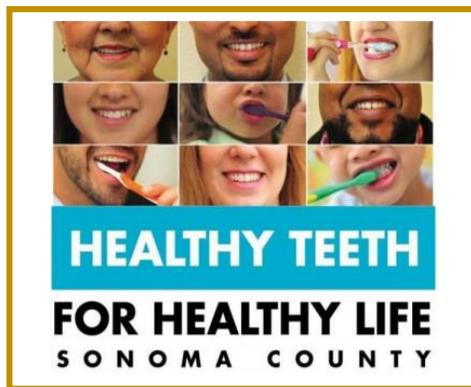




# Costs of Prevention and Early Treatment of Dental Disease in Sonoma County



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## REPORT SUMMARY

**Dental disease continues to be a source of preventable suffering and expenditures for Sonoma County residents of all ages.** Each year, the direct cost of restoring new cavities in Sonoma County is \$127 million dollars. Including the indirect costs of time and school funding brings the total to \$141.6 million dollars.

Cavities and dental decay can in large part be avoided, and Sonoma County has an opportunity to reduce the cavities, root canals, extractions and infections that cause significant human and economic burdens, especially among low-wage families and within communities of color.

The Department of Health Services has identified five key strategies, or pillars, to improve oral health in Sonoma County. Each pillar has unique benefits and impacts on population health. The implementation of each pillar also requires monetary and resource costs.

**The purpose of this report is to estimate and summarize the various cost aspects of each pillar.** It is not intended to promote one pillar at the expense of another; in fact, when implemented collectively, the strategies listed below may even provide a synergistic protective effect. A description of the pillars, their clinical implementation, and population potentially affected by each is provided in the text of this report.

The key costs associated with each of the pillars are as follows:

- **Access to Dental Health**
  - Presently, \$17.7 million dollars per year in O&M<sup>1</sup> costs to operate 62 safety net dental chairs in clinics and provide 80.6 thousand appointments for Denti-Cal and other low-wage children and adults.
  - Providing annual appointments for the 105.6 thousand enrolled in Medi-Cal would require an additional \$5.5 million, for a total of \$23.2 million dollars annually.
- **Community Health Education**
  - \$500,000 per year currently spent by the County of Sonoma in community education strategies.
  - Approximately 50 thousand children and adults reached annually through Sonoma County educational efforts.
- **Fluoride Varnishes**
  - \$7.5 million dollars per year to provide every child ages three to eighteen with fluoride varnishes twice annually.
  - Approximately 94 thousand children, or 19% of the Sonoma County population, would be reached at a cost of \$80 per child per year.
- **Sealants**
  - \$2.4 million dollars per year to apply four sealants to each of 10.5 thousand children.

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<sup>1</sup> Operations and Management costs, which include all annual costs incurred by a business (cash operations, maintenance, administration, etc.).

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

- Many more children would benefit from the sealants that remain in place from prior years.
- **Community Water Fluoridation (CWF)**
  - \$731 thousand dollars per year in O&M and annual share of capital costs to provide 308 thousand Sonoma County residents and 61 thousand Marin County residents with CWF [1]. (\$581 thousand dollars annually in O&M costs alone).

### Key Finding

**While all pillars have the potential to provide substantial benefits to Sonoma County residents, community water fluoridation would reach the greatest number of residents at the lowest per-person cost.**

## Contents

REPORT SUMMARY .....	1
Acknowledgements.....	<b>Error! Bookmark not defined.</b>
INTRODUCTION.....	4
ANNUAL COST OF NEW CAVITIES IN SONOMA COUNTY.....	5
THE FIVE PILLARS OF DENTAL HEALTH.....	6
Access to dental care .....	7
Community education .....	8
Fluoride varnishes.....	8
Sealants.....	9
Community water fluoridation .....	9
SUMMARY OF FINDINGS.....	11
APPENDIX.....	12
REFERENCES.....	13

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## INTRODUCTION

**Dental decay is the most common chronic disease of childhood – five times more common than asthma.** The 2014 Smile Survey found that more than half of Sonoma County kindergarten and third grade students have decay experience and 18% have untreated tooth decay, with 4% in need of urgent treatment [2]. Poor dental health affects adults as well – nationally, approximately 25% of adults over the age of 60 no longer have any natural teeth [3]. Adults and children living with poor dental health experience pain, have trouble concentrating, feel social stigma, and struggle to eat healthy foods. Left untreated, dental decay infects the teeth and gums, and can spread to the brain, heart and blood – occasionally resulting in death.

In 2014, the Sonoma County Department of Health Services commissioned A Portrait of Sonoma County, a report examining human development throughout Sonoma County along three dimensions: a long, healthy life, access to knowledge, and a decent standard of living. It also explored the many social and economic factors that determine individual and community health, and the uneven distribution of those factors throughout the County. Like many other health measures, dental disease is not equally spread across the community – those with limited resources often carry the greatest burdens. In Sonoma County, both the 2009 and the 2014 Smile Surveys demonstrated disparities between white and Latino children, and between wealthier and economically disadvantaged children [2].

Although dental disease is a major concern in the county, much of it can be prevented. The Sonoma County Department of Health Services has identified five key strategies, or pillars, to improve dental health for all residents. These pillars enable the county to improve the lives of many children and adults. Each pillar provides a unique benefit in the county’s overall oral health strategy, and each pillar also requires unique economic resources.

The purpose of this report is to:

- 1) provide a high-level summary of the costs associated with dental disease in Sonoma County; and
- 2) estimate the costs associated with each of the five dental health pillars under specific scenarios.

In combination with peer-reviewed research on the benefits of Sonoma County’s prevention strategies, this report describes the relative merits of each in terms of both public reach and annual costs.

## ANNUAL COST OF NEW CAVITIES IN SONOMA COUNTY

Prior to delving into the costs of each pillar, this section provides an estimate of the overall annual economic cost of new cavities in Sonoma County. This cost value provides a good point of reference with respect to the costs of prevention strategies discussed later in the report. Using national data and the established methodologies of Griffin [4] and O’Connell [5], along with Sonoma County’s age distribution, the number of new cavity surfaces among the entire Sonoma County population is estimated to be 450,000 annually. This is based on data for individuals age 5 and above, and uses annual cavity incidence as found in non-fluoridated communities.

The economic cost of cavities may be measured in multiple ways. This particular estimate considers the following three types of economic costs:

1. Direct costs associated with cavity repair by a licensed dentist
2. Indirect (opportunity) costs of personal time spent at the dentist’s office
3. Indirect costs of school funding dollars withheld due to absenteeism

1. The ADA fee schedule for 2013 is used as a proxy for dental procedure cost throughout this report [6]. The average cost of a one-surface restoration is \$283 (Appendix). When all one-surface cavities that develop over a one-year period are restored appropriately – and not delayed to a future point when the surface destruction may develop into more severe disease – the total restoration cost for new cavity surfaces equals approximately \$127 million dollars.

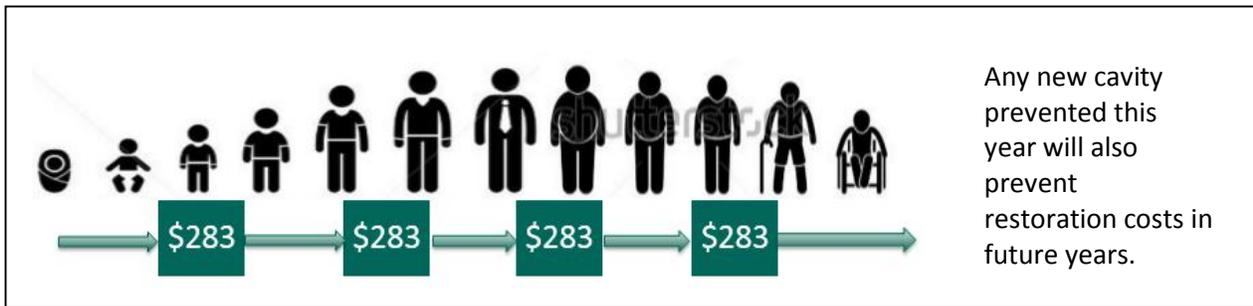
2. Dental treatment requires time spent at a dentist’s office. While the value of time is clear for the case of employees taking time off from work, all individuals’ time has value – this loss is considered an opportunity cost. When an average one-surface restoration takes 1.6 hours, and the average value of an individual’s time is \$20/hour, lost wages and time account for an economic loss of \$14.2 million dollars to restore the new cavities occurring annually in Sonoma County[5].

3. Schools receive funding based on Average Daily Attendance (ADA) at the rate of \$34 per child per day. Using California state data that estimated the number of school days missed due to dental problems, Sonoma County’s proportionate annual loss in school funding is approximately \$384,000 [7].

The annual cost associated with repair of new cavities in Sonoma County is \$127 million dollars. When including the indirect costs of personal time and school funding, the annual economic cost rises to \$141.6 million dollars.

This is an underestimate. It does not capture the entire lifetime cost of cavities developed in a given year. Most new cavity restorations will require maintenance costs in future years. The average filling is expected to last twelve years before requiring a replacement [8]. Therefore, a ten-year-old child might incur a direct cost of \$283 *this year*, but will likely require additional payments of \$283 (or more) for each replacement the individual needs throughout her 20s, 30s, and so on.

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County



**Delayed care is costly.** Good dental care begins with periodic, comprehensive oral exams. The average cost of regular preventive care which help to reduce the likelihood of developing dental decay is \$53 for a periodic oral exam and \$80 for a comprehensive dental exam [6]. An individual delaying treatment until a problem becomes too painful to endure any longer might seek emergency and surgical treatment. For example, at the PDI Surgery Center, providing anesthesia assisted dental surgeries for children 7 and under and for the disabled, scheduled outpatient procedures cost an average of \$1,400 [9]. Emergency department visits requiring hospitalizations are even more costly; California Healthcare Foundation found an estimated median reimbursement of \$5,044 based on Medi-Cal Dental Service Branch data [10]. Furthermore, hospitalizations provide temporary pain relief, not the restoration treatment that will still need to be performed by a dentist.

### THE FIVE PILLARS OF DENTAL HEALTH

The Department of Health Services has identified five key strategies, or pillars, to improve oral health in Sonoma County. While the overarching goal of promoting five pillars of health is to improve dental health for all county residents, each pillar has unique benefits and impacts on population health. The implementation of each pillar also requires monetary and resource costs.



This section examines each pillar independently and considers potential annual costs under the described scenarios. Each pillar is also evaluated in terms of reach within the population.

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

The five pillars, along with brief statements of their purposes, are:

Pillar	Rationale
1. ACCESS TO DENTAL CARE	Regular visits to a dental health professional are foundational to dental disease prevention, early diagnosis, and treatment, but is often lacking for low-wage families and others ineligible for Denti-Cal.
2. COMMUNITY HEALTH EDUCATION	Educational programs providing accurate information about dental hygiene, healthy dietary practices, and the importance of dental health to overall health reinforce positive habits and promote behavioral changes.
3. FLUORIDE VARNISH	Fluoride varnishes applied to all teeth several times yearly prevent disease, especially for those with medium- to high-risk of decay [11].
4. SEALANTS	Sealants applied to the chewing surfaces of permanent molars provide long-term protection for tooth surfaces most vulnerable to tooth decay [12].
5. COMMUNITY WATER FLUORIDATION	Community water fluoridation provides protection in two ways: systematically by making teeth stronger before they have even erupted when babies drink fluoridated water, and topically by protecting the tooth surface from decay when fluoridated water is in contact with the teeth.

### Access to dental care

Many Sonoma County residents do not have access to affordable preventative dental care. Even when enrolled in the state's Denti-Cal insurance coverage program, care is not always readily available. Only nine dental offices or clinics accept new Denti-Cal patients in Sonoma County [13]. A lack of dentists is partly due to Denti-Cal reimbursement rates, which are near the bottom for the nation and much lower than what private dentists normally charge.

Access to dental care affects many groups. While nearly 20,000 Sonoma County children are enrolled in Denti-Cal, the ratio of providers to beneficiaries is one dentist to 2,155 children [14]. No private pediatric dentist accepts Denti-Cal. In 2013, the utilization rate for child beneficiaries was only 17.9% [14].

The need is great for adult Medi-Cal enrollees as well. From 2009 to 2015, the dental health benefit was discontinued in California, resulting in a backlog of patients who delayed dental preventive and restorative treatment and now face deteriorating dental health. Although the program has been restored, present adult benefits do not include most root canals, implants nor partial dentures.

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

Other Sonoma County residents may not be eligible for Denti-Cal but are unable to afford private dental insurance either. This includes undocumented immigrants and those earning just above the poverty line.

Despite substantial investments in dental care within Sonoma County – including new dental clinics, mobile clinics and the delivery of school-based preventive and treatment services, needs surpass resources. Currently, 62 chairs are available for dental services in the federally qualified “safety net” health centers [15]. Each chair is estimated to have an annual capacity between 1,300 and 1,750 services depending on procedure type [16, 17]. The annual estimated O&M cost associated with each chair is \$285,000 [18], so currently, the annual O&M total is \$17.7 million dollars. If individuals are allotted one annual visit each for preventative dental care, and each chair serves 1,300 people, 80.6 thousand children and adults would be reached in a year.

Sonoma County has a Medi-Cal enrollment of 105,602 [19]. If current reach is 80.6 thousand, there is an unmet need of 25 thousand people. **Providing annual visits to an additional 25 thousand individuals would require nearly 20 more chairs at \$5.5 million in O&M costs annually. Therefore, providing access to 105,600 individuals in total would cost \$23.2 million dollars annually.**

### Community education

By effectively educating and encouraging individuals to care for their own and their children’s oral health, lasting habits and behaviors may be formed that reduce the likelihood of cavity transmission and formation. However, education must continually evolve and adapt to reinforce beneficial behaviors and to reach new audiences. While a single most effective method or an ideal quantity of education efforts required to inform the community is unknown, educational efforts provide a greater bang for the buck when combined with other prevention strategies in a synergistic manner.

**Many educational efforts are currently underway in Sonoma County. The Department of Health Services has invested approximately \$1 million dollars toward dental health programming over the past two years, or roughly \$500,000 per year [20].** This funding has supported a variety of efforts, including the newly established Dental Health Program, the Healthy Teeth for Healthy Life campaign, Women, Infant and Children (WIC) dental days, school-based sealant programs with strong classroom education components, and presentations, community events, printing, and website and Facebook administration. Other educational efforts, such as Mighty Mouth, Mommy and Me, Early Head Start, Head Start, and PDI Surgery Center parent meetings are carried out with the support and resources of our community based partners.

### Fluoride varnishes

A fluoride varnish is a concentrated topical fluoride solution applied directly to teeth by health care professionals. Remaining in contact with tooth surfaces for several hours, the varnish helps prevent decay and can repair tooth surfaces. Fluoride varnishes applied every six months are as effective as fluoride gels [11, 21]. Therefore, cavity incidence is reduced by 20% with the application of regular fluoride varnishes [22]. For children at higher risk for dental decay, the cavity incidence reduction can be much higher.

The average cost of a fluoride varnish procedure is \$40 [6]. **If twice-annual varnishes were made available to all Sonoma County children ages 3 to 18, approximately 94.3 thousand children would receive fluoride varnishes every six months; this represents 19% of the total Sonoma County population. At \$40 per varnish application, the total cost of this scenario would be \$7.5 million dollars per year.**

### Sealants

Dental sealants are thin plastic coatings applied to the chewing surfaces of molars by health care professionals to keep germs and food particles out of crevices. This procedure is relatively simple, and sealants can remain in the mouth for up to 10 years [11]. As long as sealants remain on teeth, they are 100% effective in preventing cavities on the biting surfaces of molars. Effectiveness is therefore gauged by length of time a sealant remains on a tooth rather than as a percent reduction in cavity incidence. Retention rates for resin-based sealants range from 86% after one year to 78.6% after two years and 58.6% after four years [23]. However, these rates vary in large measure based on the quality of the dental sealant procedure.

Many Sonoma County children currently lack sealants on their molars. For example, the 2014 Smile Survey found that less than half (43.8%) of 3<sup>rd</sup> grade children had sealants [2]. If sealants were made available to all Sonoma County children, this effective preventive measure would need to be applied twice during a child's lifetime – once when the first four molars erupt and again when the second four molars arrive. While this matches closely to the 3<sup>rd</sup> and 6<sup>th</sup> grades, respectively, children already having dental decay on molar biting surfaces cannot receive sealants and would not benefit. Therefore, it is imperative to provide sealants as soon as possible after molars erupt.

**The average cost per sealant application is \$56.19 [6]. Since there are approximately 5,250 children in each of two grades that would receive sealants in a given year, and each child receives four sealants, the annual cost of a comprehensive sealant program in Sonoma County would be \$2.4 million dollars.**

While the reach is 10.5 thousand children in any given year, children who still have sealants from previous years' applications would also benefit.

### Community water fluoridation

Community water fluoridation (CWF) is a nationally recognized method of reducing the incidence of cavities and tooth decay among children and adults alike. The US Task Force on Community Preventative Services examined 21 studies and concluded in its 2000 report that fluoridated water reduces tooth decay by a median rate of 29% among children ages 4 to 17 [24]. A review of past studies on adults found those that lived their entire lives in fluoridated areas had between 27% and 35% fewer decayed, missing and filled teeth than those living their entire lives in non-fluoridated areas, all else equal [25]. In an updated literature review, the Community Preventive Services Task Force reiterated its firm recommendation of CWF to prevent and control cavities [26].

An international engineering firm, MWH Americas, Inc. (MWH), was contracted by DHS to provide a preliminary facility design evaluating the technical and economic feasibility of CWF in Sonoma County [1]. Using water quality, flow and facility data provided by the Sonoma County Water Agency, MWH designed a scenario providing "optimum safety, system performance and minimized capital and operation and maintenance (O&M) costs to the Water Agency." Capital costs were developed using

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

design criteria, facility layouts, costs of similar projects, and the judgment of MWH staff. Annual O&M costs were determined in much the same way and separated into labor, energy, chemical and replacement costs. An Association for the Advancement of Cost Engineering International Class 3 Cost Estimate standard was followed throughout the process.

The MWH report recommended two phases of CWF facility construction – construction of Wohler and River Road facilities (Phase 1) and construction of well site facilities (Phase 2) [1]. While data for each phase is listed, this simplified example combines the costs of both phases and assumes both phases are completed concurrently.

Table 1 summarizes the costs of the project as determined by MWH. To approximate an annual cost figure that takes into account both annual O&M and a portion of the (one-time) capital cost incurred to construct the facilities, capital costs are amortized by the project’s expected 30-year design life cycle; each year’s share of capital cost is 1/30<sup>th</sup> of the total.

The annual costs (from O&M and share of capital) of Phase 1 and 2 combined are estimated at \$731,000 per year. O&M costs alone are \$581,000 annually.

**Table 1: Conceptual Project Cost Estimate Summary -- Phases 1 and 2<sup>(1)</sup>**

Description	A	B	C	Total Annual Cost (A + C)
	Total Annual O&M Cost	Total (one-time) Capital Cost	Ammortized one-year capital cost <sup>(2)</sup>	
Total Phase 1	\$459,000	\$3,840,000	\$128,000	\$587,000
Total Phase 2	\$122,000	\$660,000	\$22,000	\$144,000
<b>Grand Total Phase 1 &amp; 2</b>	<b>\$581,000</b>	<b>\$4,500,000</b>	<b>\$150,000</b>	<b>\$731,000</b>

<sup>(1)</sup>Capital Cost is AACE Class 3 Estimate, cost basis May 2013. Includes markups and project administration and management. O&M costs assume labor rate of \$80/hr and power cost of \$0.12/kW-hr.

<sup>(2)</sup>Assuming a 30-year design life cycle, or total capital cost divided by 30.

**Source:** MWH Fluoridation Preliminary Engineering Design Report, November 2014, page ES-7.

An ideal CWF system for Sonoma County would provide optimally fluoridated drinking water to all residents. However, due to the complex system of wholesale and retail water systems in the county, the CWF project described in the MWH report would provide near-optimal CWF to 308,300 thousand Sonoma County residents. The remaining receive water from small water districts and private wells, or in the case of Healdsburg, already receive CWF [27]. The SCWA also provides water to the North Marin Water District – specifically the Novato Service Area – so an additional 61,000 Marin County residents would also benefit from this CWF project [28].

**An annual per-person cost of CWF is calculated as the total annual cost (O&M plus share of capital) divided by Sonoma County recipients. This annual per-person cost is \$2.37.**

**Table 2: Annual per-person cost estimate -- Phases 1 and 2**

Population	# of Persons	Expense Type	Annual Expense	Annual cost/person
Portion of Sonoma County	308,300	O&M	\$581,000	\$1.88
		Annual Capital	\$150,000	\$0.49
		Total	\$731,000	<b>\$2.37</b>

Note: The annual per-person cost is \$1.98 when total cost is divided by the entire population receiving near-optimal CWF; this includes 61,000 Marin County residents and 308,300 Sonoma County residents.

**SUMMARY OF FINDINGS**

Pillars of Dental Health	Annual Cost	Annual Reach
<b>1. Access to Dental Care</b>		
Current	\$17.7 million	85,600 appointments
Unmet All Medi-Cal	<u>+\$5.5 million</u> \$23.2 million	<u>+ 25,000</u> 105,600 Denti-Cal enrollees and others with financial need
<b>2. Community Education</b>	\$500,000	50,000 Children and adults
<b>3. Fluoride Varnishes</b>	\$7.5 million	94,300 Children ages 3 to 18
<b>4. Sealants</b>	\$2.4 million	10,500 Children – benefits frequently last beyond year of application
<b>5. Community Water Fluoridation</b>	\$731,000 (O&M and capital share)	308,300 in Sonoma County, 61,000 in Marin County Children and adults

While all pillars have the potential to provide substantial benefits to Sonoma County residents, community water fluoridation would reach the greatest number of residents at the lowest per-person cost. Additionally,

- CWF is a nationally recognized method of reducing the incidence of cavities and tooth decay among children and adults alike;
- Unlike strategies that specifically target children, CWF provides benefits to adults as well, including the elderly;

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

- Presently, Healdsburg and the Two Rock Coast Guard station are the only communities within Sonoma County benefiting from CWF.

## APPENDIX

## Costs of Prevention and Early Treatment of Dental Disease in Sonoma County

The cost of a cavity restoration depends on the type of material used. The ADA 2013 fee survey [29] is used as a proxy for costs. An amalgam cost \$144.11, a resin-based composite cost \$174.55 and a crown cost \$710.52.

Beazoglou estimated that of one-surface restorations, 32% are amalgams, 46% are resin-based composites, and 22% are crowns.

A weighted average is calculated as:

$$(32\% \times \$144.11) + (46\% \times \$174.55) + (22\% \times \$710.52) = \$283$$

On average, one would need to spend \$283 for a one-surface restoration.

## REFERENCES

1. MWH. (2014). Fluoridation Preliminary Engineering Design Report. Presented to the Sonoma County Water Agency and the Department of Health Services.
2. County of Sonoma Dept. of Health Services. (2013). *Sonoma County Smile Survey: An Oral Health Assessment of Sonoma County's Kindergarten and Third Grade Children*. <http://www.sonoma-county.org/health/meetings/pdf/fac/sonoma-county-smile-survey.pdf>
3. Centers for Disease Control and Prevention. Oral Health for Older Americans. [http://www.cdc.gov/oralhealth/publications/factsheets/adult\\_oral\\_health/adult\\_older.htm](http://www.cdc.gov/oralhealth/publications/factsheets/adult_oral_health/adult_older.htm)
4. Griffin SO et al. (2001). [An economic evaluation of community water fluoridation](#). *Journal of Public Health Dentistry*, 61 (2), 78-86.
5. O'Connell JM et al. (2005). [Costs and savings associated with community water fluoridation programs in Colorado](#). *Preventing Chronic Disease*, 2, 1-13.
6. American Dental Association. (2013). *Survey of Dental Fees (General Practitioners – Pacific Division)*. Health Policy Institute.
7. Children's Partnership. (2011). California Children's Dental Workforce Campaign: Dental Health Needs of California's Children. Retrieved April 2015 from [http://www.childrenspartnership.org/storage/documents/OurWork/Dental/CCDWC\\_Dental\\_Needs\\_Fact\\_Sheet\\_Sept\\_2011\\_v2.pdf](http://www.childrenspartnership.org/storage/documents/OurWork/Dental/CCDWC_Dental_Needs_Fact_Sheet_Sept_2011_v2.pdf).
8. Opdam NJM et al. (2010). 12-year Survival of composite vs. amalgam restorations. *Journal of Dental Research*, 89 (10), 1063-1067.
9. Rydell, V., Exec. Director, PDI Surgery, personal communication.
10. California HealthCare Foundation. (2009). *Emergency Department Visits for Preventable Dental Conditions in California*. Retrieved April 2015 from California Healthcare Foundation: <http://www.chcf.org/~media/MEDIA%20LIBRARY%20Files/PDF/E/PDF%20EDUseDentalConditions.pdf>.
11. Centers for Disease Control and Prevention. (2011). Recommendations for using fluoride to prevent and control dental caries in the United States. *CDC Morbidity and Mortality Weekly Report*, No. RR-14, 50.
12. U.S. Department of Health and Human Services. (2000). [Oral Health in America: A Report of the Surgeon General](#). National Institute of Dental and Craniofacial Research, National Institute of Health.
13. California Dept. of Health Care Services. (2014). *Medi-Cal Managed Care Enrollment Report, August 2014*. Retrieved April 2015 from

[http://www.dhcs.ca.gov/dataandstats/reports/Documents/MMCD\\_Enrollment\\_Reports/MMCD\\_EnrollRptAug2014.pdf](http://www.dhcs.ca.gov/dataandstats/reports/Documents/MMCD_Enrollment_Reports/MMCD_EnrollRptAug2014.pdf)

14. California State Auditor. (2014). [California Department of Health Care Services: Weaknesses in Its Medi-Cal Dental Program Limit Children’s Access to Dental Care](#). Report 2013-125.
15. County of Sonoma Dept. of Health Services. (2013). *Healthy Smiles for Healthy Futures: Sonoma County Task Force on Oral Health Final Report*.
16. Montel, A., Dental Director, personal communication.
17. English, R., DDS, personal communication.
18. Fuchs, N., Exec. Director, Santa Rosa Community Health Center, personal communication.
19. Lyda, D., Partnership HealthPlan of California, personal communication.
20. County of Sonoma Dept. of Health Services.
21. Seppä L et al. (1995). [Fluoride varnish versus acidulated phosphate fluoride gel: a 3-year clinical trial](#). *Caries Res*, 29, 327–30.
22. Van Rijkom HM et al. (1999). [Fluoride gels reduce caries incidence by 20 percent](#). *Evidence-Based Dentistry*, 1, 11.
23. Beauchamp J et al. (2008). [Evidence-based Clinical Recommendations for the Use of Pit-and-fissure Sealants: A Report of the American Dental Association Council on Scientific Affairs](#). *JADA*, 139, 257-268.
24. Truman BI et al. [Reviews of evidence on interventions to reduce dental caries, oral and pharyngeal cancers, and sports-related craniofacial injury](#). Task Force on Community Preventive Services. *American Journal of Preventive Medicine*, 2002;23(1S): 1–84.
25. Griffin SO et al. (2007). [Effectiveness of fluoride in preventing caries in adults](#). *Journal of Dental Research*, 86, 410-415.
26. CDC Community Preventive Services Task Force update, 2013 update. Retrieved April 2015 from: <http://www.thecommunityguide.org/oral/fluoridation.html>.
27. County of Sonoma Dept. of Health Services. (2013). *Life is better with teeth: Sonoma County Fluoridation Assessment Draft Report*, February 26.
28. DeGabriele, C., North Marin Water District, personal communication.
29. Beazoglou T et al. (2007). [Economic Impact of Regulating the Use of Amalgam Restorations](#), *Public Health Reports*, 122, September-October, 657.