

A Literature Review of the U.S. Preventive Services Task Force Recommendation to Perform
Screening for Dental Caries in Children Ages Birth Through Five Years

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Abstract

Dental caries is the most common chronic childhood disease. Development of dental caries is impacted by sugar intake, bacteria load of the mouth, saliva content, oral hygiene practices, and fluoride use. Caries of the primary teeth can have severe consequences for children in their youth and later in life. Infants and toddlers from birth through five years of age are less likely to visit a dentist for preventive services than they are to visit a primary care clinician. To reduce the burden of this disease, the recommendation is to focus on minimizing risk factors common to the most children. The U.S. Preventive Service Task Force (USPSTF) recommends that primary care providers prescribe fluoride supplements to children without fluoridated water, and to apply fluoride varnish to the teeth as a preventive measure. The USPSTF has continued to find insufficient evidence to support screening for dental caries or risks for dental disease during primary care visits. Multiple respected medical and dental associations have promoted guidelines and dental screening tools for primary care use despite the USPSTF recommendation. The use of fluoridation, the application of varnish, and the disregard for disparities among children as modifiable risk factors are controversial topics. Education and awareness need to be promoted among primary caregivers to improve rates of fluoride varnish application, and research needs to be completed to garner USPSTF support to reinstate recommendations for routine dental screenings by primary caregivers. Those most at stake are children, their parents, primary and dental caregivers, and insurance companies, and costs include burdens of suffering, time lost, time non-reimbursed, and financial.

Keywords: children, infants, toddlers, dental caries, cavities, fluoride, oral health

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Background

In the United States, dental disease is prevalent in children ages two through five at a rate of one in four children, making dental caries the most common chronic disease among U.S. children (Centers for Disease Control and Prevention [CDC], 2012; Office of Disease Prevention and Health Promotion [ODPHP], n.d.a). Among children under the poverty threshold, over 50% of two- to eleven-year-olds experienced dental caries in the primary teeth, and minorities experienced higher rates and higher incidences of untreated dental caries than did white children (Dye et al., 2007). Dental caries is defined as untreated or treated tooth decay (indicated by the presence of a filling) (U.S. Department of Health and Human Services [HHS], n.d.). Dental caries (also called cavities) occurs when acid-forming bacteria in the mouth interact with fermentable carbohydrates, creating an infection that eats through tooth enamel; it is classified as the causative disease of destruction to dental bone and nerve root (Selwitz, Ismail, & Pitts, 2007). In infants, tooth eruption of the primary set begins at approximately six months of age, which is replaced by permanent teeth later in childhood (Chou, Cantor, Zakher, Mitchell, & Pappas, 2014). Children's primary teeth are especially susceptible to enamel demineralization—although dental cavities typically affect irregular molar surfaces and fissures and happen slowly over time, caries in children more commonly affects smooth surfaces and progresses more quickly, spreading through the entire mouth (Selwitz et al., 2007).

The development of dental caries in children is influenced by intake of dietary sugars and carbohydrates (including medicinal), inappropriate infant feeding methods, saliva composition and low salivary flow, preventive oral hygiene behaviors, poverty, deprivation, family social

status, parents' education level, and exposure to fluoride (Selwitz et al., 2007). In children, dental caries causes significant stress, including pain, tooth loss, difficulty sleeping, traumatic repairs or extractions, failure to thrive and impaired growth, self-esteem problems, speech impediments and communication disorders, poor academic performance, overcrowding of adult teeth, and increased risk for adult teeth dental caries, increasing financial burdens and requiring future orthodontic corrections (Bader, Rozier, Lohr, & Frame, 2004; Kawashita, Kitamura, & Saito, 2011). According to the National Institute of Dental and Craniofacial Research (NIDCR; 2000), dental disease is responsible for more than 51 million lost school hours annually in the United States. At least three deaths have been reported within the last 15 years, resulting from dental caries and needed repairs, and it is estimated that mortality is severely under-reported due to pediatric sepsis, facial cellulitis, and brain abscesses with undetermined causes (Casamassimo, Thikkurissy, Edelstein, & Maiorini, 2009). Hospitalization reasons and risks for dental caries include frequent emergency department treatment of facial pain and infection, pediatric overdose of over-the-counter pain medications (including liver toxicity and damage), inappropriate computed tomography (CT) usage contributing to an increase in pediatric thyroid cancers, and an average five-day hospital stay to manage severe maxillofacial or systemic infection (Casamassimo et al., 2009). Dental caries has a lifelong impact on the individual: it causes pain, disability, nourishment deficits, leads to gum disease, increases risk for swallowing difficulty, and leads to some forms of cancer (ODPHP, n.d.b; Selwitz et al., 2007). Dental problems are linked to various conditions later in life such as diabetes, heart and valve disease, and strokes (ODPHP, n.d.b).

Current Health Promotion Guidelines

In the first Surgeon General's report on oral health in the United States, the NIDCR (2000) emphasized preventive oral care as paramount to overall health status, and praised successes in increased oral health since the 1970's. Children aged six months through five years were the only demographic who continued to experience an increased incidence of this disease, yet studies showed children were less likely to see a dentist than a primary care provider between ages six months and five years (Edelstein & Chinn, 2009). Selwitz et al., (2007) recommended to focus primary prevention of dental caries towards the risk factors that were most generalized to all children, and to perform secondary prevention on lesser common risks to an individual degree. Despite the appearance of a need for primary care intervention, the U.S. Preventive Services Task Force (USPSTF) recommendation lacked evidence to support screening, and for both 2004 and 2014 did not recommend that primary care clinicians perform dental caries screenings (U.S. Preventive Services Task Force [USPSTF], 2016). Due to having insufficient evidence, the USPSTF did not recommend that primary care clinicians provide education, counseling, or referrals to parents to help prevent dental caries, even for high-risk children (Bader et al., 2004; Chou et al., 2014; USPSTF, 2016). Instead, the USPSTF has recommended since 1989 that primary care clinicians prescribe oral fluoride supplements to children whose primary water source lacked fluoridation, and since 2014, to apply fluoride varnish to the primary teeth of all children (in children ages from tooth eruption to five years old) (USPSTF, 2016).

Fluoride use has been shown to help prevent dental caries onset and progression by increasing the teeth's resistance to bacterial growth and acid breakdown and promoting remineralization of enamel, and is available in toothpaste, gel, rinse, foam, varnish, and systemic medicinal forms (Bader et al., 2004). In the United States, fluoride varnish is available as a 5%

sodium fluoride coating which is easily applied by a primary provider and carries very low risk of being swallowed (Chou et al., 2014). Fluoride also alters mineralization of existing caries, but systemic use carries a risk of fluorosis, which changes the appearance of tooth enamel to have white opaque streaks or spots (Chou et al., 2014). According to Beltran-Aguilar, Barker, and Dye (2010), severe fluorosis was present in less than 1% of fluorosis cases in the United States (ages six and above), and most cases were aesthetic and non-pitting in nature, suggesting very low risk for use in children age six and under. Both the American Dental Association (ADA) and the American Academy of Family Physicians (AAFP) support the use of public fluoridated water and supplementation for children without access to fluoridated water (American Academy of Family Physicians [AAFP], 2013; Rozier et al., 2010)

Summary of Research

History

The Continuous National Health and Nutrition Examination Survey (NHANES) has tracked data related to children's oral health since the early 1980's, and public water sources in the United States have been fluoridated since the 1930's (Beltran-Aguilar et al., 2010; HHS, n.d.). From the 1970's to the mid 1990's, the rate of dental caries in children decreased due to improvements in dental care and accessibility; however, the prevalence of dental caries in children aged two to four surged from 18% in the 1990's to greater than 33% of children ages three through five by the mid-2000's despite a Healthy People 2010 goal of 11% (CDC, 2012). At the time of the 2004 USPSTF recommendation on this subject, nearly 75% of U.S. children with dental caries had not been treated for their disease (Chou et al., 2014). Simultaneously, children who had visited a dentist increased only mildly between 1996 and 2004 (from 42% to

45%), with the largest proportionate increase among children covered by a state Children's Health Insurance Program (CHIP) (Edelstein & Chinn, 2009).

Guideline Origins

The USPSTF (1989) initially published 169 guidelines for primary care providers starting in 1989, and "counseling to prevent dental disease" was the blanket guideline description for all age groups. The A through I rating system did not exist, and the recommendations included: to encourage most patients to regularly visit the dentist every one to two years, to recommend daily tooth-brushing with a fluoride-based toothpaste and daily flossing, to educate about reducing sugar intake for patients with existing dental caries, to direct parents not to put children to bed with a bottle and to transition to cup use at one year of age, to prescribe for children ages two and under without access to fluoridated water fluoride drops, or tablets to patients aged three or older, and to examine the mouth for multiple morbidities with referrals to a dentist as needed (USPSTF, 1989). Seven years later, the USPSTF (1996) published recommendations based on new available evidence, citing that 87% of the U.S. population had access to public water but only 67% of that water was adequately fluoridated. Fluorosis was first discussed here, and attributed to inappropriate use by dental professionals or to infants and toddlers swallowing fluoridated toothpaste (USPSTF, 1996). Concerns of infant feeding practices had a greater impact on the recommendations, and the propping of bottles of milk and sugary substances at bedtime was cited to cause significant infant dental decay (commonly called "bottle mouth") (USPSTF, 1996). The recommendations at that time started carrying accompanying ratings of importance of A (good evidence to support), B (fair evidence), C (insufficient evidence, but recommendations permitted on other grounds), D (fair evidence to exclude screening), and I (good evidence to exclude screening at regular examinations) (USPSTF, 1996). The 1996

publication gave: a B rating to recommend regular dental visits in combination with oral hygiene education, a B rating to recommend teeth flossing and daily use of a fluoride-containing toothpaste, no specific rating for parental supervision of children's teeth-brushing or wiping the teeth with gauze for those too young to use a toothbrush, a B rating for promotion of breastfeeding and preventive education regarding bottle propping at bedtime with sugar- or milk-containing drinks, an A rating for prescription of daily fluoride drops/tablets to families without fluoridated water sources (but not for six months through three years of age), and it published doses depending on age (USPSTF, 1996). In 1996, the USPSTF also recommended clinicians examine the mouth of pediatric patients for multiple morbid conditions and refer pediatric patients as needed to dental specialists.

The recommendation to prescribe fluoride supplements for ages six months through three years was again reinstituted in 2004, the age group was defined as birth through five years, and new evidence was reviewed regarding fluoride supplement usage in both 2004 and 2013 (Chou et al., 2014). Calonge and the USPSTF (2004) and Bader et al. (2004) provided recommendations with rationales at initiation of the more age-specific guideline, which gave a B recommendation rating for primary care providers to prescribe oral fluoride supplements to children six months and older through preschool age whose water was deficient in fluoride. In 2004, the recommendation was limited to prescription of fluoride supplements to fluoridated-water deficient children, and no longer recommended referrals, education, breast-feeding promotion, bottle-mouth prevention, specifics of tooth-brushing guidance or usage, or oral examinations by primary providers, citing a lack of evidence in reduction of primary teeth dental caries on all accounts for primary care providers to perform (Calonge & USPSTF, 2004).

Current Guideline

During the follow-up 2013 literature review, the USPSTF determined that only a few limited studies had reviewed primary care screening for those aged five and younger, resulting in a continued lack of evidence to support dental caries screening by primary care providers (Chou et al., 2014). There had not been enough research performed to support a recommendation for primary care practitioners to perform dental examinations, and the accuracy of non-dental specialty providers in diagnosing dental caries was limited (Bader et al., 2004; Chou et al., 2014). Chou et al. (2014) determined that more research was needed to determine the effectiveness of dental referrals in this age group, and proposed that primary provider provide education or counseling to parents and caregivers. No reliable risk assessment instruments had been found effective for use by primary providers for dental screening in children (Bader et al., 2004). The final 2014 published guideline did not support or refute the provision for education, counseling, or referrals, even for high-risk patients, because of a lack of evidence that doing so reduced the prevalence of dental caries (USPSTF, 2016). The 2014 guidelines included a new addition of a B-rated primary care provider-application of fluoride varnish for all children six months through five years, citing a “moderate net benefit” for usage (Chou et al., 2014; USPSTF, 2016). The USPSTF (2016) newest guideline cautioned against a risk-based approach to varnish application, and stated this would be detrimental to children who might benefit but fall in a low-risk category. Citing a low risk for harm and evidence based on high-risk populations only, the USPSTF (2016) determined varnish application was a reasonable recommendation for all children birth through five years old. During the 2013 guideline reviews, the USPSTF (2016) did not review new tooth-brushing effectiveness documentation.

Controversies

Children have limited access to dental professionals due to shortages in pediatric-trained dentists and lack of dental insurance coverage (Lewis et al., 2009). This problem is amplified for children with economic and socio-demographic barriers such as education level, language, income, race, special health-care needs, healthcare access, and rural or remote geographic locations (Edelstein & Chinn, 2009; ODPHP, n.d.a). Further tracking of these disparities is required to address and meet Healthy People 2020 goals, and for providers (including dental) to perform necessary dental screenings (ODPHP, n.d.a).

Conversely, Kranz et al. (2014) found that children were more likely to see a primary care provider than a dentist during young childhood, and found that preventive dental services through primary care visits were more likely to result in higher dental caries treatment rates and lower insurance reimbursement costs from ages six months through three years, and recommended reimbursement policy changes. Five years after the 2004 guideline was published, Lewis et al. (2009) found that while 90% of pediatricians agreed they should screen children's teeth for caries and provide oral health education, only 54% of them did so and to only half of their six-month to three-year-old patients; furthermore, only 4% regularly applied fluoride varnish, in great part due to a lack of training.

The ADA and the American Academy of Pediatrics (AAP) have published suggested dosage and timing suggestions for the application of fluoride varnish, but with no substantiating evidence to make formal recommendations (USPSTF, 2016). Additionally, the fluoride varnishes available are regulated as medical devices, and not approved for use by the U.S. Food and Drug Administration for dental caries prevention; use for prevention of cavities is off-label (U.S. Government Publishing Office, 2017). A comprehensive meta-analysis of fluoride-use

trials performed by Ismail and Hasson (2008) found weak and highly inconsistent support for fluoride use on primary teeth for caries prevention, and mild to moderate risk of fluorosis.

Despite the USPSTF recommendation against screening, the AAP published and endorsed a childhood dental caries risk assessment tool which is now available through Bright Futures for use by primary care providers (Boulter, Duncan, Keels, & Ramos-Gomez, 2012). The updated Surgeon General's report from 2009 recommended children of low risk be referred to a dentist by the age of three, children with medium and high risk for caries to be referred by one year of age, and only suggested that providers "consider" systemic fluoride use in medium- and high-risk populations (Tinanoff & Reisine, 2009). The only solid recommendations made were to promote fluoride-containing toothpaste use, to counsel all parents on reducing carbohydrate intake and change dietary and sugar-containing-drink consumption, and to apply a fluoride varnish every six or three months in medium- and high-risk groups, respectively (Tinanoff & Reisine, 2009). The American Academy on Pediatric Dentistry Council on Clinical Affairs (2008) published a caries-risk assessment tool (CAT) and recommended its use by dental and non-dental professionals, and encouraged non-dental providers to give preventive oral health counsel. The American Dental Association Council on Scientific Affairs (2006) only recommended use of topical fluoride for medium- and high-risk children, taking patient preferences and the abilities of the provider into account.

More recently, large studies have been performed refuting the efficacy of fluoride in varnish form for caries prevention. In a 2017 study from Ireland, dental researchers performed clinical trials on over 900 two- and three-year-old participants and found no significant differences in the numbers of caries—only the number of caries per child was affected, indicating that fluoride slowed the progression of dental caries once they have developed (Tickle

et al., 2017). Another 2017 study on over 800 participants ages one through three found that twice-yearly fluoride varnish had no beneficial effects on the prevention or progression of dental caries, suggesting fluoride toothpaste was the most essential recommendation to give to parents of young children, not fluoride varnish application (Anderson, Dahllöf, Soares, & Grindefjord, 2017).

The current guidelines did not address current accessibility to affordable insurance coverage, or the increasing proportion of U.S. children who are considered in poverty, which contributes to increased consumption of lesser quality foods and more sugar-filled drinks and snacks (Newens & Walton, 2016; Nickols, Collier, & Holland, 2015). The World Health Organization (WHO) has supported fluoridation of public water, and stated that benefits outweigh the overall risks to public health (Petersen & Lennon, 2004). Minority groups, including religious organizations, political groups, alternative medicine practitioners, and the Fluoride Action Network (FAN) counter with concerns of lack of informed consent to pharmaceutical therapy, no control over dosages consumed, availability of other sources of fluoride, accumulation of fluoride in the body over time, and reliability and availability of published research on the subject (Connett, 2012).

The ethical boundaries put into place by clinical study review boards has also created difficulties for studying this age group, because large numbers of participants are difficult to recruit, poorer participants often cannot comply with study designs easily and drop out, not treating control groups in children is unethical and not permitted, and all participants must be guaranteed disease treatment at the end of a study (Tinano & Reis, 2009).

Dissemination of Information

Government agencies such as the CDC and WHO have worked to disseminate information regarding the safety of fluoride for dental protection (Petersen & Lennon, 2004). These agencies also promote the practice of fluoridating publicly sourced water. Pediatrician and primary providers are aware of dental health benefits but may not be aware of the USPSTF recommendation. Despite that varnish application is one of the two B-rated recommendations for primary providers to complete, only 4% of pediatricians had applied the varnish in a study by Lewis et al. (2009). Furthermore, fewer than 27% provided oral health education to parents of children aged six months through three years. Oral health education to primary providers, including clinical practice in application of varnish on children's teeth, will be necessary to improve compliance with the recommendation (Lewis et al., 2009; Society of Teachers of Family Medicine [STFM], n.d.). Without the firm backing of the ADA and the AAP, fluoride varnish application is not likely to increase substantially in practice settings.

One Healthy People 2020 goal was created to increase the proportion of the U.S. population who have publicly available fluoridated water, and by the most recently published numbers in 2014, the goal of 79.6% had not yet been reached (CDC, 2012). The ADA, AAFP, and the AAP all support fluoride supplementation and promote both its use and primary care dental screenings through use of various screening tools, which is not a USPSTF recommendation and is therefore not a mandatory covered preventive activity (AAFP, 2013; Rozier et al., 2010). Beyond dissemination, more research is needed to convince these organizations of the importance of and firm suggestions for dosage and timing of fluoride varnish application (USPSTF, 2016). In turn, these groups and other agencies will need to gather further evidence to support a formal USPSTF recommendation for routine screening again.

Stakeholder Impact

The stakeholders are impacted by this screening recommendation are: parents of children and children in communities with non-fluoridated water, children in all communities, primary health care providers, dental providers, and health and dental insurance companies (Casamassimo et al., 2009; Kranz et al., 2014). The children are the primary and most-affected stakeholders, who develop dental caries with an annual incidence of 4.5 million cases (Casamassimo et al., 2009). These patients are the ones who suffer ill effects such as pain and risk of infection without routine dental care, oral hygiene education, recommendations to providers, and assessments or screenings. Families bear the brunt of costs to fix their children's teeth, need to find childcare or miss work to stay home with their sick young ones, and struggle to find pediatric dental providers who take their individual dental plans or who accept state-sponsored dental insurance (Kranz et al., 2014). These families also must budget for the addition of fluoride tablets, when prescribed this due to not having fluoridated water. Fluoride tablets are available in generic form, but the per-child 30-day cost at most drugstores and pharmacies is between \$6 and \$37, depending on availability (GoodRx, n.d.). Primary providers may not be compensated for the additional time taken to assess teeth, apply varnish, and make recommendations, which is why reimbursement policy changes were recommended by Kranz et al. (2014). Dental providers are not fully reimbursed by insurance companies, and some losses from un- or under-insured families will occur. Without recommendations for screening and referrals, pediatric dental providers will continue to be in short supply without initiative to remedy this shortage (Lewis et al., 2009).

Insurance companies of both health and dental services will be impacted by increased billings for the services rendered and money spent reimbursing providers. Conversely, they may see costs lowered when dental caries in children do not develop into advanced stages of dental

disease, which requires more intervention. The Patient Protection and Affordable Care Act (PPACA) requires dental coverage availability for children ages 18 and under (U.S. Centers for Medicare & Medicaid Services [CMS], n.d.). By means of the PPACA, preventive dental services for children were included under covered preventive services, and the pediatric patients added through this law have been covered in an almost even division between Medicaid, marketplace plans and exchanges, and insurance sponsored through parents' employers (ADA, 2013). Therefore, a hidden stakeholder has become apparent – taxpayers, who help cover the cost of uninsured people by way of taxes which in part pay for public services like Health Resources and Services Administration (HRSA) centers, and for public safety nets that help make health and dental services affordable and accessible.

Impact on Current and Future Practice

In this writer's intended future practice as a family practitioner (with a desire to work in pediatrics), use of dental screening tools and of the USPSTF recommendations will be built into every-day practice. If a place of employment does not routinely update children's dental practices founded on evidence-based or USPSTF guidelines, this writer hopes to incorporate dental health education and practices into the preventive care of young children by bringing the individual practice setting up-to-date and encouraging continuing education. Education of primary practitioners is available through a source called Smiles for Life, which is endorsed by the ADA, the AAP, and the AAFP (STFM, n.d.). This resource educates primary providers in oral health and provides continuing education units for practitioners to maintain current standards. Bright Futures screening tools and others promoted by the AAFP and the AAP can be used in outpatient settings during the routine care of family-aged clients, and as a nursing leader in the practice setting, this writer will encourage and educate about the use of screening tools and

monitor the effects and improvements anticipated (Boulter et al., 2012). Lastly, this writer will work to publish findings and suggestions for future practice, reducing the lack of research available to support routine screenings.

Conclusion

This USPSTF guideline has evolved much since 1989, relying more strictly upon available research and less upon assumptions. The recommendations are not being thoroughly carried about despite mandatory insurance coverage for these preventive services. Although dental screenings are not recommended to be performed by primary caregivers to young children, many pediatric and dental associations encourage the use of screening tools and educational supplements for parents of young children. The lack of cohesion between USPSTF recommendations and behavior by clinicians does not serve the community, and at-risk children are the ones who suffer the most as a result. Further research is required to make solid recommendations for timing of practice, and education for providers should be continued and upheld to promote evidence-based standards for oral screenings, education to parents and children, and preventive services.

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