



OREGON SMILE SURVEY

2012 REPORT

Oregon
Health
Authority

PUBLIC HEALTH DIVISION
Center for Prevention and Health Promotion
Maternal and Child Health Section

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Executive summary

The 2012 Oregon Smile Survey was conducted during the 2011–2012 and 2012–2013 school years. Specially trained dental hygienists screened 5,258 children in 1st, 2nd and 3rd grades from a statewide representative sample of 82 elementary schools in Oregon.



Results of the 2012 Smile Survey show that tooth decay rates for school-age children in Oregon remain above the goals set by Healthy People 2020. A little more than half of children 6 to 9 years old in 2012 already had a cavity. About one-fifth of children 6 to 9 years old had untreated decay and more than 17,000 children were found to have rampant decay, defined as having seven or more teeth with treated or untreated decay. Together, these findings indicate that the burden of oral health problems among school-age children in Oregon remains substantial.



Results of the 2012 survey also show that oral disease disparities exist for school-age children in Oregon based on geographic residence, household income, and race and ethnicity. Children from lower-income households had substantially higher cavity rates compared to children from higher-income households (63% vs. 38%), almost twice the rate of untreated decay (25% vs. 13%) and more than twice the rate of rampant decay (19% vs. 8%). Hispanic/Latino children had substantially higher rates of cavities, untreated decay, and rampant decay compared to white children, while black/African American children had higher rates of untreated decay.

The 2012 Smile Survey documented that there was improvement in the measures that had worsened from 2002 to 2007. For example, the percentage of children 6 to 9 years old with a cavity declined from 64% to 52% between 2007 and 2012. While this is encouraging, there is still considerable room for progress in preventing tooth decay in Oregon, where more than one in two children in 1st to 3rd grades have cavities, and cavity rates remain above the goals set by Healthy People 2020.

In addition, the survey showed that many children do not receive the oral health care they need. About 24,000 children 6 to 9 years old were in need of early or urgent dental care. On any given day, as many as 3,800 children in 1st to 3rd grades in Oregon are suffering from dental pain or infection.

The Oregon Health Authority Oral Health Program has focused on ensuring that statewide systems are in place to implement evidence-based prevention strategies, and those efforts have increased the capacity to provide effective preventive services in Oregon. For example, the state School-based Dental Sealant Program has expanded every year since its inception in 2006, with 140 schools served during the 2011–2012 school year compared to 43 during 2007–2008.

The work of the School-based Dental Sealant Program has supported increased access to dental sealants for 6- to 9-year-old children in Oregon. In 2012, 38% of 1st- to 3rd-graders had dental sealants, compared to 30% in 2007. By the time they reached 3rd grade during the 2011–2012 school year, 52% of children in Oregon had dental sealants, compared to 43% in 2006–2007. This progress is encouraging, but there is still substantial work to do to ensure that more children have access to this highly effective, safe, and low-cost method that prevents cavities.

The Oregon Health Authority also is collaborating with partners on programs such as “First Tooth,” which provides training to medical and dental providers on how to provide early childhood cavities prevention services. This includes applying fluoride varnish for infants and toddlers so that tooth decay can be prevented before children reach school age.

Meaningful collaboration between dental and medical providers, public health programs, schools, and others with a strong interest in oral health will be needed to support policies and programs to prevent dental disease in children. With that goal in mind, the Oral Health Program recommends five effective community-based preventive measures:

- Oral health care in coordinated care organizations (CCOs);
- Early childhood cavities prevention;
- Community water fluoridation;
- School-based fluoride supplement programs in areas without community water fluoridation; and
- School-based dental sealant programs.



Fast facts — 2012 Smile Survey

Among 6- to 9-year-olds:

Cavities



- Despite being preventable, tooth decay remains a major public health concern and causes needless pain and suffering for many of our children in Oregon.
- More than one in two children (52%) has had a cavity, representing about 66,000 Oregon school children.
- Children's overall decay experience has improved somewhat since the last Smile Survey. In 2012, the statewide cavity rate in primary (baby) or permanent (adult) teeth was lower than in the previous Smile Survey in 2007.
- The 52% cavity rate does not meet the Healthy People 2020 goal (49%), indicating there is more progress to be made in preventing tooth decay.

Untreated decay

- One in five children (20%) had untreated decay in their primary or permanent teeth.

Rampant decay

- More than 17,000 children had rampant decay — seven or more teeth with treated or untreated decay.

Dental sealants

- 38% of children had dental sealants, representing about 48,000 children in 1st to 3rd grades. Oregon has already surpassed the Healthy People 2020 target for dental sealants (28%).
- Just over half of all 3rd-graders have dental sealants. This means that about 20,000 3rd-graders do not have this highly effective, safe, and low-cost intervention that protects against cavities.

Need for dental care

- 19% of children were in need of early or urgent dental care, representing more than 24,000 children needing access to professional care.
- 3% of children had pain or infection and needed to see a dental professional immediately.

Disparities

- Children from counties in southeastern Oregon had higher cavity rates than the rest of the state.
- Children from lower-income households suffer more than children from higher-income households. Low-income children had:
 - » Higher cavity rates (63% vs. 38%)
 - » Almost twice the rate of untreated decay (25% vs. 13%)
 - » More than twice the rate of rampant decay (19% vs. 8%)
- Hispanic/Latino children experienced particularly high rates of cavities, untreated decay, and rampant decay compared to white children.
- Black/African American children had higher rates of untreated decay compared to white children.



Survey methods

The 2012 Oregon Smile Survey was conducted during the 2011–2012 and 2012–2013 school years. Specially trained dental hygienists screened 5,258 children in 1st, 2nd and 3rd grades from a statewide representative sample of 82 elementary schools in Oregon. The dental hygienists performed a brief, simple visual screening of each child’s mouth. Information on grade, age, sex, and language spoken at home was obtained from the school or from the children directly. Race and ethnicity were assessed by screeners if not provided by the school.

Information on eligibility for free and reduced price meals in the National School Lunch Program was obtained from the school. Data collected for the Smile Survey are representative of the state of Oregon and specific regions of the state. Data represent the statewide burden of oral disease related to tooth decay among 6- to 9-year-olds but do not measure the effect of any particular intervention on rates of tooth decay.

Height and weight of each child screened also was measured and recorded for a body mass index (BMI) calculation with this survey. This was the first statewide standardized collection of height and weight monitoring data for school-age children in Oregon. BMI data from this survey will be reported separately.*

* A complete description of the survey methods and sampling is available in the Appendix on page 20.

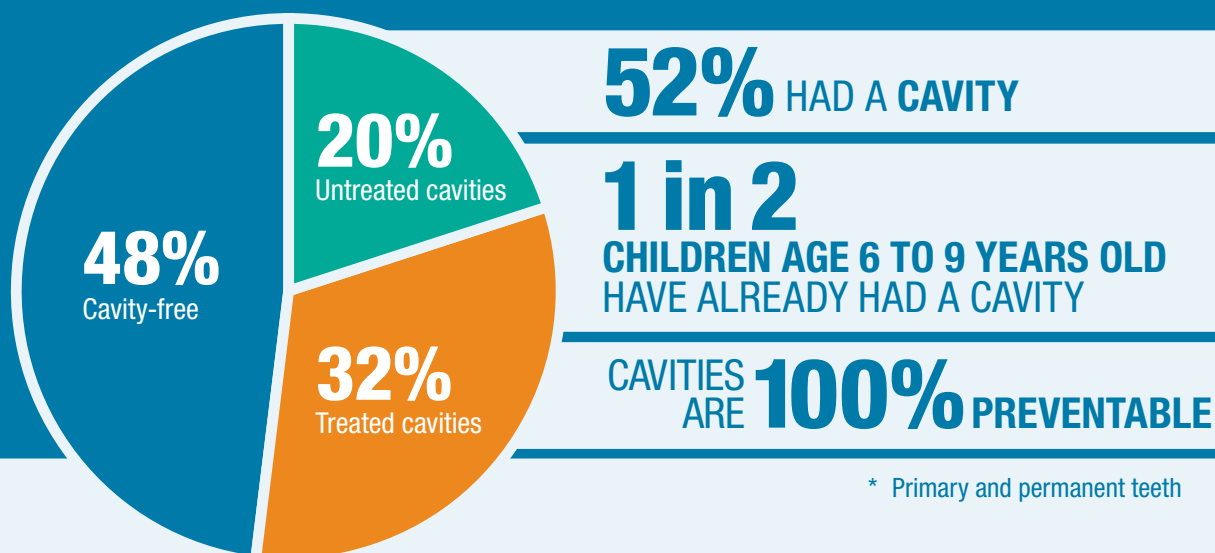
Survey findings

Tooth decay

In 2012, 52% of 6- to 9-year-old children in Oregon had already had a cavity,¹ while about one in five (20%) had untreated decay (Fig. 1). This means that about 66,000 children in 1st to 3rd grades had a cavity in 2012 and about 38% of those with a cavity had not received treatment.

Figure 1

Cavities* among children 6–9 years old, Oregon, Smile Survey 2012



Many children get their first cavity before they lose their first baby tooth. Tooth decay can be painful and lead to infection. Left untreated, tooth decay often has serious consequences that can negatively affect a child's development and school performance. It can make it difficult to chew, difficult to speak, increase the number of missed school days, and increase health care costs. Over time, dental decay can become severe enough to require costly emergency treatment.

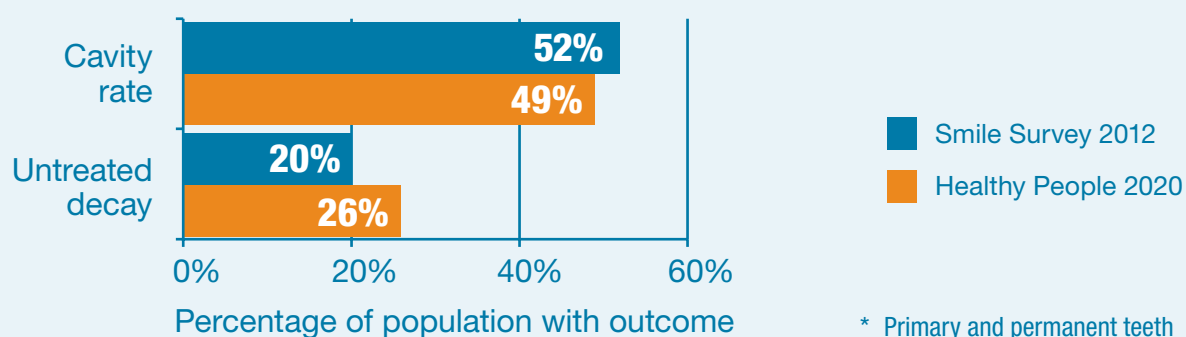
Given the potential consequences of cavities for school-age children, efforts need to be focused on preventing cavities whenever possible and treating them promptly when they occur. In 2012, the proportion of 6- to 9-year-olds with a cavity in Oregon was above the U.S. Department

¹ Cavities include tooth decay in the primary (baby) and/or permanent (adult) teeth across the lifespan. Cavities can be past (fillings, crowns, or teeth that have been extracted because of decay) or present (untreated cavities).

of Health and Human Services' Healthy People 2020 goal (52% vs. 49%) (Fig. 2). This indicates there is more work to be done in Oregon to prevent cavities among school-age children.

Figure 2

Oral health status* of children 6-9 years old compared to Healthy People 2020 objectives, Oregon, Smile Survey 2012



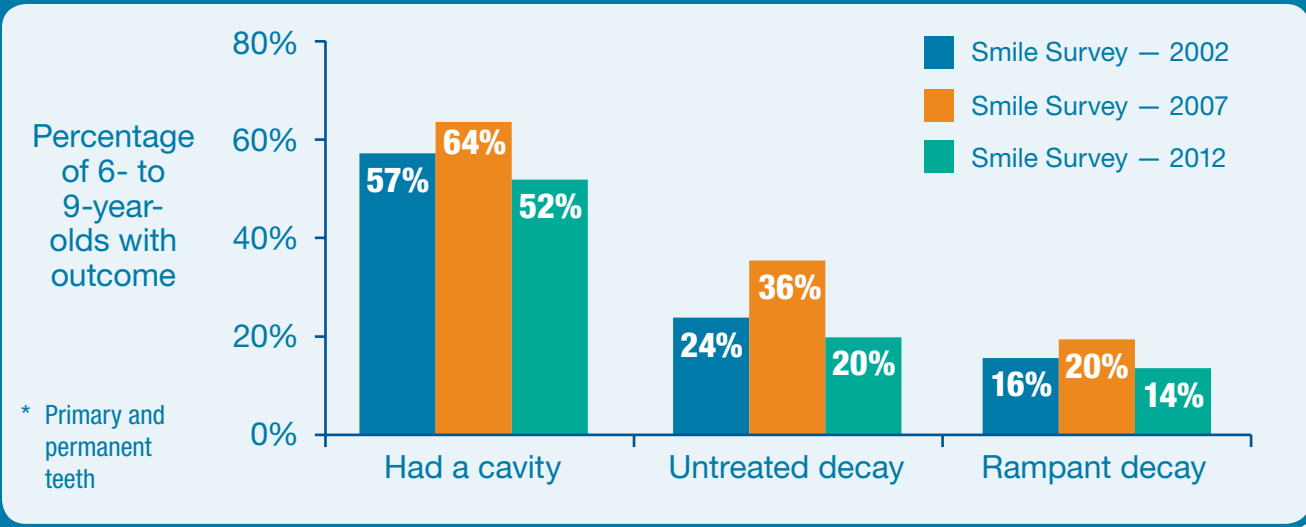
In 2012, Oregon surpassed the Healthy People 2020 goal for untreated decay among 6- to 9-year-olds (20% vs. 26%) (Fig. 2). While this is encouraging, it means that nearly two out of five school-age children with cavities in Oregon had not received treatment in 2012.

Results of the three Smile Surveys conducted since 2002 have consistently shown that more than one in two 6- to 9-year-olds in Oregon have had at least one cavity, at least one in five has untreated decay (cavities that have not been treated), and at least one in seven has rampant decay (seven or more teeth with decay) (Fig. 3).

While results in 2012 appear improved from the worsening oral health status seen between 2002 and 2007, the burden of oral health problems among school-age children in Oregon remains substantial.

Figure 3

Oral health status,* children 6-9 years old, Oregon, 2002 - 2012 Smile Surveys



Focus on disparities Regional disparities

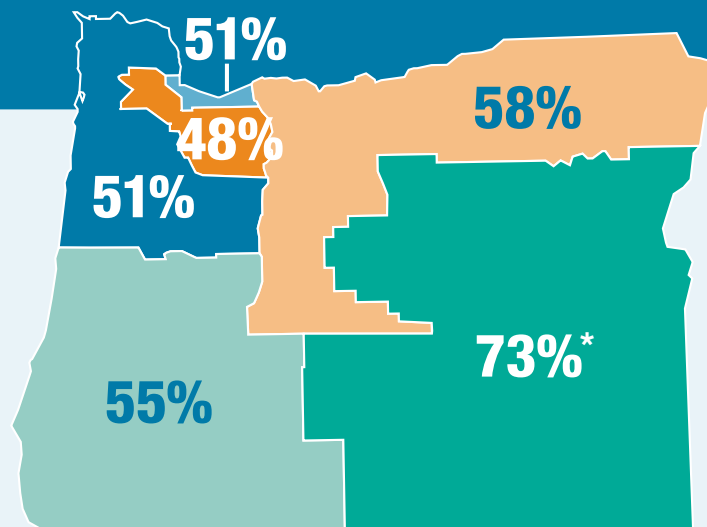
Cavity rates among 6- to 9-year-old children in 2012 were generally at or above 50% throughout the state of Oregon, with one region in southeast Oregon experiencing cavity rates that were substantially higher than the rest of the state (Fig. 4). All other regions had cavity rates that were similar to the statewide average of 52%. This indicates that there are remaining challenges in providing children with preventive oral health services, especially in rural locations.

Figure 4

Cavity rates[†] by geographic region, Oregon, Smile Survey 2012

[†] 6- to 9-year-olds, primary and permanent teeth

* Statistically different from the statewide average of 52%

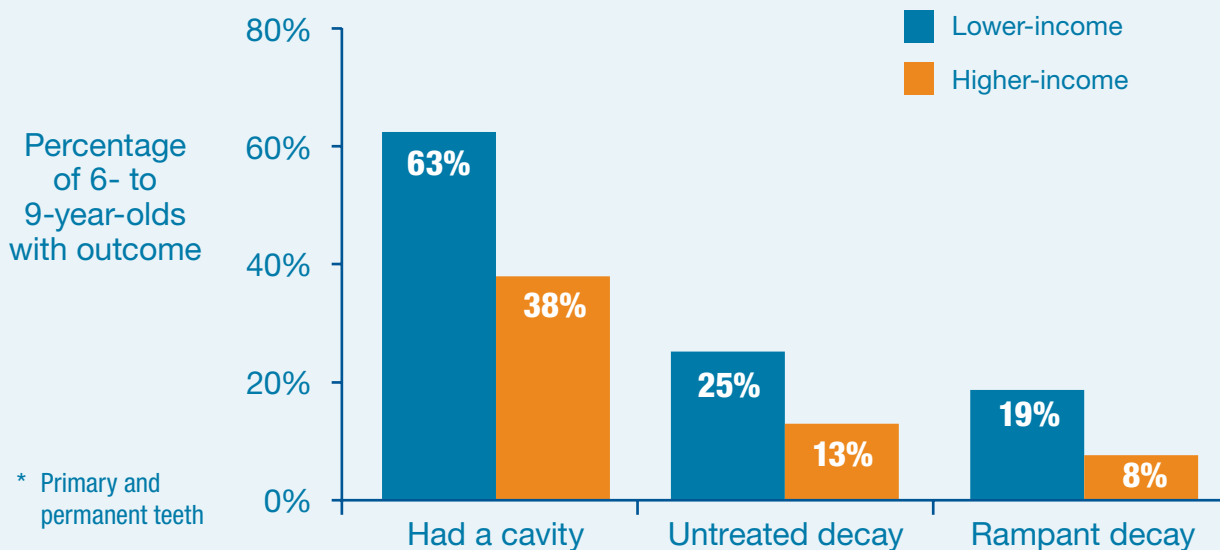


Household income disparities

In 2012, children from lower-income households had substantially higher rates of cavities and untreated decay, and more than twice the rate of rampant decay, compared to children from higher-income households (Fig. 5).

Figure 5

Oral health status* of children 6-9 years old by household income^{†‡}, Oregon, Smile Survey 2012



Racial and ethnic disparities

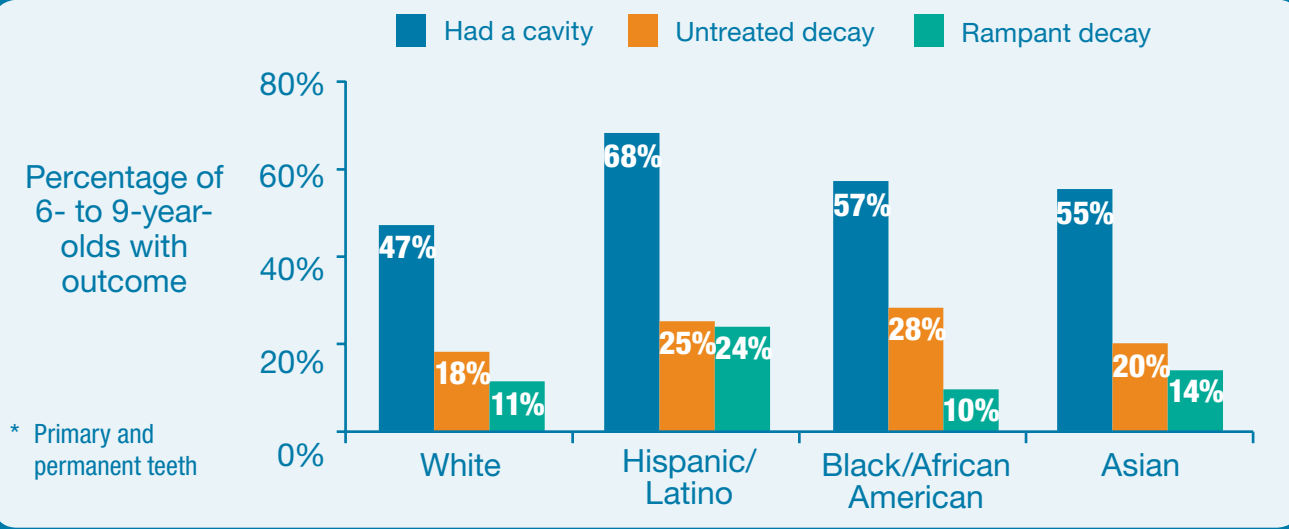
In 2012, Hispanic/Latino 6- to 9-year-olds experienced particularly high rates of cavities, untreated decay, and rampant decay compared to white children (Fig. 6). Black/African American children had substantially higher rates of untreated decay compared to white children.

[†] Information on household income was not collected for this survey. A proxy for household income was used instead based on eligibility for free and reduced price meals in the National School Lunch Program. Children eligible for free and reduced price meals are characterized as being from lower income households for this report.

[‡] Eligibility for free and reduced-price meals in the National School Lunch Program (NSLP) is a household income at or below 130% of the federal poverty level (FPL) for free meals and between 130% and 185% of the FPL for reduced-price meals.

Figure 6

Oral health status* among children 6-9 years old by race/ethnicity, Oregon, Smile Survey 2012



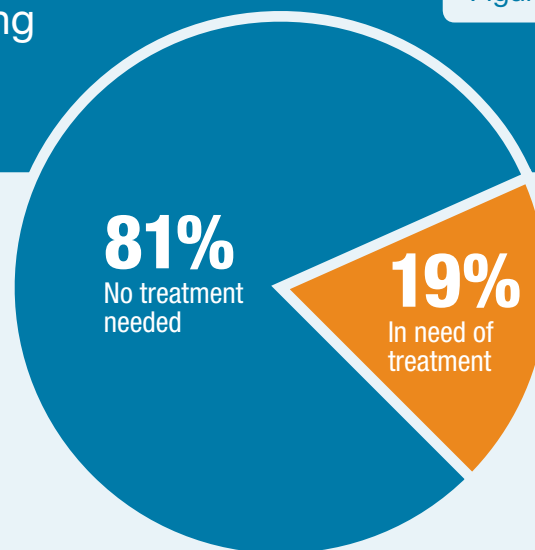
Access to dental care

Many of Oregon's children do not receive the oral health care they need. In 2012, 19% of 6- to 9-year-old children in Oregon were in need of early or urgent dental care (Fig. 7).³ This represents about 24,000 children who need access to professional care. In Oregon, children from lower-income households were more than twice as likely to need early or urgent treatment as children from higher-income households in 2012.

Figure 7

Children 6-9 years old needing early or urgent dental care³, Oregon, Smile Survey 2012

Overall, 3% of 6- to 9-year-old children had pain or infection that needed urgent treatment in 2012. That means that, **on any given day, as many as 3,800 children in 1st to 3rd grades in Oregon may be in school suffering from dental pain or infection.**



³ Early dental care was defined as a child having visible signs of oral problems at the time of screening. Urgent dental care was defined as a child having pain or infection at the time of screening.

Dental sealants

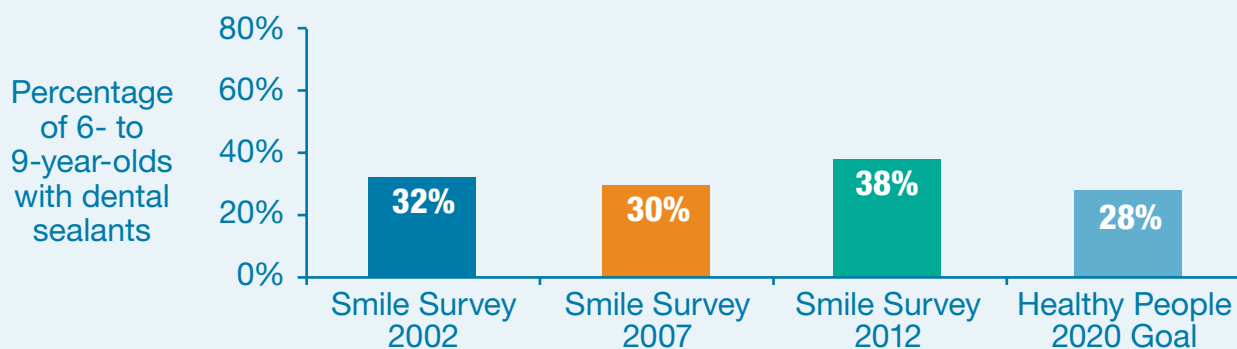
Dental sealants are thin liquid coatings applied to the chewing surfaces of the back adult teeth. The coatings flow into the grooves and pits of these surfaces, then harden, and effectively seal out bacteria that causes decay. Most tooth decay (90%) occurs in these grooves and pits.⁴ Sealants prevent about 40%–75% of decay in the treated teeth and last for about nine years.^{5,6}



In Oregon, 38% of 6- to 9-year-old children had dental sealants in 2012 (Fig. 8), representing about 48,000 children in 1st to 3rd grades. Oregon has already surpassed the Healthy People 2020 target for dental sealants for 6- to 9-year-olds (28%).⁷

Figure 8

Dental sealant rates for children 6-9 years old



When looking at only 3rd-graders, just over half of them had dental sealants (52%). While more 3rd-graders in Oregon had dental sealants in 2012 compared to the last Smile Survey in 2007, there are still about 20,000 3rd-graders currently without this highly effective, safe, and low-cost intervention that protects against cavities.

⁴ Gooch BF, Griffin SO, Gray SK, et al. Preventing dental caries through school-based sealant programs: updated recommendations and reviews of evidence. *J Am Dent Assoc.* 2009;140(11):1356-1365.

⁵ <http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>

⁶ Beauchamp J, Caufield PW, Crall JJ, et al. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *J Am Dent Assoc.* 2008;139(3):257-68.

⁷ The Healthy People 2020 goal for dental sealants (28%) is much lower than the Healthy People 2010 goal of 50%. The Healthy People 2010 goal only measured 8-year-olds, and by 2010, only 32% had dental sealants. For Healthy People 2020, the targeted population category was broadened from 8-year-olds to 6- to 9-year-olds and the goal lowered to 28%, as children 6 and 7 years old are less likely to have dental sealants.

Summary

Results of the 2012 Smile Survey show that tooth decay rates in Oregon remain above the goals set by Healthy People 2020, with more than half of children 6 to 9 years old in 2012 already having a cavity.

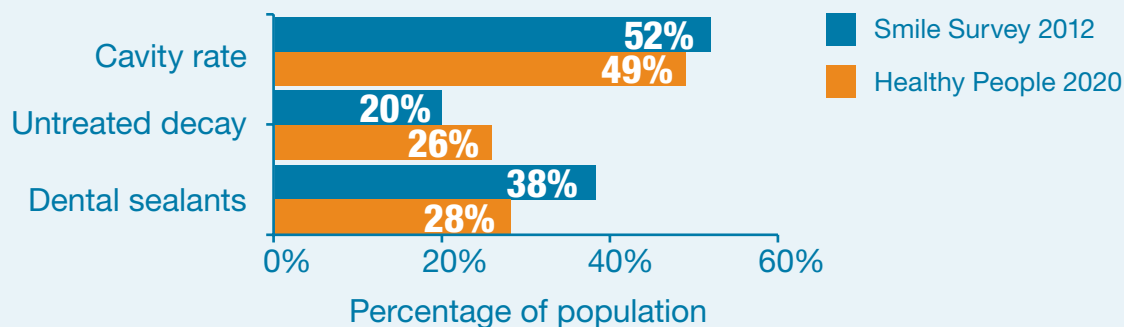
While improvements generally have been made between 2007 and 2012, results of the survey indicate that substantial disparities in oral health exist for children in Oregon based on geographic residence, household income, and race and ethnicity. Children from lower-income households have substantially higher rates of cavities, untreated decay, and rampant decay compared to children from higher-income households. Hispanic/Latino children have substantially higher rates of cavities, untreated decay, and rampant decay compared to white children, while black/African American children have higher rates of untreated decay.

The survey also documented that many children do not receive the oral health care they need. On any given day, as many as 3,800 children in Oregon are suffering from dental pain or infection.

Healthy People 2020 established 10-year national objectives for improving access to oral health care and improving the oral health of all Americans. In 2012, Oregon met the Healthy People 2020 objectives for improving health care (reducing the proportion of 6- to 9-year-old children with untreated dental decay and increasing the prevalence of dental sealants), but did not meet the Healthy People 2020 objective for improving oral health (reducing the prevalence of cavities in 6- to 9-year-old children) (Fig. 9). As measured against Healthy People 2020 goals, Oregon has progress to make with respect to reducing the rate of cavities among 6- to 9-year-olds.

Figure 9

Oral health of children 6-9 years old compared to Healthy People 2020 objectives, Oregon, Smile Survey 2012



Recommendations and current program activities

Continued improvements in oral health in Oregon will require collaborative efforts by public health, dental and medical providers, schools, and the community at large to support policies and programs intended to prevent dental disease in children. With that goal in mind, the Oral Health Program recommends five effective community-based preventive measures:

- Oral health care in coordinated care organizations (CCOs);
- Early childhood cavities prevention;
- Community water fluoridation;
- School-based fluoride supplement programs in areas without community water fluoridation; and
- School-based dental sealant programs.

Oral health care in coordinated care organizations (CCOs)

Access to oral health care for individuals needs continued attention. Efforts to transform Oregon's health system have great promise to help in this regard. The creation of coordinated care organizations (CCOs) and expansion of patient-centered primary care homes can help create the infrastructure needed to improve access to dental care for individuals in need.

Early childhood cavities prevention

Early childhood cavities prevention services are a first step in prevention of tooth decay and set a child on a healthy path for other preventive measures at the appropriate developmental stage, such as dental

sealants for school-age children. The Oral Health Program, in partnership with the Oregon Oral Health Coalition, launched a program called "First Tooth," which provides no-cost training to medical and dental professionals on how to integrate oral health preventive services for infants and toddlers into their current practices. "First Tooth" follows evidence-based practice for early childhood caries prevention (ECCP) that includes a risk assessment, anticipatory guidance, an intervention as appropriate (fluoride varnish application), and referral to a dental home. Research shows that application of



fluoride varnish can reduce tooth decay by about 30% in primary teeth of high-risk children.⁸ Since 2010, “First Tooth” has been able to train more than 1,400 participants from medical and dental practices in 25 different counties in Oregon.

In addition to these interventions delivered in a clinical setting, the following community-based prevention efforts delivered outside of the dental care provider’s office have great potential to reduce the burden of dental disease in Oregon. These prevention approaches are recommended because they complement clinical dental care and produce additional reductions in dental decay beyond that achievable in a provider’s office. Community-based efforts also have the potential to impact lower-income groups and communities of color, where rates of tooth decay are particularly high.



Three evidence-based preventive measures delivered outside of a health care provider’s office are recommended: community water fluoridation; school-based fluoride supplement programs in areas without community water fluoridation; and school-based dental sealant programs.

Community water fluoridation

Water fluoridation is the controlled addition of a fluoride compound to a public water supply to achieve a concentration optimal for tooth decay prevention. Community water fluoridation is an evidence-based practice recommended by the Community Preventive Services Task Force based on strong evidence of effectiveness in reducing dental cavities across populations.⁹ It is an effective, affordable, and safe way to protect children from tooth decay and is recognized as one of the 10 greatest public health achievements of the 20th century.^{10,11} Water fluoridation complements, but does not replace other efforts to improve oral health. After communities fluoridate their water supplies, the percentage of children in the population with at least one cavity decreases by about

⁸ Association of State and Territorial Dental Directors (ASTDD). Fluoride varnish policy statement. 2010, February 1. [http://www.astdd.org/docs/FluorideVarnishPolicyStatement\(ECFebruary12010\).pdf](http://www.astdd.org/docs/FluorideVarnishPolicyStatement(ECFebruary12010).pdf)

⁹ <http://www.thecommunityguide.org/oral/supportingmaterials/RRfluoridation.html>

¹⁰ <http://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm>

¹¹ <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4841a1.htm>

15%, on average, compared to before water fluoridation.⁹ The average number of cavities experienced by children in the population also is reduced when community water fluoridation is initiated.⁹ Water fluoridation is a valuable tool in addressing oral health disparities, since everyone benefits from it regardless of age, income level, or race or ethnicity. In 2010, about 74% of the U.S. population served by community water systems received fluoridated water compared to about 23% in Oregon.¹²

School-based fluoride supplement programs

Although community water fluoridation is the most efficient and effective way to provide fluoride for communities, children in communities without water fluoridation can receive fluoride by tablets or rinses. For communities without water fluoridation, participation in a school-based fluoride supplement program is recommended. School fluoride programs can reduce the rate of cavities by about 20%–30% for the children who participate,¹³ but there are several challenges in delivering school-based fluoride programs. It is more expensive and children miss services while out of school on breaks.

The Oral Health Program currently partners with elementary schools around the state to implement fluoride tablet and rinse programs for children in kindergarten through 6th grade in elementary schools with 30% or more of the students eligible for the federal free or reduced lunch (FRL) program.¹⁴ School-based fluoride tablets are delivered daily in the classroom by a teacher, aide, or onsite coordinator. Fluoride rinse is delivered in a similar manner once per week. During the 2011–2012 school year, more than 14,400 children were served by the program. Forty-two schools participated in the tablet program and 40 schools participated in the rinse program.



¹² Centers for Disease Control and Prevention (CDC). Community water fluoridation: 2010 water fluoridation statistics. 2010, December 31. <http://www.cdc.gov/fluoridation/statistics/2010stats.htm>

¹³ <http://www.astdd.org/use-of-fluoride-school-based-fluoride-mouthrinse-and-supplement-programs/>

School-based dental sealant programs

A dental sealant is a liquid coating applied to the chewing surfaces of molar teeth for the purpose of preventing tooth decay. School-based dental sealant programs are an evidence-based practice recommended by the Community Preventive Services Task Force based on strong evidence of effectiveness in preventing tooth decay among children.¹⁵ Most tooth decay (90%) occurs in the molars, and school-based dental sealant programs can reduce tooth decay by about 40%–50% in the treated teeth.¹⁵ The Oral Health Program, in partnership with communities, elementary schools, and dental care professionals, promotes and implements a statewide School-based Dental Sealant Program.

The state School-based Dental Sealant Program provides screenings and dental sealants to 1st- and 2nd-graders in elementary schools with 50% or more of the students eligible for the federal free or reduced lunch (FRL) program. In small schools, dental sealants are provided to students in 1st through 5th grades. Any student with parental permission can receive services. Dental sealants are delivered by registered dental hygienists onsite at participating schools using portable dental equipment. During the 2011–2012 school year, the program directly served close to 7,000 children in 140 schools, providing more than 16,000 dental sealants. Statewide, the program reaches 30% of all eligible schools. When combined with locally operated dental sealant programs, approximately 69% of eligible schools are served.



¹⁴ The Oral Health Program's fluoride tablet and rinse programs are funded by the federal Maternal and Child Health Title V Block Grant.

¹⁵ <http://www.thecommunityguide.org/oral/supportingmaterials/RRschoolsealant.html>

Appendix

Methodology

The 2012 Oregon Smile Survey was conducted during the 2011–2012 and 2012–2013 school years. In Oregon, 5,258 children in 1st, 2nd and 3rd grades were screened from a statewide representative sample of 82 elementary schools. Specially trained dental hygienists performed a brief, simple visual screening of each child’s mouth and recorded the height and weight of each child for a body mass index (BMI) calculation. This was the first statewide standardized collection of height and weight monitoring data for school-age children in Oregon. BMI data from this survey will be reported separately.



Sampling was based on 3rd-grade enrollment and stratified by six geographic regions. Schools were sorted within each region based on the percentage of children participating in the federal free or reduced lunch (FRL) program. A systematic sampling system was used to originally select 84

elementary schools with 3rd-grade children. Three of the schools had closed, leaving 81 schools in the sample. Two of the elementary schools selected did not have 1st- or 2nd-grade students, so the appropriate “feeder” schools were added to the sample for a total of 83 schools. After contacting the sample schools for participation, 70 replacement schools were randomly selected to replace the schools that declined to participate. Replacement schools matched the schools they replaced. From a total of 151 schools contacted, 81 schools with 3rd grades plus one “feeder” school participated in the Smile Survey for a total of 82 schools. For each randomly selected school, children were screened in one 1st-, one 2nd- and one 3rd-grade classroom.

Student participation was achieved using a passive consent approach. Letters in English, Spanish, Russian, Vietnamese, and any other language, as requested, were sent home to parents explaining the purpose of the survey and that all information would be kept confidential unless an urgent dental need was identified. Information about children's urgent dental needs was shared with appropriate school staff that could help ensure prompt treatment. Parents were instructed to return a signed form only if they did not want their children screened. In each randomly selected school, all children enrolled in the selected 1st-, 2nd- and 3rd-grade classrooms that were present on the day of the screening were examined, unless a parent/guardian returned the consent form specifically requesting that the child not take part in the survey.



Prior to the beginning of data collection (screening), the Oregon Health Authority Oral Health Program contracted with registered dental hygienists from the state School-based Dental Sealant Program. Dental hygienists attended a one-day training that included a review of the diagnostic criteria, along with a hands-on calibration session. The Basic Screening Survey (BSS) clinical indicator definitions and data collection protocols were used. Whenever possible, screenings for the Smile Survey were coordinated with the school schedules of the state School-based Dental Sealant Program.

On the screening day for each school, children were screened by dental hygienists using gloves, dental mirrors, and an external light source. Information on grade, age, sex, and language spoken at home was obtained from the school or from the children directly. Race and ethnicity were assessed by screeners if not provided by the school. Information on participation in the federal free or reduced lunch (FRL) program was obtained from the school only. Presence of treated decay (defined as fillings, crowns, or teeth that have been extracted because of decay); presence of untreated decay (defined as dental cavities in the primary or permanent teeth that have not received appropriate treatment); need for early or urgent dental care at time of screening (early dental care defined as visible signs of oral infection; urgent care



defined as pain or infection); and presence of dental sealants was determined by the dental hygienists. Data were collected using scannable forms.

Data analysis was completed using the complex survey procedures within SAS 9.3. Sample weights were used to produce population estimates based on selection probabilities. The survey design was based on grade rather than age; therefore, children between 6-9 years of age in grades other than 1st, 2nd and 3rd were not screened. Since 9-year-olds may be in 4th grade, the survey underrepresented 9-year-old children. However, national oral health data collected using similar methods are used to represent 6- to-9-year-old children nationwide. Because these data are used for comparison, Smile Survey results are used to represent 6- to 9-year-old children in Oregon.

Data limitations:

- Data collected for the Smile Survey are representative of the state of Oregon and specific regions of the state.
- Data from the Smile Survey represent the overall burden of oral health issues related to tooth decay for 6- to 9-year-old children; other age groups are not included in the survey.
- Data are not meant to measure the effect of any particular intervention.

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