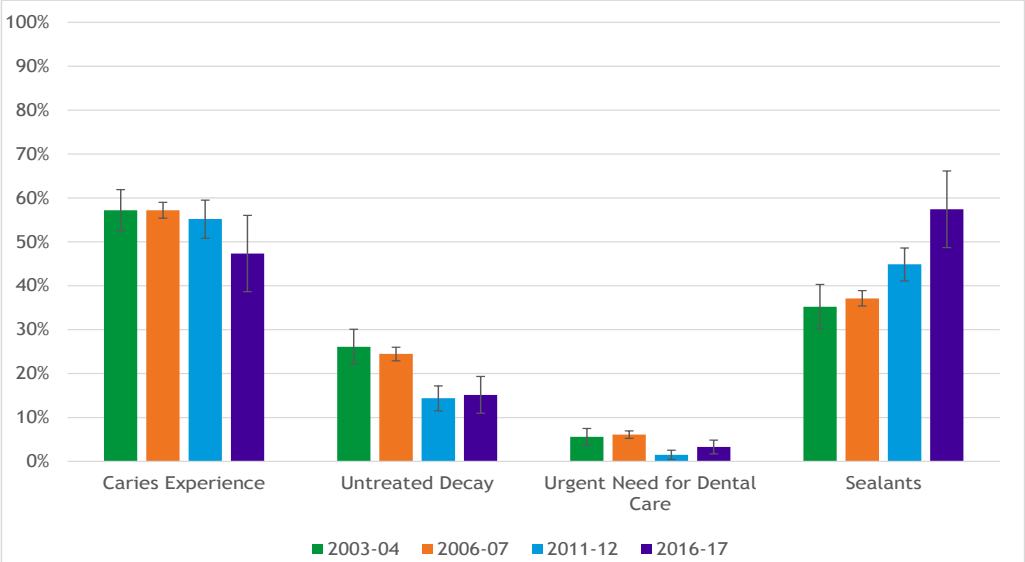
Caries experience has not changed significantly over this period among third grade students. Regarding untreated decay among third grade students, there was a significant decrease in 2016-17 (15.2 percent) compared with 2003-04 (26.1 percent). The percentage of third grade students with untreated decay did not change from 2003-04 to 2006-07, but then significantly decreased in 2011-12 and then remained level in 2016-17. A similar trend was found for urgent need for care among third grade students, with a decrease in 2011-12 compared with previous BSS years and then a leveling off from 2011-12 to 2016-17. As previously mentioned, there was a significant increase in prevalence of having a dental sealant from 2011-12 to 2016-17. The longer-term trend was also significant, increasing from 35.2 percent in 2003-04, to 37.1 percent in 2006-07, 44.9 percent in 2011-12, and then 57.4 percent in 2016-17.

Figure 9: Trends in Oral Health Outcomes, Kindergarten Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 10: Trends in Oral Health Outcomes, Third Grade Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Trends in Oral Health Disparities by Race/Ethnicity and School-Level Socioeconomic Status

Some improvements in oral health disparities among kindergarten and third grade students have occurred over time, but disparities remain. Trend data are presented by FRL eligibility and race/ethnicity within each grade level. Disparities between White and Hispanic/Latino(a) students are presented, but data for other races over time are suppressed due to low sample sizes in historical data. As discussed earlier in the report, the authors acknowledge the need for more data that represent other racial and ethnic groups in Colorado and did not intentionally exclude these groups.

The Colorado Department of Public Health and Environment acknowledges that generations-long social, economic and environmental inequities result in adverse health outcomes. They affect communities differently and have a greater influence on health outcomes than either individual choices or one's ability to access health care. Reducing health disparities through policies, practices and organizational systems can help improve opportunities for all Coloradans.

Caries Experience

The percentage of both kindergarten and third grade students with caries experience has reduced over time for children at schools of all FRL eligibility levels. However, this change was only statistically significant for kindergarten students and third grade students at the highest SES schools (less than 25 percent FRL eligibility) and for kindergarten students at the lowest SES schools (greater than 75 percent FRL eligibility) (Figures 11 and 12). For both kindergarten and third grade students, there remains a pervasive disparity in caries experience between students at schools with less than 25 percent FRL eligibility and lower SES schools, particularly those with 75 percent or more FRL eligibility.

Kindergarten students in the highest SES schools (less than 25 percent FRL eligibility) had significantly lower caries experience compared with each of the other SES school categories in 2016-17. In 2016-17, 14.9 percent of kindergarten students at schools with less than 25 percent eligibility had caries experience compared with 31.6 percent in schools with 25-49.9 percent FRL eligibility, 42.5 percent in schools with 50-74.9 percent FRL eligibility, and 45.4 percent in schools with 75 percent or more eligibility. The decreasing trend in caries experience among kindergarten students was significant among students from schools with less than 25 percent FRL eligibility, with a decrease from 35.2 percent in 2003-04, to 34.4 percent in 2006-07, to 23.1 percent in 2011-12 and to 14.9 percent in 2016-17. The decreasing trend was also significant among kindergarten students from schools with 75 percent or more FRL eligibility, with a decrease from 72.7 percent in 2003-04, to 64.4 percent in 2006-07, to 53.1 percent in 2011-12 and to 45.4 percent in 2016-17. The disparity between students in the highest SES schools and lowest SES schools has improved for kindergarten students in terms of the absolute disparity (37.5 in 2003-04 to 30.5 in 2016-17) but has worsened in terms of relative disparity (2.1 in 2003-04 to 3.0 in 2016-17).

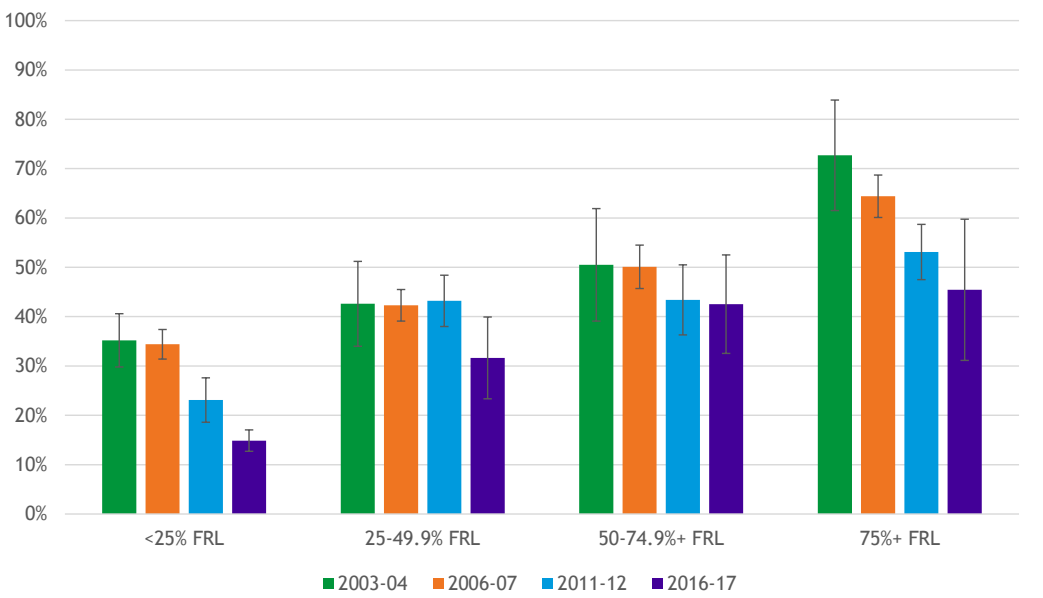
For third grade students, the disparity in 2016-17 is only statistically significant between the highest SES schools (those with less than 25 percent FRL eligibility), where 35.1 percent of students had caries experience, and the lowest SES schools (75 percent or more FRL eligibility), where 63.9 of students had caries experience. The trend in caries experience among third grade students was only significant among students from schools with less than

25 percent FRL eligibility, with a decrease from 52.1 percent in 2003-04, to 46.7 percent in 2006-07, to 40.7 percent in 2011-12 and to 35.1 percent in 2016-17. The disparity between students in the highest SES school and lowest SES schools has worsened for third grade students in terms of both absolute disparity (21.3 in 2003-04 to 28.8 in 2016-17) and relative disparity (1.4 in 2003-04 to 1.8 in 2016-17).

The burden of caries experience among White kindergarten students has not changed over time (Figure 13). Among Hispanic/Latino(a) kindergarten students, the prevalence of caries experience did not change significantly from 2003-04 to 2011-12, but then decreased in 2016-17. The total decrease was from 62.9 percent in 2003-04 to 40.9 percent in 2016-17. White students had a significantly lower prevalence of caries experience than Hispanic/Latino(a) students. The disparity between White students and Hispanic/Latino(a) students has improved for kindergarten students in terms of both the absolute disparity (27.1 in 2003-04 to 17.5 in 2016-17) and the relative disparity (1.8 in 2003-04 to 1.7 in 2016-17).

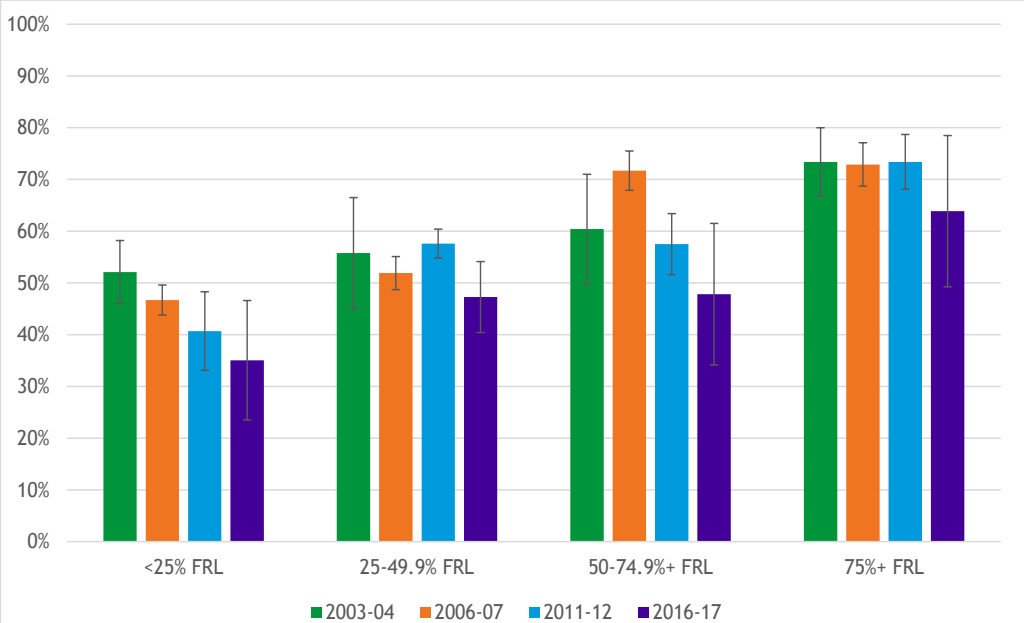
Over time, the burden of caries experience has not changed among Hispanic/Latino(a) students in third grade (Figure 14). Among White third grade students, the prevalence of caries experience decreased from 53.3 percent in 2003-04 to 37.9 percent in 2016-17. White students (37.9 percent) had lower caries experience when compared with their Hispanic/Latino(a) counterparts (57.9 percent) in 2016-17. The disparity between White students and Hispanic/Latino(a) students has worsened for third grade students in terms of both absolute disparity (14.0 in 2003-04 to 20.0 in 2016-17) and relative disparity (1.3 in 2003-04 to 1.5 in 2016-17).

Figure 11: Trends in Caries Experience by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Kindergarten Students, Colorado



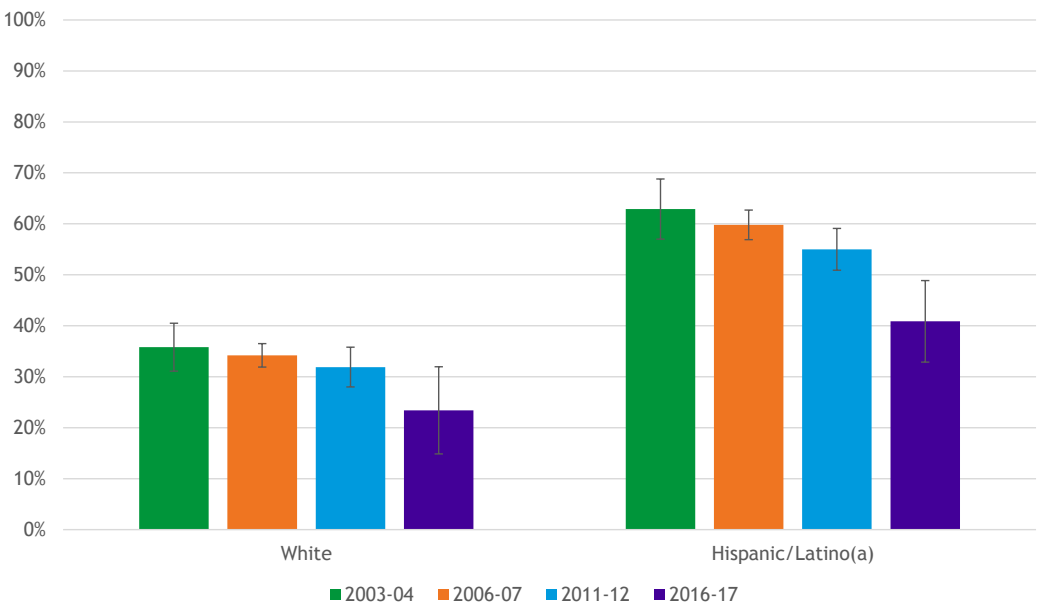
Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 12: Trends in Caries Experience by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Third Grade Students, Colorado



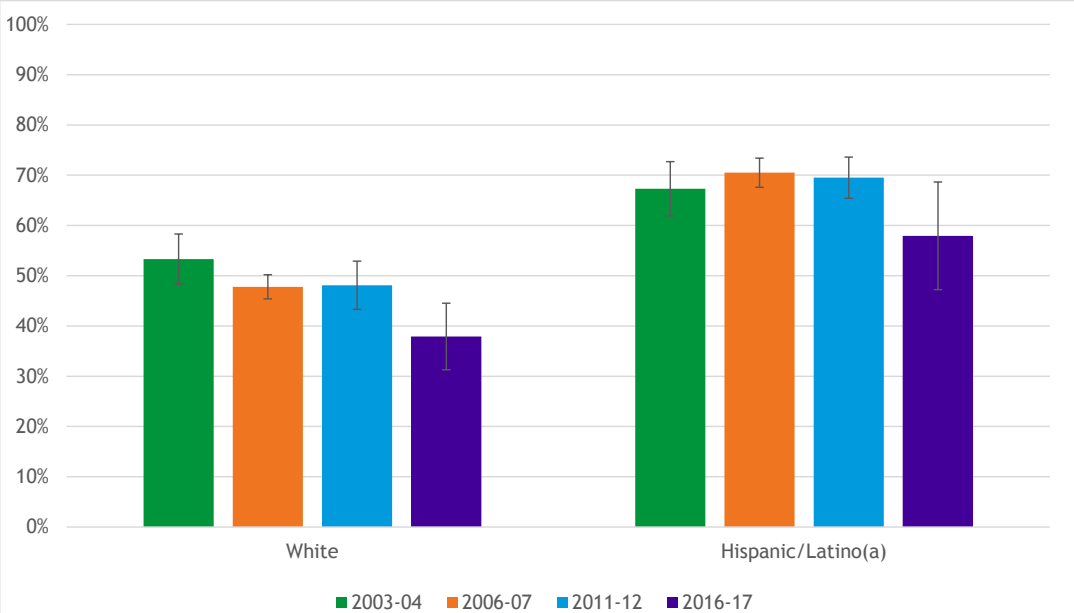
Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 13: Trends in Caries Experience by Race/Ethnicity, Kindergarten Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 14: Trends in Caries Experience by Race/Ethnicity, Third Grade Students, Colorado



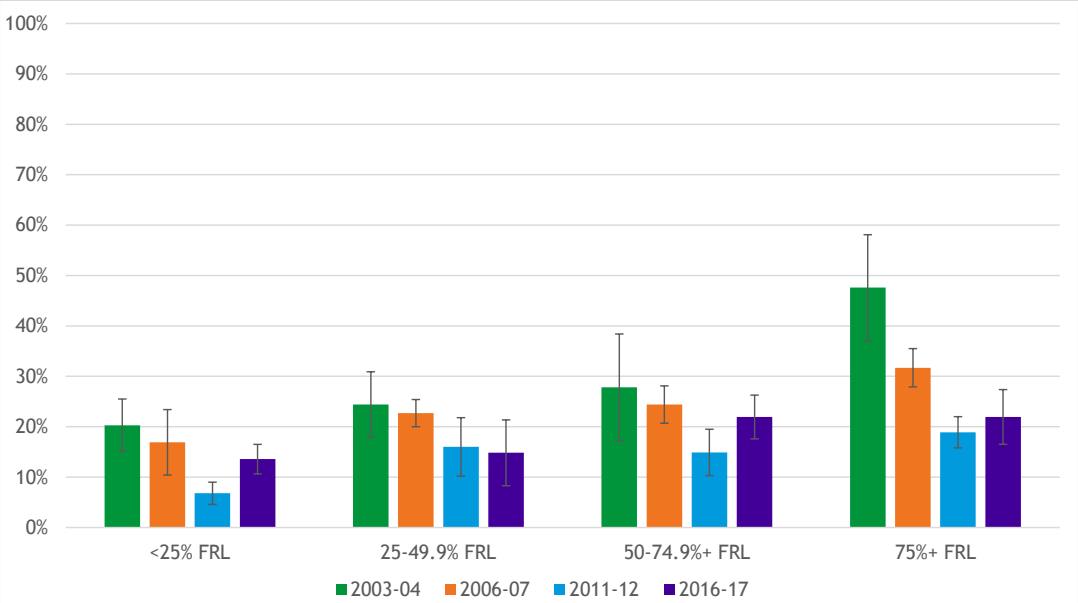
Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Untreated Decay

The test of whether estimates of untreated decay changed at a constant percentage change per school year from the 2003-04 school year to the 2016-17 school year was significant only among kindergarten students in schools with 25-49.9 percent FRL eligibility. The percentage of these students with untreated decay decreased from 24.4 percent in 2003-04, to 22.7 percent in 2006-07, to 16.0 percent in 2011-12, and then to 14.8 percent in 2016-17. Additionally, the percentage of kindergarten students with untreated decay in schools with 75 percent or more FRL eligibility decreased significantly from 47.6 percent in 2003-04 to 21.9 percent in 2016-17. There was a similar decrease in untreated decay among third grade students in schools with 75 percent or more FRL eligibility (41.1 percent in 2003-04 to 17.7 percent in 2016-17) and also a decrease among third grade students in schools with less than 25 percent FRL eligibility (18.4 percent in 2003-04 to 8.1 percent in 2016-17).

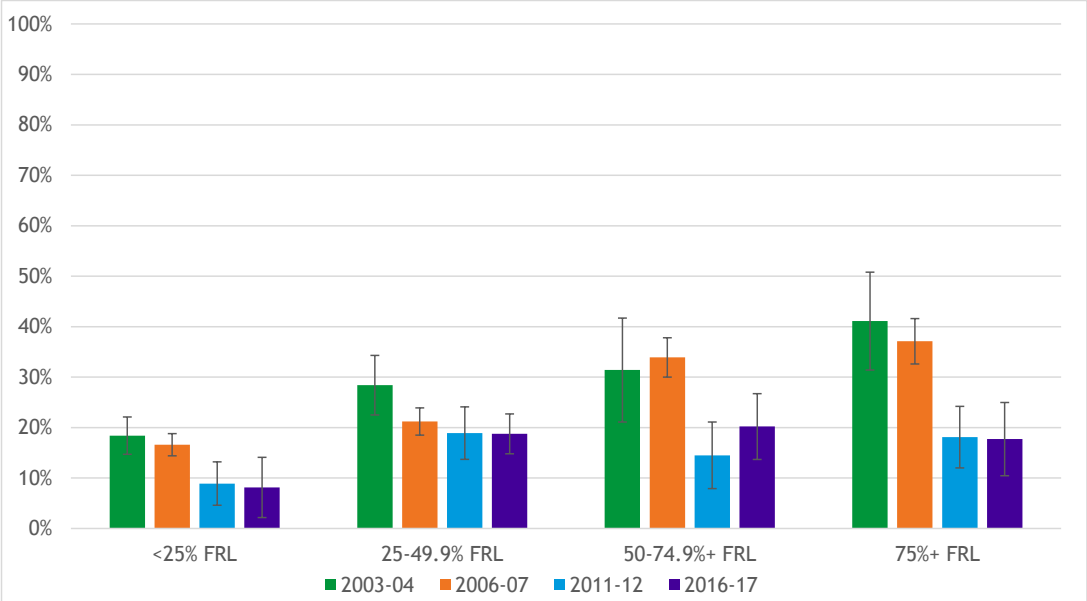
Kindergarten students from schools with the lowest SES level (75 percent or more FRL eligibility) had significantly higher levels of untreated decay than students from schools with higher SES (less than 25 percent FRL eligibility). The disparity between students in the highest SES school and lowest SES schools has improved for kindergarten students both in terms of absolute disparity (27.3 in 2003-04 to 8.3 in 2016-17) and relative disparity (2.3 in 2003-04 to 1.6 in 2016-17). The disparity between students in the highest SES schools and lowest SES schools has improved for third grade students in terms of absolute disparity (22.7 in 2003-04 to 9.6 in 2016-17), but has not changed in terms of relative disparity (2.2 in 2003-04 to 2.2 in 2016-17).

Figure 15: Trends in Untreated Decay by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Kindergarten Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 16: Trends in Untreated Decay by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Third Grade Students, Colorado

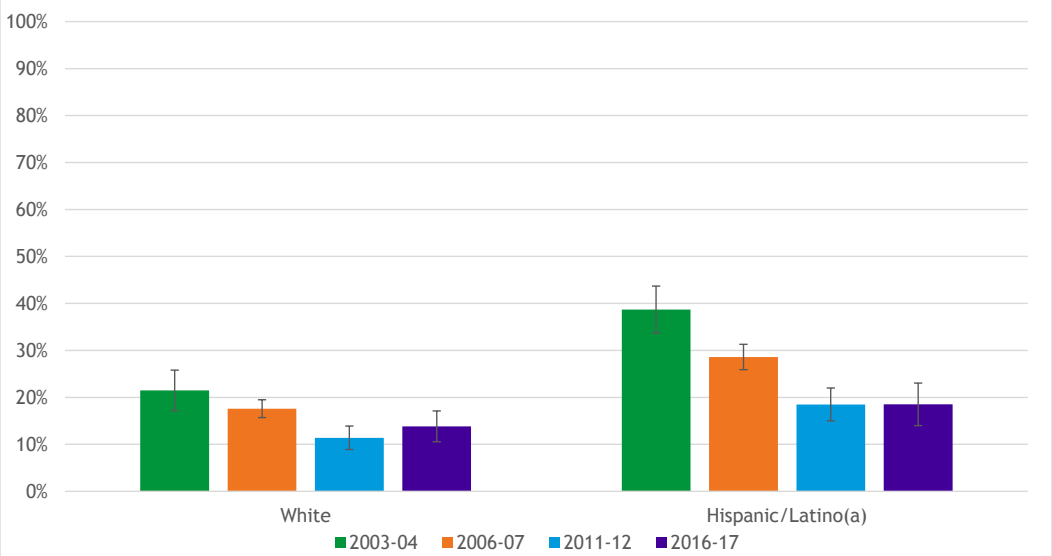


Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

The percentage of White kindergarten students with untreated decay did not change from 2003-04 to 2006-07, but decreased from 17.6 percent in 2006-07 to 11.4 percent in 2011-12 and then did not significantly change in 2016-17 (13.8 percent) (Figure 17). The prevalence of untreated decay among Hispanic/Latino(a) kindergarten students decreased from 38.7 percent in 2003-04, to 28.6 percent in 2006-07, to 18.5 percent in 2011-12, but did not change in 2016-17 (18.5 percent). Disparities in untreated decay between White and Hispanic/Latino(a) students, which existed in 2003-04, 2006-07 and 2011-12, were still statistically significant for kindergarten students in 2016-17. The disparity between White students and Hispanic/Latino(a) students has improved for kindergarten students both in terms of absolute disparity (17.2 in 2003-04 to 4.7 in 2016-17) and relative disparity (1.8 in 2003-04 to 1.3 in 2016-17).

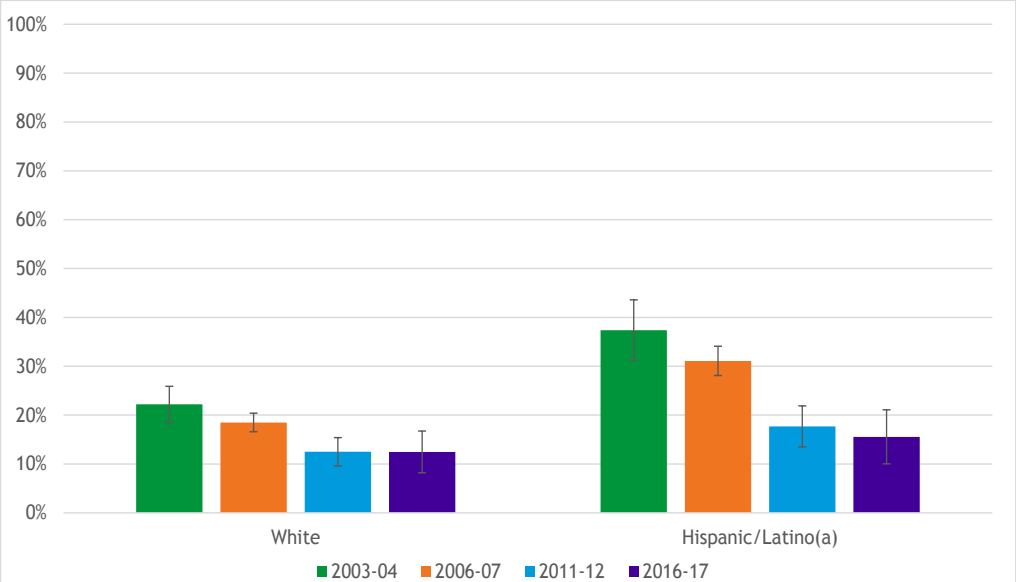
The percentage of students with untreated decay has significantly declined among White third grade students from 22.2 percent in 2003-04 to 12.5 percent in 2016-17, and among Hispanic/Latino(a) third grade students from 37.4 percent in 2003-04 to 15.6 percent in 2016-17. The gap between White students and Hispanic/Latino(a) students, which was present in 2003-04 and 2006-07, was not statistically significant in 2011-12 or 2016-17. The percentage of students with untreated decay among both groups of students was very similar in 2016-17: 12.5 percent for White students and 15.6 percent for Hispanic/Latino(a) students (Figure 18). The disparity between White students and Hispanic/Latino(a) students has improved for third grade students both in terms of the absolute disparity (15.2 in 2003-04 to 3.1 in 2016-17) and the relative disparity (1.7 in 2003-04 to 1.2 in 2016-17).

Figure 17: Trends in Untreated Decay by Race/Ethnicity, Kindergarten Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 18: Trends in Untreated Decay by Race/Ethnicity, Third Grade Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Dental Sealants

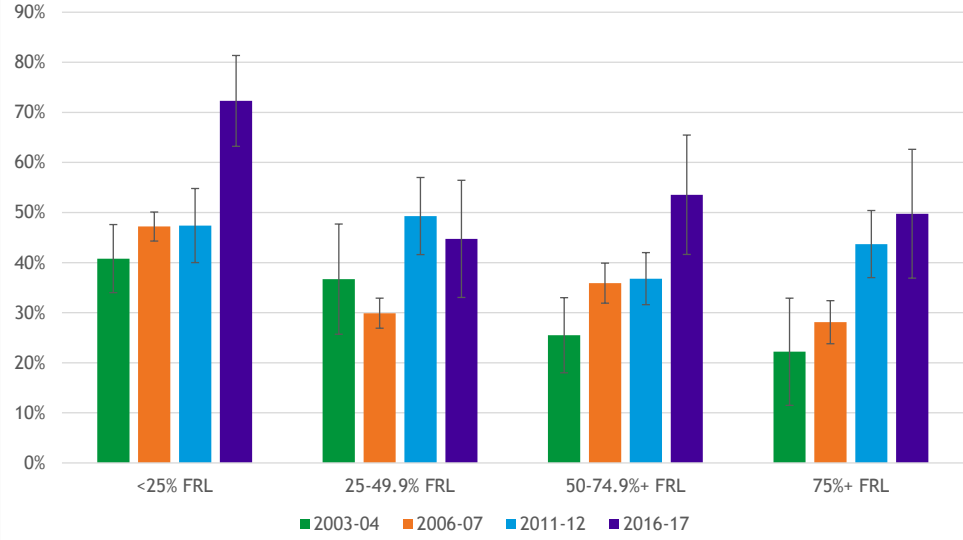
The test of whether estimates of the prevalence of having a dental sealant changed at a constant percentage per school year from 2003-04 to 2016-17 was significant only among third grade students who were in the lowest SES schools (75 percent or more FRL eligibility) and among Hispanic/Latino(a) third grade students from 2003-4 to 2016-17. The percentage of third grade students in the lowest SES schools who had dental sealants increased from 22.2 percent in 2003-04, to 28.1 percent in 2006-07, to 43.7 percent in 2011-12 and then to 49.8 percent in 2016-17. The percentage of Hispanic/Latino(a) third grade students who had dental sealants increased from 25.7 percent in 2003-04, to 30.8 percent in 2006-07, to 41.8 percent in 2011-12 and to 55.4 percent in 2016-17.

Additionally, the percentage of third grade students with dental sealants in schools with less than 25 percent FRL eligibility increased significantly from 40.8 percent in 2003-04 to 72.3 percent in 2016-17. There was also an increase in dental sealants among third grade students in schools with 50-74.9 percent FRL eligibility (25.5 percent in 2003-04 to 53.6 percent in 2016-17) and also an increase among White third grade students (38.1 percent in 2003-04 to 61.2 percent in 2016-17).

The prevalence of sealants among third grade students was highest among those at the highest SES schools. In 2016-17, 72.3 percent of third grade students at schools with less than 25 percent eligibility had a sealant on at least one molar compared with 44.7 percent in schools with 25-49.9 percent FRL eligibility, 53.6 percent in schools with 50-74.9 percent FRL eligibility, and 49.8 percent in schools with 75 percent or more eligibility. The disparity between students in the highest SES schools and lowest SES schools has improved for third grade students in terms of relative disparity (0.5 in 2003-04 to 0.7 in 2016-17) but has

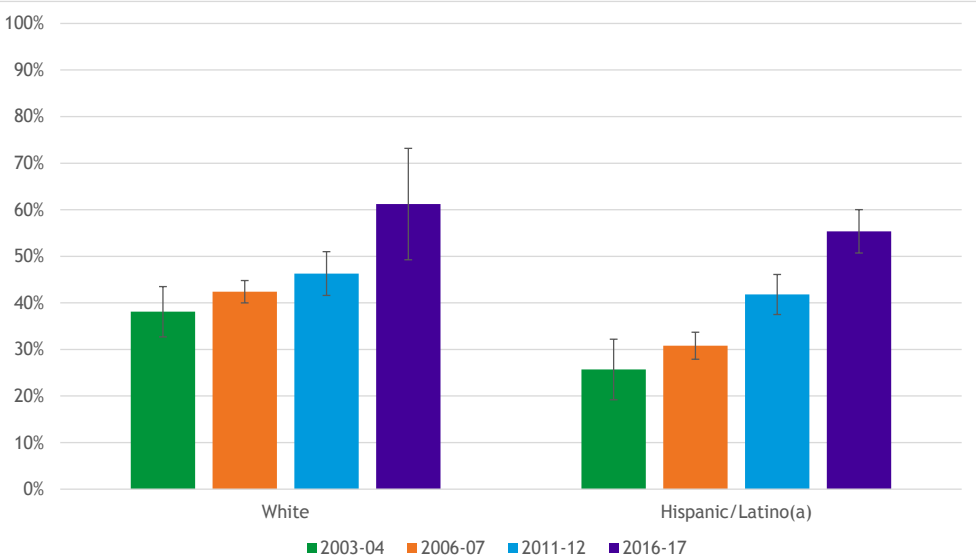
worsened in terms of absolute disparity (18.6 in 2003-04 to 22.5 in 2016-17). The disparity between White students and Hispanic/Latino(a) students has improved for third grade students both in terms of absolute disparity (12.4 in 2003-04 to 5.8 in 2016-17) and relative disparity (0.7 in 2003-04 to 0.9 in 2016-17).

Figure 19: Trends in Prevalence of Having a Dental Sealant by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Third Grade Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: "FRL" refers to the Free and Reduced-Price Lunch Program.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Figure 20: Trends in Prevalence of Having a Dental Sealant by Race/Ethnicity, Third Grade Students, Colorado



Data Source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment.
Note: The error bars presented represent 95% confidence intervals. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Conclusion

The 2016-17 data suggest that while Colorado has made great strides in children's oral health over the past 10 to 15 years, there is still work to do to improve the oral health of Colorado children and reduce disparities. There is still a substantial need for improved oral health care access and use across the state: 17.5 percent of kindergarten students and 15.2 percent of third grade students have untreated decay and need dental treatment. This equates to more than 21,000 children across the state in these two grade levels alone. Untreated decay can progress to become a more serious health issue if left unchecked.

Significant disparities in oral health have been pervasive: students of color and students who attend low SES schools continue to have poorer oral health outcomes than their White and higher SES counterparts. The disparities among Hispanic/Latino(a) students have improved at varying levels for caries experience among kindergarten students, untreated decay among both kindergarten and third grade students, and dental sealants among third grade students. The disparities among students in the highest SES schools compared with those in the lowest SES schools has improved for untreated decay among both kindergarten and third grade students. At the same time, caries experience disparities worsened for both Hispanic/Latino(a) third grade students and those at the lowest SES schools.

Programs such as Cavity Free at Three and school sealant programs have clearly improved outcomes for Colorado children. Continuation and expansion of these and other preventive programs to communities with the most need should be a priority in order to reduce the burden of oral disease overall and to prevent demographic disparities from negatively affecting Colorado children over the next decade.

Appendix

Table A.1: Sample Demographics for the Basic Screening Survey, Colorado, 2016-17

	Unweighted Frequency with Available Data	Weighted Estimate	95% Confidence Interval
Kindergarten			
Age (years)			
Mean age	1,771	5.9 (SE 0.04)	N/A
Age range		4 -7	N/A
4 year olds		0.4%	0.0% - 1.1%
5 year olds		56.6%	49.7% - 63.5%
6 year olds		41.8%	35.4% - 48.3%
7 year olds		1.1%	0.2% - 2.0%
Sex			
Male	1,765	49.5%	46.1% - 52.9%
Female		50.5%	47.1% - 53.9%
Race/Ethnicity			
White	1,753	54.1%	40.1% - 68.0%
Hispanic/Latino(a)		31.5%	18.1% - 44.8%
Black/African-American		4.8%	1.8% - 7.8%
Other		9.7%	5.5% - 13.8%
School-Level Free and Reduced-Price Lunch Program Eligibility			
Less than 25.0%	1,771	33.7%	6.6% - 60.7%
25.0-49.9%		23.0%	6.4% - 39.6%
50.0-74.9%		22.0%	5.2% - 38.8%
75.0% or more		21.3%	4.3% - 38.4%
School-Level Urban or Rural Designation			
Urban	1,771	67.2%	45.6% - 88.9%
Rural		32.8%	11.3% - 54.4%
Third Grade			
Age (years)			
Mean age	1,788	9.0 (SE 0.06)	N/A
Age range		7 - 11	N/A
7 year olds		0.4%	0.0% - 1.2%
8 year olds		51.9%	41.7% - 62.1%
9 year olds		44.2%	34.6% - 53.8%
10 year olds		3.3%	0.5% - 6.2%
11 year olds		0.1%	0.0% - 0.4%
Sex			
Male	1,788	53.5%	50.9% - 56.2%
Female		46.5%	43.8% - 49.1%
Race/Ethnicity			
White	1,778	53.2%	37.4% - 68.9%
Hispanic/Latino(a)		35.1%	20.6% - 49.5%
Black/African American		4.3%	1.7% - 6.8%
Other		7.5%	3.7% - 11.3%
School-Level Free and Reduced-Price Lunch Program Eligibility			
Less than 25.0%	1,788	33.9%	6.8% - 60.9%
25.0-49.9%		21.7%	5.9% - 37.4%
50.0-74.9%		19.8%	4.0% - 35.7%
75.0% or more		24.7%	6.5% - 42.9%
School-Level Urban or Rural Designation			
Urban	1,788	68.1%	45.6% - 90.7%
Rural		31.9%	9.3% - 54.4%

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.2: Oral Health Outcomes by Grade Level, Colorado, 2016-17

	Unweighted Frequency with Available Data	Weighted Estimate	95% Confidence Interval
Kindergarten			
Caries Experience			
No caries experience	1,770	68.7%	60.4% - 76.9%
Caries experience		31.3%	23.1% - 39.6%
Untreated Decay			
No untreated decay	1,770	82.5%	79.6% - 85.4%
Has untreated decay		17.5%	14.6% - 20.4%
Quadrants of Untreated Decay			
No untreated decay	1,770	82.5%	79.6% - 85.4%
1 quadrant		8.5%	6.0% - 10.9%
2 quadrants		3.6%	2.4% - 4.9%
3 quadrants		2.4%	1.7% - 3.1%
4 quadrants		3.0%	1.8% - 4.1%
Treatment Urgency			
No obvious problem	1,762	82.5%	79.5% - 85.5%
Early dental care		14.5%	11.7% - 17.3%
Urgent dental care		3.0%	1.5% - 4.6%
Third Grade			
Caries Experience			
No caries experience	1,786	52.7%	44.0% - 61.4%
Caries experience		47.3%	38.6% - 56.0%
Untreated Decay			
No untreated decay	1,785	84.8%	80.6% - 89.0%
Has untreated decay		15.2%	11.0% - 19.4%
Quadrants of Untreated Decay			
No untreated decay	1,785	84.8%	80.6% - 89.0%
1 quadrant		7.6%	5.5% - 9.8%
2 quadrants		3.6%	2.0% - 5.2%
3 quadrants		1.3%	0.5% - 2.1%
4 quadrants		2.7%	1.1% - 4.2%
Treatment Urgency			
No obvious problem	1,783	85.3%	80.8% - 89.7%
Early dental care		11.4%	7.6% - 15.3%
Urgent dental care		3.3%	1.7% - 4.9%
Sealants			
No sealants	1,681	42.6%	33.9% - 51/3%
Sealant on at least one permanent molar		57.4%	48.7% - 66.1%

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.3: Oral Health Outcomes by Grade Level and Race/Ethnicity, Colorado, 2016-17

Kindergarten

	White	Hispanic/ Latino(a)	Black/African American	Other	Rao-Scott Chi-Square *(p)*
Caries experience	23.4% (14.9% - 32.0%)	40.9% (32.1% - 49.7%)	34.7% (15.6% - 53.7%)	41.5% (26.6% - 56.4%)	<0.001
Untreated decay	13.8% (10.6% - 17.1%)	18.5% (14.0% - 23.0%)	20.8% (7.6% - 34.1%)	31.2% (19.0% - 43.3%)	0.004
Early need for dental care	12.2% (9.2% - 15.1%)	15.3% (11.2% - 19.4%)	14.6% (3.2% - 25.9%)	23.8% (9.7% - 37.8%)	0.125
Urgent need for dental care	1.8% (0.3% - 3.3%)	3.3% (1.8% - 4.8%)	4.6% (0.2% - 9.1%)	8.1% (0.0% - 17.9%)	0.053

Third Grade

	White	Hispanic/ Latino(a)	Black/African American	Other	Rao-Scott Chi-Square *(p)*
Caries experience	37.9% (31.3% - 44.5%)	57.9% (47.2% - 68.6%)	67.9% (50.4% - 85.4%)	54.5% (40.5% - 68.5%)	<0.001
Untreated decay	12.5% (8.2% - 16.8%)	15.6% (10.0% - 21.1%)	25.0% (11.8% - 38.3%)	27.2% (10.5% - 44.0%)	0.030
Early need for dental care	9.0% (5.6% - 12.4%)	12.0% (7.6% - 16.4%)	21.7% (8.1% - 35.3%)	20.2% (0.0% - 43.6%)	0.176
Urgent need for dental care	2.8% (0.7% - 4.8%)	2.8% (0.9% - 4.6%)	4.4% (0.0% - 9.1%)	8.8% (0.0% - 18.2%)	0.192
Sealants	61.2% (49.3% - 73.2%)	55.4% (50.7% - 60.0%)	45.1% (36.3% - 53.9%)	47.2% (25.6% - 68.7%)	0.108

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.4: Oral Health Outcomes by Grade Level and by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Colorado, 2016-17

Kindergarten

	Less than 25.0%	25.0% - 49.9%	50.0% - 74.9%	75.0% or More	Rao-Scott Chi-Square *(p)*
Caries experience	14.9% (12.7% - 17.1%)	31.6% (23.4% - 39.9%)	42.5% (32.6% - 52.5%)	45.4% (31.1% - 59.7%)	<0.001
Untreated decay	13.6% (10.6% - 16.5%)	14.8% (8.3% - 21.4%)	21.9% (17.6% - 26.3%)	21.9% (16.5% - 27.4%)	0.006
Early need for dental care	11.7% (7.6% - 15.8%)	10.2% (6.4% - 14.0%)	20.1% (14.5% - 25.6%)	17.8% (11.7% - 23.9%)	0.006
Urgent need for dental care	1.8% (0.0% - 4.9%)	3.7% (0.4% - 7.1%)	3.3% (1.7% - 4.9%)	3.9% (1.2% - 6.6%)	0.661

Third Grade

	Less than 25.0%	25.0% - 49.9%	50.0% - 74.9%	75.0% or More	Rao-Scott Chi-Square *(p)*
Caries experience	35.1% (23.5% - 46.6%)	47.3% (40.4% - 54.1%)	47.8% (34.1% - 61.5%)	63.9% (49.3% - 78.5%)	<0.001
Untreated decay	8.1% (2.2% - 14.1%)	18.8% (14.8% - 22.7%)	20.2% (13.7% - 26.7%)	17.7% (10.5% - 25.0%)	0.003
Early need for dental care	4.8% (1.2% - 8.4%)	12.9% (8.3% - 17.5%)	16.2% (9.3% - 23.1%)	15.5% (7.6% - 23.3%)	<0.001
Urgent need for dental care	1.9% (0.0% - 4.8%)	4.7% (1.5% - 7.9%)	4.7% (1.5% - 7.9%)	2.8% (0.8% - 4.9%)	0.413
Sealants	72.3% (63.2% - 81.4%)	44.7% (33.0% - 56.4%)	53.6% (42.6% - 65.5 %)	49.8% (36.9% - 62.6%)	<0.001

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.4b: Oral Health Outcomes by Grade Level and by School-Level Free and Reduced-Price Lunch Program (FRL) Eligibility, Colorado, 2016-17

Kindergarten			
	Less than 50.0%	50% or More	Rao-Scott Chi-Square *(p)*
Caries experience	21.7% (14.9% - 28.5%)	44.0% (35.3% - 52.6%)	<0.001
Untreated decay	14.1% (10.9% - 17.3%)	21.9% (18.5% - 25.4%)	<0.001
Early need for dental care	11.1% (8.1% - 14.1%)	19.0% (14.9% - 23.0%)	<0.001
Urgent need for dental care	2.6% (0.2% - 5.0%)	3.6% (2.0% - 5.2%)	0.502
Third Grade			
	Less than 50.0%	50% or More	Rao-Scott Chi-Square *(p)*
Caries experience	39.8% (31.0% - 48.6%)	56.7% (45.3% - 68.1%)	0.001
Untreated decay	12.3% (7.0% - 17.6%)	18.8% (13.9% - 23.8%)	0.041
Early need for dental care	7.9% (4.1% - 11.8%)	15.8% (10.5% - 21.1%)	0.002
Urgent need for dental care	3.0% (0.6% - 5.4%)	3.6% (1.9% - 5.4)	0. 659
Sealants	62.1% (50.5% - 73.8%)	51.3% (42.0% - 60.6%)	0.088

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.5: Oral Health Outcomes by Grade Level and by School-Level Urban or Rural Designation, Colorado, 2016-17

Kindergarten			
	Urban	Rural	Rao-Scott Chi-Square *(p)*
Caries experience	32.4% (21.1% - 43.8%)	29.1% (19.4% - 38.8%)	0.646
Untreated decay	16.8% (13.6% - 20.0%)	18.9% (12.5% - 25.2%)	0.554
Early need for dental care	13.9% (10.5% - 17.3%)	15.7% (10.6% - 20.8%)	0.558
Urgent need for dental care	3.2% (1.4% - 4.9%)	2.7% (0.0% - 5.7%)	0.089
Third Grade			
	Urban	Rural	Rao-Scott Chi-Square *(p)*
Caries experience	52.3% (42.0% - 62.5%)	36.8% (27.2% - 46.4%)	0.005
Untreated decay	14.5% (8.9% - 20.0%)	16.8% (10.7% - 22.8%)	0.576
Early need for dental care	11.1% (6.0% - 16.3%)	12.1% (7.4% - 16.8%)	0.782
Urgent need for dental care	3.1% (1.4% - 4.8%)	3.6% (0.1% - 7.2)	0. 782
Sealants	58.0% (46.6% - 69.4%)	55.9% (45.7% - 66.1%)	0.779

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.6: Trends in Caries Experience by Grade Level, Colorado

Kindergarten					
	2003-2004	2006-2007	2011-2012	2016-2017	*p-value*
Overall	45.7% (40.0% - 50.1%)	45.4% (43.6% - 47.2%)	39.7% (35.5% - 43.9%)	31.3% (23.1% - 39.6%)	0.043
Race/Ethnicity					
White	35.8% (31.1% - 40.5%)	34.2% (31.9% - 36.5%)	31.9% (28.0% - 35.8%)	23.4% (14.9% - 32.0%)	0.117
Hispanic/Latino(a)	62.9% (57.0% - 68.8%)	59.8% (56.9% - 62.7%)	55.0% (50.9% - 59.1%)	40.9% (32.9% - 48.9%)	0.086
School-Level Free and Reduced-Price Lunch Program Eligibility					
Less than 25.0%	35.2% (29.8% - 40.6%)	34.4% (31.4% - 37.4%)	23.1% (18.6% - 27.6%)	14.9% (12.7% - 17.1%)	0.025
25.0-49.9%	42.6% (34.0% -51.2%)	42.3% (39.1% - 45.5%)	43.2% (38.0% -48.4%)	31.6% (23.4% - 39.9%)	0.462
50.0-74.9%	50.5% (39.1% - 61.9%)	50.1% (45.7% - 54.5%)	43.4% (36.3% - 50.5%)	42.5% (32.6% - 52.5%)	0.061
75.0% or more	72.7% (61.5% - 83.9%)	64.4% (60.1% - 68.7%)	53.1% (47.5% - 58.7%)	45.4% (31.1% - 59.8%)	0.002
Third Grade					
	2003-2004	2006-2007	2011-2012	2016-2017	*p-value*
Overall	57.2% (52.5% - 61.9%)	57.2% (55.4% - 59.0%)	55.2% (50.9% - 59.6%)	47.3% (38.7% - 56.0%)	0.156
Race/Ethnicity					
White	53.3% (48.3% - 58.3%)	47.8% (45.4% - 50.2%)	48.1% (43.3% - 52.9%)	37.9% (31.3% - 44.5%)	0.191
Hispanic/Latino(a)	67.3% (61.9% - 72.7%)	70.5% (67.6% - 73.4%)	69.5% (65.4% - 73.6%)	57.9% (47.2% - 68.7%)	0.678
School-Level Free and Reduced-Price Lunch Program Eligibility					
Less than 25.0%	52.1% (46.0% - 58.2%)	46.7% (43.8% - 49.6%)	40.7% (33.1% - 48.3%)	35.1% (23.5% - 46.6%)	0.005
25.0-49.9%	55.8% (45.1% - 66.5%)	51.9% (48.7% - 55.1%)	57.6% (54.8% - 60.4%)	47.3% (40.4% - 54.1%)	0.777
50.0-74.9%	60.4% (49.8% - 71.0%)	71.7% (67.9% - 75.5%)	57.5% (51.6% - 63.4%)	47.8% (34.1% - 61.5%)	0.232
75.0% or more	73.4% (66.8% - 80.0%)	72.9% (68.7% - 77.1%)	73.4% (68.1% - 78.7%)	63.9% (49.3% - 78.5%)	0.576

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.7: Trends in Untreated Decay by Grade Level, Colorado

Kindergarten	2003-2004	2006-2007	2011-2012	2016-2017	*p-value*
Overall	26.9% (22.2% - 26.8%)	22.9% (21.4% - 24.4%)	13.8% (11.5% - 16.2%)	17.5% (14.6% - 21.4%)	0.276
Race/Ethnicity					
White	21.5% (17.2% - 25.8%)	17.6% (15.7% - 19.5%)	11.4% (8.9% - 13.9%)	13.8% (10.6% - 17.1%)	0.175
Hispanic/Latino(a)	38.7% (33.7% - 43.7%)	28.6% (25.9% - 31.3%)	18.5% (15.0% - 22.0%)	18.5% (14.0% - 23.1%)	0.060
School-Level Free and Reduced-Price Lunch Program Eligibility					
Less than 25.0%	20.3% (15.1% - 25.5%)	16.9% (10.4% - 23.4%)	6.8% (4.6% - 9.0%)	13.6% (10.6% - 16.5%)	0.493
25.0-49.9%	24.4% (17.9% - 30.9%)	22.7% (20.0% - 25.4%)	16.0% (10.2% - 21.8%)	14.8% (8.3% - 21.4%)	0.042
50.0-74.9%	27.8% (17.2% - 38.4%)	24.4% (20.7% - 28.1%)	14.9% (10.3% - 19.5%)	21.9% (17.6% - 26.3%)	0.525
75.0% or more	47.6% (37.1% - 58.1%)	31.7% (27.9% - 35.5%)	18.9% (15.8% - 22.0%)	21.9% (16.5% - 27.4%)	0.144
Third Grade					
	2003-2004	2006-2007	2011-2012	2016-2017	*p-value*
Overall	26.1% (22.1% - 30.0%)	24.5% (23.0% - 26.0%)	14.4% (11.6% - 17.3%)	15.2% (11.0% - 19.4%)	0.056
Race/Ethnicity					
White	22.2% (18.5% - 25.9%)	18.5% (16.6% - 20.4%)	12.5% (9.6% - 15.4%)	12.5% (8.2% - 16.8%)	0.046
Hispanic/Latino(a)	37.4% (31.2% - 43.6%)	31.1% (28.1% - 34.1%)	17.7% (13.5% - 21.9%)	15.6% (10.0% - 21.1%)	0.048
School-Level Free and Reduced-Price Lunch Program Eligibility					
Less than 25.0%	18.4% (14.7% - 22.1%)	16.6% (14.4% - 18.8%)	8.9% (4.6% - 13.2%)	8.1% (2.2% - 14.1%)	0.080
25.0-49.9%	28.4% (22.5% - 34.3%)	21.2% (18.5% - 23.9%)	18.9% (13.7% - 24.1%)	18.8% (14.8% - 22.7%)	0.212
50.0-74.9%	31.4% (21.1% - 41.7%)	33.9% (30.0% - 37.8%)	14.5% (7.9% - 21.1%)	20.2% (13.7% - 26.7%)	0.206
75.0% or more	41.1% (31.4% - 50.8%)	37.1% (32.6% - 41.6%)	18.1% (12.0% - 24.2%)	17.7% (10.5% - 25.0%)	0.072

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.8: Trends in Dental Sealants, Third Grade Students, Colorado

Third Grade					
	2003-2004	2006-2007	2011-2012	2016-2017	*p-value*
Overall	35.2% (30.1% - 40.2%)	37.1% (35.3% - 38.8%)	44.9% (41.2% - 48.7%)	57.4% (48.7% - 66.1%)	0.008
Race/Ethnicity					
White	38.1% (32.7% - 43.5%)	42.4% (40.0% - 44.8%)	46.3% (41.6% - 51.0%)	61.2% (49.3% - 73.2%)	0.051
Hispanic/Latino(a)	25.7% (19.2% - 32.2%)	30.8% (27.9% - 33.7%)	41.8% (37.5% - 46.1%)	55.4% (50.7% - 60.0%)	<0.001
School-Level Free and Reduced-Price Lunch Program Eligibility					
Less than 25.0%	40.8% (34.0% - 47.6%)	47.2% (44.3% - 50.1%)	47.4% (40.0% - 54.8%)	72.3% (63.2% - 81.4%)	0.654
25.0-49.9%	36.7% (25.7% - 47.7%)	29.9% (26.9% - 32.9%)	49.3% (41.6% - 57.0%)	44.7% (33.0% - 56.4%)	0.214
50.0-74.9%	25.5% (18.0% - 33.0%)	35.9% (31.9% - 39.9%)	36.8% (31.6% - 42.0%)	53.6% (41.6% - 65.5%)	0.154
75.0% or more	22.2% (11.5% - 32.9%)	28.1% (23.8% - 32.4%)	43.7% (37.0% - 50.4%)	49.8% (36.9% - 62.6%)	0.041

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.

Table A.9: Trends in Oral Health Outcomes among Students at Schools with 50 percent or more Free and Reduced-Price Lunch Program Eligibility by Grade Level, Colorado

Kindergarten				
	2003-2004	2006-2007	2011-2012	2016-2017
Caries experience	60.2% (50.5% - 70.0%)	57.5% (54.6% - 60.5%)	48.5% (43.6% - 53.3%)	44.0% (35.3% - 52.6%)
Untreated decay	36.5% (27.5% - 45.5%)	28.2% (25.5% - 30.9%)	17.0% (14.1% - 19.9%)	21.9% (18.5% - 25.4%)
Urgent need for dental care	9.2% (4.5% - 13.8%)	4.9% (3.6% - 6.2%)	2.1% (0.7% - 3.5%)	3.6% (2.0% - 5.2%)
Third Grade				
	2003-2004	2006-2007	2011-2012	2016-2017
Caries experience	66.5% (58.9% - 74.2%)	72.2% (69.4% - 75.0%)	65.7% (60.6% - 70.9%)	56.7% (45.3% - 68.1%)
Untreated decay	36.0% (27.9% - 44.0%)	35.4% (32.4% - 38.4%)	16.4% (11.8% - 21.0%)	18.8% (13.9% - 23.8%)
Urgent need for dental care	9.2% (4.4% - 13.9%)	9.5% (7.7% - 11.4%)	1.4% (0.2% - 2.5%)	3.6% (1.9% - 5.4)
Sealants	23.8% (17.1% - 30.5%)	32.4% (29.4% - 35.3%)	40.3% (35.9% - 44.7%)	51.3% (42.0% - 60.6%)

Data source: Colorado Basic Screening Survey, Colorado Department of Public Health and Environment
Note: 95% confidence intervals are indicated in parentheses. A wider confidence interval around an estimate indicates less reliability, most likely due to smaller sample sizes.