Oral Health in Elementary School Students: An Evaluation of the Oregon Smile and Healthy Growth Screening

Jackie Gilroy[1] and Joyce Millen[1#]

[1]Willamette University
[#]Advisor

ABSTRACT

Cavities—a result of progressed tooth decay—are 100% preventable, and yet they are the most common chronic disease of childhood in the United States. If left untreated, cavities can cause health complications, and in rare cases, death. Therefore, addressing tooth decay in children proves crucial for ensuring their long-term health. The Oregon Smile and Healthy Growth Screening (previously known as the Oregon Smile Survey), a statewide effort conducted every five years, identifies oral health concerns and provides the state with a broad understanding of childhood oral health status. The screening process serves as a way for state public health officials to communicate with caretakers and encourage them to seek dental care for their children. Furthermore, screening results enable policymakers to create more effective, preventative policies, programs, and services to reduce oral health problems and disparities. This article analyzes Oregon Smile Surveys from 2002-2017, comparing their respective methods and results. In addition, it examines the research methods used in the current 2022 Oregon Smile and Healthy Growth Screening and offers preliminary sets of recommendations for ways to improve the screening process in Oregon. Data informing the screening recommendations come from participant observations gathered during a spring 2023 internship with the Oregon Health Authority on the 2022 Oregon Smile and Healthy Growth Screening.

Introduction

Oral health refers to the state of the structures within the mouth (World Health Organization, n.d.). While enabling individuals to perform essential functions such as eating, breathing, and speaking, oral health also affects people's self-esteem, well-being, comfortability, and ability to show emotions. Oral health significantly impacts a person's quality of life, and if compromised, an individual may experience oral diseases. As one of the most common noncommunicable diseases worldwide, oral diseases—encompassing those from cavities to oral cancers—affect roughly 3.5 billion people. Risk factors for oral diseases include tobacco use, alcohol consumption, high-sugar diets, and poor oral hygiene (World Health Organization, n.d.). Across the life course, these diseases disproportionately impact the most vulnerable, disadvantaged, and underserved populations, as these individuals face barriers to quality oral health care due to low socioeconomic status, discrimination, lack of eligibility or high out-of-pocket costs for insurance coverage, and distance from healthcare facilities (Northridge et al., 2020). Worldwide, those of low socioeconomic status experience the largest burden of oral diseases across the life course (World Health Organization, n.d.).

Oral diseases can impact anyone; however, they affect people in different ways. Socially, those with oral diseases may feel self-conscious around others, potentially causing more socially isolating behavior or a reluctance to smile and verbally express themselves (World Health Organization, n.d.). Physically, people may experience pain or discomfort, resulting in difficulty eating or speaking. This discomfort can make concentrating challenging, causing people to miss school or work. Economically, work absence may financially burden an individual or their family, and

treatment for oral diseases increases household expenditures (World Health Organization, n.d.). In the United States in 2023, one cavity filling costs an average of $200. This price varies depending on the material used, the location of the affected tooth in the mouth, and the number of tooth surfaces requiring treatment (Dégallier & Stewart, 2023). Uninsured, inadequately insured, or low-income individuals may struggle to afford this cost of care. According to the 2023 U.S. Federal Poverty Guidelines prepared by the U.S. Department of Health and Human Services, a person is considered impoverished if their annual income is less than or equal to $14,580 per year (U.S. Department of Health and Human Services, n.d.-b). Therefore, if an individual earns $14,580 or less per year, a $200 out-of-pocket expense for a dental filling would represent 16.5% of their monthly income—a burdensome expense that could cause many low-income individuals to not seek the necessary treatment.

While a myriad of oral diseases exists, cavities—small holes in the teeth—remain the most common, yet 100% preventable, oral health disease (Johns Hopkins, 2019; Oregon Health Authority, 2022). Affecting more than two billion people globally and more than 70% of Americans, cavities are a result of progressed tooth decay (Centers for Disease Control and Prevention, 2021a; Centers for Disease Control and Prevention, 2021b; Johns Hopkins Medicine, 2019; National Institute of Dental and Craniofacial Research, 2022a; National Institute of Dental and Craniofacial Research, 2022b; Searing, 2022). Tooth decay is the breakdown of the tooth enamel—the hard outer surface of the tooth (Johns Hopkins Medicine, 2019). Bacteria cause this degradation by producing an acid that attacks the enamel (National Institute of Dental and Craniofacial Research, 2023). Symptoms of cavities include tooth pain or sensitivity (Mayo Clinic, 2022). Risk factors for cavities include biological determinants, such as tooth morphology and enamel composition and structure; people more susceptible to cavities include those with crowded teeth, deep molar groves, or naturally weaker tooth enamel (Wright, 2019). Other risk factors include family history, relative dental knowledge of caretakers, consuming high-sugar diets, and wearing oral appliances such as braces or retainers (Anil & Anand, 2017; Centers for Disease Control and Prevention, 2022). If caregivers lack oral health literacy, their children may develop insufficient oral hygiene practices. High-sugar diets increase the risk of cavities because bacteria metabolize the sugar to produce the acid that breaks down the tooth enamel; the more sugar present, the greater the acid production (World Health Organization, 2017). Oral appliances increase the risk of cavities by trapping sugar and food particles against the teeth.

To prevent cavities, dental providers can apply dental sealants—inexpensive, thin, coatings placed on back permanent molars. These aid in cavity prevention by effectively preventing tooth-decay-causing bacteria from entering the grooves and pits of these teeth (Oregon Department of Human Services, 2007). Additionally, fluoride exposure helps to prevent cavities by making tooth enamel more resistant to acid (New York University, 2020). Fluoride exposure can come from toothpaste as well as from drinking fluoridated water. To prevent cavities from worsening, dental providers can apply silver diamine fluoride to cavities—an odorless liquid containing silver particles and fluoride (Hurst Pediatric Dentistry, 2021).

If left untreated, cavities can harm an individual's quality of life, and in rare cases, result in death. According to the Centers for Disease Control and Prevention (CDC), "Untreated cavities can lead to abscess (a severe infection) under the gums which can spread to other parts of the body and have serious, and in rare cases fatal, results" (Centers for Disease Control and Prevention, 2021a). To offer an admittedly extreme example, in February 2007, Deamonte Driver, a 12-year-old Black boy, passed away due to complications from an abscessed tooth. An $80 tooth extraction could have saved his life; however, his mother struggled to find a dental provider who would accept Medicaid and perform the extraction. Consequently, bacteria from the abscessed tooth spread to Driver's brain, resulting in a fatal brain infection (Harvard School of Dental Medicine, 2007).

According to the CDC, cavities are the most common chronic disease of childhood in the United States, and given the detrimental impact that cavities can have on a person's life, prioritizing, monitoring, and addressing tooth decay in children remains crucial for ensuring their long-term health (Centers for Disease Control and Prevention, 2022). To prioritize cavity prevention in children, the U.S. Department of Health and Human Services released objectives for improving oral health in Healthy People 2030—the nation's plan for improving health from 2020-2030. These objectives aim to improve oral health by increasing access to oral health care, including preventative services.

For children, these objectives include increasing preventative dental care among low-income children, reducing the number of children with active and untreated tooth decay, and increasing the proportion of children who have dental sealants on one or more molars (U.S. Department of Health and Human Services, n.d.-a). To monitor and address a public health problem such as tooth decay, political entities such as health departments at the country, state, and county level conduct assessments—one of the ten essential public health services helping to protect and promote the health of all people in all communities (Centers for Disease Control and Prevention, 2023). When done well, assessments can raise the public's awareness of a public health issue, and they can provide data that enable political entities to prioritize efforts and determine resource allocation. The results of health assessments can also help to inform policy. One example of an ongoing assessment that monitors and addresses childhood tooth decay at the state level is the Oregon Smile and Healthy Growth Screening—an assessment I had the privilege of assisting with during a spring 2023 internship with the Oral Health Unit at Oregon Health Authority (OHA). During the screenings, I recorded data, accompanied students to the screening room, and observed the screening process through a public health lens to provide recommendations for how OHA could improve the screening process in the future. Data informing the recommendations discussed later in this article come from participant observations at urban and peri-urban schools.

Context of the Oregon Smile and Healthy Growth Screening

The Oregon Smile and Healthy Growth Screening (previously known as the Oregon Smile Survey) is a statewide assessment conducted every five years that helps identify oral health concerns and provides the state with a broad understanding of childhood oral health status (Oregon Health Authority, n.d.-a). The screening process serves as a way for state public health officials to communicate with caretakers and encourage them to seek dental care for their children. Additionally, screening results enable policymakers to create more effective, preventative policies, programs, and services to reduce oral health problems and disparities. While not mandated by federal or state governments, Title V—a federal program that provides funding to state maternal and child health programs—funds the Oregon Smile and Healthy Growth Screening (Association of Maternal & Child Health Programs, 2022). The Oregon Department of Human Services conducted the first two screenings in 2002 and 2007, and OHA conducted the following screenings. Previous reports are posted online and publicly available. While OHA attempts to design and conduct the best possible screening given the available resources, there are some limitations regarding what this screening can accomplish. One limitation is that the screening provides single point-in-time data; it does not track children over time. Additionally, data from the screenings only represent the burden of tooth decay for six to nine-year-old children in Oregon. Finally, the few guardians who elect to not have their child screened minorly decrease student participation.

The Oregon Smile and Healthy Growth Screening selects a representative sample of Oregon public schools and sends contracted, trained, registered dental hygienists and volunteer assistants to screen a class of first, second, and third-grade students. Researchers obtain a random sample of schools from the Oregon Department of Education, stratified by students who qualify for the federal Free and Reduced Price Meals program to account for low socioeconomic status. Schools randomly choose the classes of first, second, and third-grade students for screening; each class must contain 15 or more students. If a school declines to participate, researchers select a replacement school in the same geographic location. Unless the guardians of a student indicate a preference to not have their child screened, dental hygienists perform a brief, two to four-minute visual screening of each student's mouth, inspecting for treated decay (defined as fillings, crowns, or extracted teeth), untreated decay (defined as untreated cavities in primary or permanent teeth), rampant decay (defined as having seven or more teeth with treated or untreated decay), the urgency level of dental care (defined as treatment for cavities or other health concerns in the mouth), and the presence of dental sealants. Volunteer assistants record these data on scannable forms during the screenings.

2002 Oregon Smile Survey Methods and Results

To select the sample of schools to be surveyed in the 2002 Oregon Smile Survey, researchers stratified elementary schools by six state regions (using county lines and population density) and by the percentage of children qualifying for free and reduced lunch (Oregon Department of Human Services, 2002). Out of the 86 schools selected, 70 schools participated; school locations covered 22 of Oregon's 36 counties. This survey used an active opt-in recruitment strategy for participants. Dental hygienists conducting the survey received information on each child's grade, age, sex, and language spoken at home from the school or verbally from the child under screening. If not provided by the school, dental hygienists and volunteer assistants guessed the race or ethnicity of the children—a highly problematic assumption, as many children may "appear" as a particular race or ethnicity and identify as a completely different race or ethnicity. Schools provided information on child eligibility for free and reduced lunch. Thirteen dental hygienists collected data on 3,956 students in first through third grade in January, February, and March of 2002. All dental hygienists followed the diagnostic criteria outlined in the Association of State and Territorial Dental Directors 1999, Basic Screening Surveys: An Approach to Monitoring Community Oral Health (Oregon Department of Human Services, 2002).

Results of the 2002 Oregon Smile Survey revealed that low-income children experienced far higher rates of untreated decay and rampant decay than their higher-income counterparts; in fact, low-income children were three times more likely to have untreated decay (Oregon Department of Human Services, 2002). Additionally, children of color experienced more dental decay than White children; Pacific Islander children had an untreated decay rate of 44%—the highest rate for this oral health measure—whereas White children had an untreated decay rate of 20%. That said, it is important to note that oral health is not genetically tied to race; rather it is the low socioeconomic status, distance from healthcare facilities, discrimination, and systemic racism that these minority groups face that contribute to these oral health disparities. Finally, 42% of eight-year-old children had dental sealants (Oregon Department of Human Services, 2002).

2007 Oregon Smile Survey Methods and Results

The 2007 Oregon Smile Survey, conducted during the 2006-2007 school year, used the same sampling strategy and methods as the 2002 survey with a few exceptions. First, this survey used national Basic Screening Survey (BSS) criteria recommended by the CDC and the Association of State and Territorial Dental Directors (Oregon Department of Human Services, 2007). Dental hygienists attended a one-day training that covered a review of the diagnostic criteria and a hands-on calibration session. Additionally, researchers used a passive consent approach in hopes of recruiting more students for the study. They sent letters home to the families detailing the confidential nature and purpose of the study, and unless guardians signed and returned a release letter to the school, their student participated in the study. Researchers also sent guardians a questionnaire to gather information on children's age, race/ethnicity, participation in the federal free or reduced lunch program, language spoken at home, gender, medical insurance, dental insurance, and the time since their last dental visit. Approximately 50% of the guardians returned the questionnaire. Dental hygienists screened 3,865 first, second, and third-grade students, just 91 fewer than in the previous survey (Oregon Department of Human Services, 2007).

Since the 2002 Oregon Smile Survey, several measures of oral health among elementary school children worsened (see Figure 1). The 2007 results revealed a 12% increase in students with untreated decay. Low-income children were more than twice as likely to have untreated decay and nearly three times as likely to have rampant decay (Oregon Department of Human Services, 2007). Compared to the 2002 survey, all children experienced worsening oral health conditions regardless of race and ethnicity, and Hispanics continued to experience a higher rate of oral disease compared to White non-Hispanic students. In 2002, 42% of Hispanic children had untreated decay compared to 20% of White non-Hispanic children, and 20% of Hispanic children had rampant decay compared to 14% of White non-Hispanic children. In 2007, 46% of Hispanic children had untreated decay compared to 34% of White non-

Hispanic children, and 28% of Hispanic children had rampant decay compared to 17% of White non-Hispanic children. Compared to the 32 other states with BSS data, Oregon ranked 25th for the percentage of children with untreated decay. Regarding dental sealants, 43% of third-grade students had sealants on their molar teeth. Unlike the 2002 study, this screening also included a geographic component, discovering oral disease disparities according to place of residence. Twenty-one percent of children living in the Portland metropolitan area had untreated tooth decay and 1% needed urgent dental treatment due to pain or infection, whereas 44% of children living outside of the Portland metropolitan area had untreated tooth decay and 6% needed urgent dental treatment due to pain or infection (Oregon Department of Human Services, 2007).

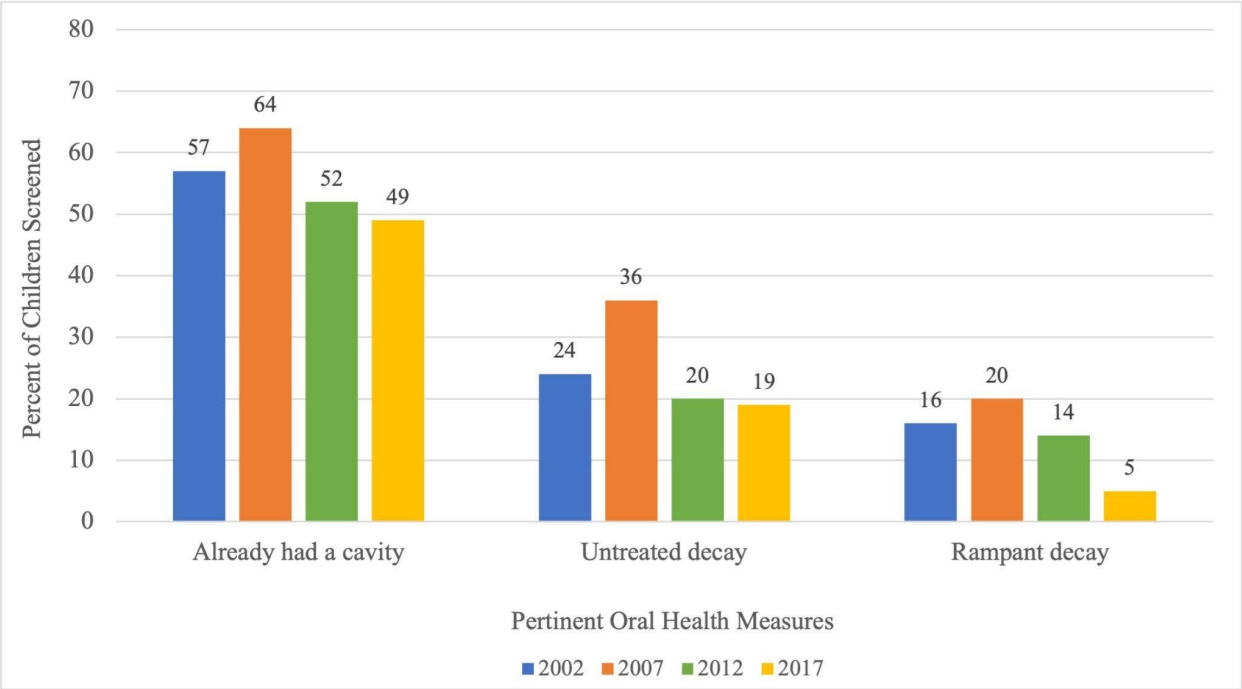

Figure 1. A comparison of pertinent oral health measures. (Data collected from Oregon Health Authority, 2015 and Oregon Health Authority, 2022).

2012 Oregon Smile Survey Methods and Results

Occurring during the 2011-2012 and 2012-2013 school years, the 2012 Oregon Smile Survey used the same methods as the 2007 survey. Dental hygienists screened 5,258 children—a 26% increase from the 2007 survey—from a representative sample of 82 schools (Oregon Health Authority, n.d.-c). In addition, dental hygienists measured and recorded the height and weight of each child involved in the study to calculate the body mass index (BMI)—the first statewide standardized collection of height and weight data for Oregon school-age children (Oregon Health Authority, n.d.-c).

Results of the 2012 Oregon Smile Survey indicated that 20% of children had untreated tooth decay, with 3% of children needing immediate dental care due to pain or infection (Oregon Health Authority, 2015). Lower-income children had higher rates of cavities and untreated decay compared to higher-income children. Additionally, lower-income children had over twice the rate of rampant decay and nearly twice the rate of untreated decay as higher-income children—a slight improvement in the decay rates compared to the previous surveys but still consistent in showing lower-income children as having much higher tooth decay rates compared to higher-income children. While all students of color experienced higher rates of cavities and untreated decay compared to White children, Hispanic/Latino children had a cavity rate of 68%—the highest rate for this oral health measure—whereas White children had a cavity rate of 47%. Additionally, African American children had an untreated decay rate of 28%—the highest rate for

this oral health measure—whereas White children had an untreated decay rate of 18%. Thirty-eight percent of children six to nine years old had dental sealants, and children from southeastern Oregon—a rural region—experienced a cavity rate of 73% compared to the statewide average of 52% (Oregon Health Authority, 2015).

2017 Oregon Smile Survey Methods and Results

The 2017 Oregon Smile Survey, conducted during the 2016-2017 and 2017-2018 school years, followed the same methods as the 2012 Smile Survey with a couple of exceptions. Researchers stratified schools by seven (as opposed to six) state health regions (using county lines and population density) and by the percentage of children qualifying for free and reduced lunch. Researchers collected demographic information from the Oregon Department of Education. Dental hygienists inspected the mouths of 8,023 children—a 34% increase from the 2012 survey—from a sample of 134 elementary schools (Oregon Health Authority, 2022).

Results found that 18% of children needed dental care, with 2% needing urgent dental care due to pain or infection (Oregon Health Authority, 2022). Compared to children from higher-income households, lower-income children had higher cavity rates, nearly twice the rate of untreated decay, and over twice the rate of rampant decay. All minority racial and ethnic groups (American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Hispanic/Latino, Black/African American, and Asian) had a higher prevalence of any dental decay and rampant decay compared to White children; aside from Asians, all racial and ethnic groups also had a higher prevalence of untreated decay. Native Hawaiian/Pacific Islanders had an untreated decay rate of 26%—the highest rate for all racial and ethnic groups. American Indian/Alaska Native students had the highest rates of any dental decay and rampant decay for all racial and ethnic groups, 63% and 10% respectively (Oregon Health Authority, 2022). Thirty-nine percent of first through third-grade students had dental sealants, and 53% of third-grade students had sealants (Oregon Health Authority, n.d.-b). This study found that children living in southeastern Oregon suffered a cavity rate of 68%—a higher rate than the rest of the state but a 5% improvement from the 2012 Oregon Smile Survey (Oregon Health Authority, 2022).

Discussion

While the percentage of children needing dental treatment decreased from 2007 to 2017, tooth decay disproportionately burdened low-income children across all surveys, demonstrating the significance of low socioeconomic status as a determinant of oral health. Perhaps unsurprisingly in a state with a long history of systemic racism, tooth decay also disproportionately burdened children of color (Camhi, 2020; Oregon Health Authority, 2015; Oregon Health Authority, 2022). The 2007, 2012, and 2017 Oregon Smile Surveys also indicated that geographic residence influenced cavity rates, where children living in more rural areas had worse dental health outcomes. A likely cause of the urban-rural differences is the paucity of dentists in rural areas; children living in rural areas must travel farther distances to access dental care facilities (Thomas, 2023). In addition, a significant percentage of homes in rural areas are fed by private well water which is not fluoridated as many municipal water supplies are (“Oral Health in Rural Communities”, 2022). Nonetheless, despite these persisting inequities, decay rates have improved since 2007 (see Figure 1). While there are multiple attributing factors to this improvement, one attributing factor, which was likely informed by the screening data, is the implementation of the state School-based Dental Sealant Program—a program designed to increase access to dental sealants for six to nine-year-old children in Oregon. Established in 2006, this program expanded from originally serving 43 schools during the 2007-2008 school year to serving 140 schools in the 2011-2012 school year (Oregon Health Authority, 2015). That said, and despite these improved decay rates, considerable room for improvement remains, as almost half (49%) of six to nine-year-old Oregon school children suffered a cavity in 2017 (Oregon Health Authority, 2022). Due to the COVID-19 pandemic, many children missed dental check-ups,

making the current 2022 Oregon Smile and Healthy Growth Screening especially important (Oregon Health Authority, n.d.-a).

2022 Oregon Smile and Healthy Growth Screening Methods

Occurring during the current 2022-2023 school year and set to continue in the 2023-2024 school year, the 2022 Oregon Smile and Healthy Growth Screening uses the same research methods as the 2017 Oregon Smile Survey. It aims to send registered dental hygienists and volunteer assistants to at least 17 elementary schools in each of the seven geographic regions. As stated earlier, I had the privilege of interning with Oregon Health Authority during the spring of 2023, and during my internship, I assisted with several Oregon Smile and Healthy Growth Screenings at schools in the Willamette Valley from March-April of 2023. During the screenings, I recorded data and accompanied students to the screening room. In addition to these tasks, I observed the screening process through a public health lens, reflecting on the strengths of the process, identifying any procedural shortcomings, and evaluating the process with attention to equity. The following participant observations and recommendations are based on my work with three different dental hygienists from five school screenings.

Upon arrival at the school, the dental hygienist and volunteer assistant first check in at the front office and collect a class list for each of the first, second, and third-grade classes scheduled for screening. The class lists contain each student's name, student ID number, date of birth, grade, and gender. The dental hygienist or volunteer assistant also asks the front office personnel or the teacher of each class if they received any parental verbal or written opt-outs, if there are any absent students, and if there are any students who speak a language other than English at home. The dental hygienist or volunteer assistant record all of this information on each class list. Then, class by class, students are shepherded into a room provided by the office for screening. Students undergo an oral inspection and a height and weight measurement. At the beginning of each screening, the dental hygienist asks for the child's name, date of birth, and age to ensure that the information provided on the class list matches the child's responses. Subsequently, the assistant records the date of the screening, the screener ID number (a number attached to each dental hygienist), the school's name, and the child's age, date of birth, grade, gender, name, and student ID number on OHA'S 2022 Smile & Healthy Growth Screening Data Collection Form (see Appendix A). Meanwhile, the dental hygienist performs a brief inspection of each child's mouth with a disposable mirror and penlight. If necessary, the dental hygienist uses a swab or toothpick to remove excess debris or to check for the presence of dental sealants. During the screening, the dental hygienist reports to the assistant whether the child has treated decay on primary and/or permanent teeth, active untreated decay on primary and/or permanent teeth, potentially arrested decay or silver diamine fluoride on primary and/or permanent teeth, sealants on permanent first molar teeth, and the presence of rampant decay. Potentially arrested decay refers to inactive and no longer progressing areas of decay. The dental hygienist also reports the number of permanent first molars fully erupted and a number from zero to two to indicate the relative treatment urgency. The number zero corresponds to no obvious problems; one corresponds to needed dental care; two corresponds to urgent dental care. The assistant records all information on the data collection form and writes the names of each student requiring urgent dental care on another carbon-copied form. The dental hygienist and assistant deliver a copy of this form to the front office at the conclusion of the day's screening. After the oral inspection, the dental hygienist takes the student's height, in centimeters, and weight, in kilograms, and the assistant records both measurements on the data collection form. Each screening lasts approximately two to four minutes.

At the end of each child's screening, the assistant completes another form—a pre-printed letter from OHA addressed to the guardians of the child (see Appendix B). To prevent any language barriers, OHA prints copies of the letter in over 10 different languages; each child receives a letter in the family's preferred language. Letters provide a brief statement about the screening, the general finding for the child, and resources for the family to contact if they do not have a dentist. The resources section includes a website for low-cost dental care for low-income families and information for accessing care for Oregon families on Medicaid. On these pre-printed forms, the assistant writes the child's name and marks the general finding for the child, which corresponds to the treatment urgency on the data

collection form. At the end of the screening, students are instructed to deliver the letter to their guardians. Among the schools I assisted at, students chose a toothbrush and a sticker after their screening at two schools; students at the other three schools received a toothbrush and a sticker from their teacher later in the day (see Appendix C for the sticker the children received). After completing student screenings, the dental hygienist sends all data collection forms back to OHA for analysis. OHA intends to release the screening results in 2024.

Analysis of Findings

Those involved with the planning, implementation, and analysis of the screening—including supervisors, dental hygienists, volunteer assistants, and data analysts—made genuine efforts to assess children's teeth across the state, to provide information to multiple linguistic communities, and to cater to children in specific grades; dental hygienists brought smaller-sized toothbrushes for the first and second-grade students—a beneficial consideration, as a smaller toothbrush will help these students clean their teeth more effectively and comfortably. While there were plenty of strengths and considerations of equity, one procedural shortcoming included failing to remind students to brush their teeth during the screening sessions—a realization I had after hearing several students from one particular school comment that they had not brushed their teeth that morning. For future Oregon Smile and Healthy Growth Screenings, I recommend asking students if they brushed their teeth the morning of the screening as well as asking how many times a day they typically brush their teeth. Volunteer assistants could easily record this information on the OHA data collection form, giving the state a better picture of the oral hygiene practices of Oregon's children. Additionally, after the dental screening, I recommend having the dental hygienist remind each student to brush their teeth twice a day after breakfast and dinner. Furthermore, I suggest having a sentence at the end of the letter that the child takes home to their guardians that says, "Remind your child to brush their teeth twice a day after breakfast and dinner!" These small changes could directly help improve the oral health literacy of these children and their families as well as help to normalize teeth brushing for young children.

Another recommendation includes asking the guardians of the screened children whether they received the letter and if they have questions. This may prompt caregivers to ask their child for the letter if they have not already received it. By talking with caretakers, OHA will understand whether the students fulfilled their task of delivering the letters to their guardians. If caregivers are not receiving these letters, OHA should devise a new method for relaying information. OHA should also ask these guardians if they can access and afford treatment if their child needs dental care. If the family cannot access or afford treatment, marking a student as needing dental care seems futile. Guardian feedback will help OHA implement changes that create a more effective screening process in the future.

A final suggestion includes letting student participants choose their sticker and toothbrush after their screening. I noticed that at a few schools, students did not choose a sticker and toothbrush after their screening. Instead, teachers received and distributed stickers and toothbrushes to students later in the day. Allowing students to choose their sticker and toothbrush immediately after their screening makes the experience more fun for the children, and it creates positive associations with the Oregon Smile and Healthy Growth Screening and oral health.

Conclusion

The Oregon Smile and Healthy Growth Screening, a state preventative public health assessment, assesses the oral health status of Oregon's children with a specific focus on tooth decay. By raising public awareness of tooth decay levels in children, those involved with the planning, implementation, and analysis of the Oregon Smile and Healthy Growth Screening—including supervisors, dental hygienists, volunteer assistants, and data analysts—hope to increase effective and preventative oral health initiatives as well as increase the number of children receiving dental treatment. Findings from previous Oregon Smiles Surveys indicate that oral health disparities exist based on race and ethnicity, family income level, and geographic residence. That said, the conclusion that oral health disparities exist based on

race and ethnicity is complex; there is an intersectionality of race and ethnicity with other social determinants of health, structural racism, and discrimination that work together to create these oral health disparities in minority groups. OHA intends to release the results of the current 2022 Oregon Smile and Healthy Growth Screening in 2024.

The 2022 Oregon Smile and Healthy Growth Screening had many strengths and considerations of equity. Supervisors, dental hygienists, volunteer assistants, and data analysts made genuine efforts to assess children's teeth across the state, to provide information to multiple linguistic communities, and to cater to children in specific grades; dental hygienists brought smaller-sized toothbrushes for the first and second-grade students—a beneficial consideration, as a smaller toothbrush will help these students clean their teeth more effectively and comfortably. For future screenings, one recommendation includes asking students if they brushed their teeth the morning of the screening and asking how many times a day they typically brush their teeth. Volunteer assistants should report this information on OHA's data collection form to give the state a better picture of the oral hygiene practices of Oregon's children. Additionally, after each child's screening, dental hygienists should verbally remind each student to brush their teeth twice a day after breakfast and dinner. Letters to the guardians should have a concluding sentence that states, "Remind your child to brush their teeth twice a day after breakfast and dinner!" These verbal and written reminders could directly help improve the oral health literacy of these children and their families as well as help to normalize teeth brushing for young children. Another recommendation includes conducting in-depth follow-ups with the guardians of the screened children, inquiring whether they received their child's letter, whether they can access and afford treatment if their child needs dental care, and whether they have any feedback on the screening. Feedback from guardians will help OHA implement changes that create a more effective screening process in the future. Finally, I recommend that dental hygienists and volunteer assistants allow all student participants to choose their sticker and toothbrush after their screenings, as this makes the experience more fun for the children and creates positive associations with the screenings and oral health.

The Oregon Smile and Healthy Growth Screening is an assessment that aims to provide a snapshot of the oral health status of Oregon's children to help inform preventative interventions and policies related to childhood tooth decay. Given that guardians serve as the main educators and role models of oral hygiene practices for their children, I recommend that future research studies investigate guardian oral hygiene education as a potentially beneficial intervention for reducing childhood tooth decay.

Limitations

My assistance with the Oregon Smile and Healthy Growth Screenings spanned from March-April of 2023; observations in this report came from only five school screenings in urban or peri-urban locations. I was unable to attend a screening at a rural school.

Acknowledgments

I would like to express gratitude toward the members of the Oral Health Unit within the Maternal and Child Health Section at Oregon Health Authority. I am forever grateful for this internship opportunity, and I sincerely appreciate the kind assistance of Catalina Aragon, Karen Phillips, and Kelly Hansen in preparing this manuscript. Additionally, I would like to thank my thesis advisor, Professor Joyce Millen, my academic advisor, Professor Sammy Basu, and my peers who all provided instrumental guidance and support in producing this article.

References

Anil, S., & Anand, P. S. (2017). Early childhood caries: Prevalence, risk factors, and prevention. *Frontiers in Pediatrics*, *5*, 157. https://doi.org/10.3389/fped.2017.00157

Association of Maternal & Child Health Programs. (2022). *Title V overview*. Retrieved March 26, 2023, from https://amchp.org/title-v/

Camhi, T. (2020). *A racist history shows why Oregon is still so white*. Oregon Public Broadcasting. Retrieved May 1, 2023, from https://www.opb.org/news/article/oregon-white-history-racist-foundations-black-exclusion-laws/

Centers for Disease Control and Prevention. (2021a). *Cavities*. Retrieved March 24, 2023, from https://www.cdc.gov/oralhealth/fast-facts/cavities/index.html

Centers for Disease Control and Prevention. (2021b). *Older adult oral health*. Retrieved April 17, 2023, from https://www.cdc.gov/oralhealth/basics/adult-oral-health/adult_older.htm#:~:text=Nearly%20all%20adults%20(96%25),5%20have%20untreated%20tooth%20decay.&text=Gum%20disease.,or%20older%20have%20gum%20disease

Centers for Disease Control and Prevention. (2022). *Children's oral health*. Retrieved February 28, 2023, from https://www.cdc.gov/oralhealth/basics/childrens-oral-health/index.html

Centers for Disease Control and Prevention. (2023). *10 essential public health services*. Retrieved April 23, 2023, from https://www.cdc.gov/publichealthgateway/publichealthservices/essentialhealthservices.html

Dégallier, P., & Stewart, M. (2023). *How much does a cavity filling cost in 2023?* Authority Dental. Retrieved March 24, 2023, from https://www.authoritydental.org/cavity-filling-cost

Harvard School of Dental Medicine. (2007). *12-year-old Deamonte Driver dies from lack of access to dental care*. Retrieved April 5, 2023, from https://perspectivesofchange.hms.harvard.edu/node/165

Hurst Pediatric Dentistry. (2021). *Can silver diamine fluoride stop tooth decay?* Retrieved April 2, 2023, from https://hurstpediatricdentistry.com/2021/01/25/can-silver-diamine-fluoride-stop-tooth-decay/

Johns Hopkins Medicine. (2019). *Tooth decay (caries or cavities) in children*. Retrieved March 24, 2023, from https://www.hopkinsmedicine.org/health/conditions-and-diseases/tooth-decay-caries-or-cavities-in-children

Mayo Clinic. (2022). *Cavities/tooth decay*. Retrieved March 25, 2023, from https://www.mayoclinic.org/diseases-conditions/cavities/symptoms-causes/syc-20352892#:~:text=Mild%20to%20sharp%20pain%20when,Pain%20when%20you%20bite%20down

National Institute of Dental and Craniofacial Research. (2022a). *Dental caries (tooth decay) in adults (ages 20 to 64 years)*. Retrieved April 17, 2023, from https://www.nidcr.nih.gov/research/data-statistics/dental-caries/adults

National Institute of Dental and Craniofacial Research. (2022b). *Dental caries (tooth decay) in children ages 2 to 11 years*. Retrieved April 17, 2023, from https://www.nidcr.nih.gov/research/data-statistics/dental-caries/children

National Institute of Dental and Craniofacial Research. (2023). *Tooth decay*. Retrieved March 24, 2023, from https://www.nidcr.nih.gov/health-info/tooth-decay#:~:text=Tooth%20decay%20begins%20when%20bacteria,infection%2C%20and%20even%20tooth%20loss

New York University. (2020). *Study reveals how too much fluoride causes defects in tooth enamel*. Retrieved March 25, 2023, from https://www.nyu.edu/about/news-publications/news/2020/february/fluorosis.html#:~:text=Fluoride%20is%20a%20naturally%20occurring,enamel%20more%20resistant%20to%20acid

Northridge, M. E., Kumar, A., & Kaur, R. (2020). Disparities in access to oral health care. *Annual Review of Public Health*, *41*, 513-535. https://doi.org/10.1146/annurev-publhealth-040119-094318

Oral health in rural communities. Rural Health Information Hub. (2022). Retrieved May 1, 2023, from https://www.ruralhealthinfo.org/topics/oral-health

Oregon Department of Human Services. (2002). *Smile survey 2002*. Retrieved March 27, 2023, from https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/ORALHEALTH/Documents/smile-survey2002.pdf

Oregon Department of Human Services. (2007). *Oregon smile survey 2007*. Retrieved March 27, 2023, from https://www.astdd.org/docs/or-third-grade-bss-2007.pdf

Oregon Health Authority. (n.d.-a). *Oral health publications*. Retrieved March 26, 2023, from https://www.oregon.gov/oha/ph/preventionwellness/oralhealth/pages/oral-health-publications.aspx#:~:text=(In%20past%20years%2C%20this%20was%20called%20the%20Oregon%20Smile%20Survey)&text=The%202022%20Oregon%20Smile%20and,which%20would%20otherwise%20be%20missed

Oregon Health Authority. (n.d.-b) *Oregon oral health surveillance system*. Retrieved April 3, 2023, from https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/ORALHEALTH/Documents/Oregon%20Oral%20Health%20Surveillance%20System%202021%2010.19.22.pdf

Oregon Health Authority. (n.d.-c). *Oregon smile survey 2012 report*. Retrieved March 31, 2023, from https://media.oregonlive.com/portland_impact/other/2012smilesurvey.pdf

Oregon Health Authority. (2015). *Oregon smile survey 2012 report*. Retrieved March 27, 2023, from https://www.astdd.org/docs/or-third-grade-bss-2012.pdf

Oregon Health Authority. (2022). *Oral health among Oregon's children: Oregon smile survey data brief*. Retrieved February 28, 2023, from https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/ORALHEALTH/Documents/2017%20Smile%20Survey%20Data%20Brief.pdf

Searing, L. (2022). *World Health Organization cites 'alarming' dental statistics*. The Washington Post. Retrieved March 24, 2023, from https://www.washingtonpost.com/wellness/2022/11/29/cavities-teeth-gum-disease-dental/

Thomas, J. (2023). *They were supposed to fix dental shortages, but Oregon has only a handful*. The Lund Report. Retrieved May 1, 2023, from https://www.thelundreport.org/content/they-were-supposed-fix-dental-shortages-oregon-has-only-handful

U.S. Department of Health and Human Services. (n.d.-a). *Oral conditions*. Healthy People 2030. Retrieved February 28, 2023, from https://health.gov/healthypeople/objectives-and-data/browse-objectives/oral-conditions

U.S. Department of Health and Human Services. (n.d.-b). *Poverty guidelines*. Office of the Assistant Secretary for Planning and Evaluation. Retrieved March 24, 2023, from https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines

World Health Organization. (n.d.). *Oral health*. Retrieved February 28, 2023, from https://www.who.int/health-topics/oral-health#tab=tab_1

World Health Organization. (2017). *Sugars and dental caries*. Retrieved March 25, 2023, from https://www.who.int/news-room/fact-sheets/detail/sugars-and-dental-caries

Wright, J. T. (2019). The role of genetics in caries risk and resistance. *Dimensions of Dental Hygiene*, *17*(2), 26-28,31. https://dimensionsofdentalhygiene.com/article/genetics-caries-risk/