

Problem

Dental caries is a chronic, progressive, multi-factorial, infectious disease that can begin in early infancy. By adulthood, dental caries will affect the majority of the US adult population,¹ with some individuals experiencing moderate or severe disease. Dental caries prevalence and severity vary by age, dentition and type of tooth surface.² Tooth decay is highly related to socio-environmental determinants, with the greatest burden on disadvantaged and socially-marginalized populations.^{3,4} Historically, efforts to prevent and control dental caries have primarily focused on promoting daily brushing, modifying dietary practices, and improving the resistance of tooth enamel to acid attack. Scientific evidence supports the effectiveness of fluoride and dental sealants at reducing dental caries in populations. Benefiting from fluoridated water and toothpastes, baby boomers will be the first generation to routinely maintain natural teeth throughout their lives.⁵

Methods

Fluoride modalities, systemic and topical, include: drinking water (natural and adjusted levels), milk, salt, toothpaste, mouthrinse, and professionally applied fluoride in gels or varnishes. Caries protection, lifetime cost and appropriateness for use in populations will vary by the fluoride method or combination of fluoride methods selected.^{6,7,8,9,10,11,12} Fluorides are most effective when used in combination with other modalities to prevent, control and reverse early dental caries.^{13,14,15,16} Fluorides are especially effective in preventing dental caries on the smooth surfaces of teeth.¹⁷ For the prevention of carious lesions in the pits and fissures of teeth, dental sealants, alone or combined with fluoride, are more effective than fluoride alone.^{18,19} Daily, multiple, low-dose topical exposures to fluorides facilitate the balance between remineralization and demineralization of tooth enamel, thus reducing the prevalence and incidence of dental caries throughout life.^{20,21}

Fluoride varnish, like other highly concentrated fluoride products, is available only by prescription from authorized health professionals. Most fluoride varnishes are lacquers containing 5% sodium fluoride in a colophony/resin base. Fluoride varnish provides a highly concentrated, temporary dose of fluoride to the tooth surface. The varnish holds fluoride close to the tooth surface for a longer time than other concentrated fluoride products. This layer slowly disappears over the following months and repeated application of the varnish is needed to maintain effectiveness.^{15,22,23,24}

Fluoride varnish is quickly and easily applied without the need for bulky mouth trays or suctioning of saliva. This is especially helpful for infants and toddlers, some developmentally disabled individuals, or people with severe gag reflexes who otherwise might not tolerate the use of trays.²⁵ There have been a few reports of contact dermatitis to the resin base used in fluoride varnish; however, there have been no reports of acute effects from fluoride varnish application in infants and toddlers.^{26, 27} Although the fluoride concentration in varnish is relatively high, since applications occur infrequently, generally at 3 to 12 month intervals, fluoride varnishes pose little risk for enamel fluorosis.

A panel of experts convened by the American Dental Association (ADA) Council on Scientific Affairs recommends fluoride varnish as an alternative to acidulated phosphate gels (APF) for people six years or

older at risk of developing dental caries and as the only professionally applied fluoride for children under age six.⁶ Fluoride varnish has an advantage over APF gels, particularly for use in settings outside the dental office since no special equipment or prophylaxis is needed. Application of fluoride varnish is no more costly than other professionally applied topical fluoride products.

In a number of states, fluoride varnish is applied by individuals who are not oral health professionals. The American Academy of Pediatrics (AAP) created and maintains a table of all state policies ([Caries Prevention Services Reimbursement Table](#)) describing oral health services including dental and non-dental clinicians who may apply it, age limits of children who can receive fluoride varnish, the number of applications allowed, any training required prior to implementation, allowable delegation and the codes used to submit for Medicaid payment.²⁸

Fluoride varnish is effective in preventing caries.²⁹ According to the Centers for Disease Control and Prevention (CDC) and the ADA, the quality of evidence for the efficacy of fluoride varnish in preventing and controlling dental caries in the primary and permanent teeth of moderate/high-risk children is high.^{6,11,16,30,31,32,33,34,35} These organizations strongly recommend fluoride varnish because of consistent, good quality, patient-oriented evidence.^{6,36}

Fluoride varnish may arrest early active enamel lesions.³⁵ Fluoride varnish enhances enamel remineralization with the initial fluoride uptake in early carious lesions (white spots) until it is brushed off or it flakes off. Calcium fluoride formed in carious lesions makes them more resistant to future demineralization. Fluoride varnish used as a secondary prevention strategy may be especially cost-effective when active, non-cavitated, smooth surface caries are detectable in low-risk populations.^{37,38} In high-risk populations, the preventive effect is strongest when fluoride varnish applications begin before the onset of detectable dental caries.³¹ In a randomized clinical trial in Canada, 1,146 young aboriginal children with high caries incidence were provided caregiver counselling and fluoride varnish three times a year for two years. Reductions in dental caries of 18% to 25% were demonstrated when preventive care was initiated before caries was observed.³² Infants, toddlers and preschool children who were caries free at baseline benefited most from the intervention.

The frequency of fluoride varnish applications depends on the professional's determination of the individual's risk for dental caries and concomitant use of other fluoride modalities.^{32,39,40} The CDC and the ADA agree that *at least* biannual applications for two years reduces dental caries in primary or permanent teeth for moderate or high-risk children.^{Error! Bookmark not defined.} In very high-risk populations, intensive programs of fluoride varnish application, greater than twice annually, did not provide additional benefits.^{41,42,43} The goal of four or more applications over two years appears to be consistent for ongoing caries prevention.^{44,45}

As of 2015, while the efficiency and efficacy of fluoride varnish for individuals has been established, the benefits of fluoride varnish in population-based programs, such as schools, have not. Approximately 46% of children have had a dental visit in the last 12 months, ranging by income from 36% of children from families at less than 100% of the federal poverty level and 58% for children in higher income brackets.^{46,47} Outside the US, there is mixed evidence that fluoride varnish can be effective in a school program. A Brazilian study of 7 to 14-year-old school children, demonstrating a 41% caries reduction in permanent teeth, may have been influenced by a 44.6% attrition rate.⁴⁸ A similar study of adolescents and fluoride varnish by Zimmer demonstrated 37% caries reduction in permanent teeth after two applications for four years.⁴⁹ Yet two 2011 studies were not able to conclude that fluoride varnish applied in low-income and high-caries prevalence schools provided a preventive benefit. It is theorized that exposure to

fluoride toothpastes may have been responsible for the lack of demonstrable benefits.^{39,1} Tagliaferro et al reported demonstrable benefits from dental sealants in school programs, but not fluoride varnish in high-risk schools.⁵⁰ Exposures to fluoride (water, toothpastes, mouthrinses and other dental products) in the United States have increased significantly since the early 1960s.⁵¹ The addition of fluoride varnish in caries prevention programs for low-risk individuals and populations, especially those that use fluoridated water and fluoride toothpastes, is unlikely to be cost-effective.⁹ Community prevention programs utilizing fluoride varnish will be more effective when initiated before age two for the primary dentition of children at highest risk.^{52,53,54}

The 2014 U.S. Preventive Services Task Force document, [*Prevention of Dental Caries in Preschool Children: Recommendations and Rationale*](#), recommends that all primary care clinicians apply fluoride varnish to primary teeth of all infants and children starting at the age of primary tooth eruption to age five. They concluded that current evidence is insufficient for making a recommendation for or against risk assessment performed by primary care clinicians in children younger than age six.⁵⁵ However, the AAP recommends pediatric medical providers conduct a risk-assessment for all children when there is no access to a dentist.⁵⁶ Until a dental home is established, primary care practitioners are able to screen accurately and provide fluoride varnish and oral health anticipatory guidance for children.⁵⁷ In North Carolina's 2011 evaluation of their medical office-based preventive dentistry program for Medicaid-enrolled children, children who had at least four or more fluoride varnish applications at office visits in three years had fewer carious lesions by age six compared to children who had no visits.^{44,2} In addition, North Carolina demonstrated a significant population effect in reducing dental caries in school children from at risk schools when children had had at least four fluoride varnish applications before four years of age.⁴⁵

Fluoride varnish is effective in preventing dental caries in both permanent and primary teeth.^{8,15,58} School and community program outcome evaluations are strongly recommended.

Policy Statement

The Association of State and Territorial Dental Directors (ASTDD) supports the judicious use of fluoride varnish beginning with primary tooth eruption as an effective adjunct in programs designed to reduce lifetime dental caries experience.

The ASTDD Dental Public Health Resources Committee acknowledges the ASTDD Fluorides Committee for their work in updating and revising this document.

¹ Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, et al. [Trends in oral health status: United States, 1988-1994 and 1999-2004](#). Vital Health Stat 11 2007(248):1-92.

² Macek MD, Heller KE, Selwitz RH, Manz MC. [Is 75 percent of dental caries really found in 25 percent of the population?](#) J Public Health Dent 2004;64(1):20-5.

³ Fisher-Owens SA, Gansky SA, Platt LJ, Weintraub JA, Soobader MJ, Bramlett MD, Newacheck PW. [Influences on children's oral health: a conceptual model](#). Pediatrics. 2007;120(3):e510-520.

⁴ Petersen PE. [The World Oral Health Report 2003: continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme](#). Community Dent Oral Epidemiol. 2003;31(s1):3-24.

⁵ U.S. Department of Health and Human Services. [Oral Health in America: A report of the Surgeon General](#). Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000.

-
- ⁶Weyant RJ, Tracy SL, Anselmo TT, Beltrán-Aguilar ED, Donly KJ, Frese WA, Hujoel PP, Iafolla T. et.al. American Dental Association Council on Scientific Affairs Expert Panel on Topical Fluoride Caries Preventive Agents. [Topical fluoride for caries prevention: executive summary of the updated clinical recommendations and supporting systematic review](#). *J Am Dent Assoc*. 2013 Nov;144(11):1279-91.
- ⁷Marinho VC, Higgins JP, Logan S, Sheiham A. [Topical fluoride \(toothpastes, mouthrinses, gels or varnishes\) for preventing dental caries in children and adolescents](#). *Cochrane Database Syst Rev*. 2003(4):CD002782.
- ⁸Marinho VC, Worthington HV, Walsh T, Clarkson JE. [Fluoride varnishes for preventing dental caries in children and adolescents](#). *Cochrane Database Syst Rev*. 2013 Jul 11;7:CD002279.
- ⁹Marinho VC, Higgins JP, Sheiham A, Logan S. [Combinations of topical fluoride \(toothpastes, mouthrinses, gels, varnishes\) versus single topical fluoride for preventing dental caries in children and adolescents](#). *Cochrane Database Syst Rev*. 2004(1):CD002781.
- ¹⁰Marinho VC, Higgins JP, Sheiham A, Logan S. [One topical fluoride \(toothpastes, or mouthrinses, or gels, or varnishes\) versus another for preventing dental caries in children and adolescents](#). *Cochrane Database Syst Rev*. 2004(1):CD002780.
- ¹¹Marinho VC, Higgins JP, Logan S, Sheiham A. [Fluoride gels for preventing dental caries in children and adolescents](#). *Cochrane Database Syst Rev*. 2002(2):CD002280.
- ¹²[AAPD Policy on Early Childhood Caries \(ECC\): Classifications, Consequences, and Preventive Strategies 2008](#). (http://www.aapd.org/media/Policies_Guidelines/P_ECCClassifications.pdf)
- ¹³National Institutes of Health (US), [Diagnosis and management of dental caries throughout life](#). NIH Consensus Statement. 2001 Mar 26-28;18(1):1-23.
- ¹⁴Takahashi N, Nyvad B. [Caries ecology revisited: microbial dynamics and the caries process](#). *Caries Res*. 2008; 42(6):409-18. Epub 2008 Oct 3.
- ¹⁵Beltran-Aguilar E, Boldstein J, Lockwood S. [Fluoride Varnishes, A Review of Their Clinical Use, Cariostatic Mechanism, Efficacy and Safety](#). *J Am Dent Assoc*. 2000; 131(5): 589-96.
- ¹⁶Weintraub, JA, Ramos-Gomez, F, June B. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res* 2006; 85(2):172-176.
- ¹⁷Liu BY, Lo EC, Chu CH, Lin HC. [Randomized trial on fluorides and sealants for fissure caries prevention](#). *J Dent Res*. 2012 Aug;91(8):753-8.
- ¹⁸Hiiri A, Ahovuoto-Saloranta A, Nordblad A, Mäkelä M. [Pit and fissure sealants versus fluoride varnishes for preventing dental decay in children and adolescents](#). *Cochrane Database Syst Rev*. 2010 Mar 17;(3):CD003067.pub3..
- ¹⁹S.O. Griffin E. Oong, W. Kohn, B. Vidakovic, B.F. Gooch' CDC Dental Sealant Systematic Review Work Group, J. Bader, J. Clarkson, M.R. Fontana, D.M. Meyer, R.G. Rozier, J.A. Weintraub, D.T. Zero. [The Effectiveness of Sealants in Managing Caries Lesions](#). *J Dent Res.*, Vol. 87, No. 2, 169-174 (2008) DOI: 10.1177/154405910808700211
- ²⁰Bravo M, Garcia-Anllo I, Baca P, Llodra JC. [A 48-month survival analysis comparing sealant \(Delton\) with fluoride varnish \(Duraphat\) in 6- to 8-year-old children](#). *Community Dent Oral Epidemiol* 1997;25:247-250.
- ²¹Bravo M, Garcia-Anllo I, Baca P, Llodra JC. [Sealant and fluoride varnish in caries: a randomized trial](#). *J Dent Res*. 2005 Dec;84(12):1138-43.
- ²²Featherstone JD. [Caries prevention and reversal based on the caries balance](#). *Ped. Dent*. 2006 Mar-Apr;28(2):128-32; discussion 192-8.
- ²³Dijkman TG, Arends J. [The role of 'CaF₂-like' material in topical fluoridation of enamel in situ](#). *Acta Odontol Scand* 1988;46:391-7.
- ²⁴Tenuta LM, Cerezetti RV, Del Bel Cury AA, Tabchoury CP, Cury JA. [Fluoride release from CaF₂ and enamel demineralization](#). *J Dent Res* 2008;87(11):1032-6.
- ²⁵Bawden JW. [Fluoride varnish: a useful new tool for public health dentistry](#). *J Public Health Dent*. 1998 Fall;58(4):266-9.
- ²⁶Bayless JM, Tinanoff N. [Diagnosis and treatment of acute fluoride toxicity](#). *J Am Dent Assoc*. 1985 Feb;110(2):209-11.
- ²⁷Skold-Larsson K, Modeer T, Twetman S. [Fluoride concentration in plaque in adolescents after topical application of different fluoride varnishes](#), *Clin Oral Investig*. 2000 Mar;4(1):31-4.
- ²⁸American Academy of Pediatrics. [Caries Prevention Services Reimbursement Table](#). June 2013. <http://www2.aap.org/commpeds/dochs/oralhealth/State.html>. Accessed online on June 16, 2014.
- ²⁹Calonge N, U.S. Preventive Services Task Force. [Prevention of dental caries in preschool children: recommendations and rationale](#). *Am J Prev Med*. 2004 May;26(4):326-9.
- ³⁰Lawrence HP, Binguis D, Douglas J et al. [A 2-Year Community Trial of Fluoride Varnish for the Prevention of Early Childhood Caries in Aboriginal Children](#). *Community Dent Oral Epidemiol*. 2008 Dec;36(6):503-16.
- ³¹CDC. [Recommendations for using fluoride to prevent and control dental caries in the United States](#). *MMWR* August 17, 2001a;50(RR14):1-42.
- ³²Autio-Gold JT, Courts F. [Assessing the effect of fluoride varnish on early enamel carious lesions in the primary dentition](#). *J Am Dent Assoc*. 2001;132(9):1247-53.

-
- ³³ Autio-Gold, JT, Tomar SL. [Prevalence of noncavitated and cavitated carious lesions in 5-year old Head Start schoolchildren in Alachua County, Florida.](#) *Pediatr Dent.* 2005;27 (1): 54-60.
- ³⁴ Cury JA, Tenuta LM, Ribeiro CC, Paes Leme AF. [The importance of fluoride dentifrices to the current dental caries prevalence in Brazil.](#) *Braz Dent J.* 2004 Mar;15(3):167-74.
- ³⁵ Gatti A, Camargo LB, Imparato JC, Mendes FM, Raggio DP. [Combination effect of fluoride dentifrices and varnish on deciduous enamel demineralization.](#) *Braz Oral Res.* 2011 Sep-Oct;25(5):433-8.
- ³⁶ Slawson DC, Shaughnessy AF. [Becoming an information master: using POEMs to change practice with confidence.](#) *Patient-Oriented Evidence that Matters. J Fam Pract.* 2000 Jan;49(1):63-7.
- ³⁷ Woodward GL, Lewis DW. [The use of professionally applied topical fluorides in the North York Public Dental Program.](#) Quality Assurance Report No. 8, Community Dental Health Services Research Unit, University of Toronto, 1995.
- ³⁸ Zero D, Fontana M, Lennon AM. [Clinical applications and outcomes of using indicators of risk in caries management.](#) *J Dent Educ.* 2001 Oct; 65(10):1126-32.
- ³⁹ Milsom KM, Blinkhorn AS, Walsh T, Worthington HV, Kearney-Mitchell P, Whitehead H, Tickle M. [A cluster-randomized controlled trial: fluoride varnish in school children.](#) *J Dent Res.* 2011 Nov;90(11):1306-11.
- ⁴⁰ Mejäre I¹, Axelsson S, Dahlén G, Espelid I, Norlund A, Tranæus S, Twetman S. [Caries risk assessment. A systematic review.](#) *Acta Odontol Scand.* 2014 Feb;72(2):81-91
- ⁴¹ Weinstein P, Spiekerman C, Milgrom P. [Randomized Equivalence Trial of Intensive and Semiannual Applications of Fluoride Varnish in the Primary Dentition.](#) *Caries Res.* 2009;43:484–490.
- ⁴² Moberg Sköld U, Petersson LG, Lith A, Birkhed D. [Effect of school-based fluoride varnish programmes on approximal caries in adolescents from different caries risk areas.](#) *Caries Res.* 2005;39(4):273-9.
- ⁴³ Petersson LG, Twetman S, Dahlgren H, et.al. [Professional fluoride varnish treatment for caries control: a systematic review of clinical trials.](#) *Acta Odontol Scand.* 2004;62(3):170-6.
- ⁴⁴ Bhavna PT, Rozier GR, Stearns SC, Quiñonez RB. [Effectiveness of Preventive Dental Treatments by Physicians for Young Medicaid Enrollees Pediatrics.](#) *Pediatrics.* 2011 Mar;127(3):e682-9. doi: 10.1542/peds.2010-1457.
- ⁴⁵ Rozier RG. [Effectiveness of methods used by dental professionals for the primary prevention of dental caries.](#) *J Dent Educ.* 2001 Oct; 65(10):1063-72.
- ⁴⁶ Vujicic M, Nasseh K. [A Decade in Dental Care Utilization among Adults and Children \(2001–2010\).](#) *Health Serv Res.* 2014 April; 49(2): 460–480. Published online 2013 December 3
- ⁴⁷ Macek MD, Manski RJ, Vargas CM, Moeller JF. [Comparing oral health care utilization estimates in the United States across three nationally representative surveys.](#) *Health Serv Res.* 2002 Apr;37(2):499-521.
- ⁴⁸ Greig V, Conway DI. [Fluoride varnish was effective at reducing caries on high caries risk school children in rural Brazil.](#) *Evid Based Dent.* 2012;
- ⁴⁹ Zimmer S, Robke FJ, Roulet JF. [Caries prevention with fluoride varnish in a socially deprived community.](#) *Community Dent Oral Epidemiol.* 1999 Apr;27(2):103-8.
- ⁵⁰ Tagliaferro EP, Pardi V, Ambrosano GM, Meneghim Mde C, da Silva SR, Pereira AC. [Occlusal caries prevention in high and low risk schoolchildren.](#) A clinical trial. *Am J Dent* 24:109-114.
- ⁵¹ http://www.cdc.gov/fluoridation/fact_sheets/cwf_qa.htm#13
- ⁵² Tankkunnasombut S, Youcharoen K, Wisuttisak W, Vichayanrat S, Tiranathanagul S. [Early colonization of mutans streptococci in 2- to 36-month-old Thai children.](#) *Ped. Dent.* 2009 Jan-Feb;31(1):47-51.
- ⁵³ Ramos-Gomez FJ, Crall JJ, Gansky, S Slayton RL, Featherstone, JDB. [Caries Risk assessment appropriate for the age 1 visit \(infants and toddlers\).](#) *J Calif Dent Assoc,* 2007;35(10):687-702.
- ⁵⁴ Indian Health Service. [The 2010 Indian Health Service Oral Health Survey of American Indian and Alaska Native Preschool Children.](#) Rockville, MD: U.S. Department of Health and Human Services, Indian Health Service, 2013.
- ⁵⁵ [Prevention of Dental Caries in Children From Birth Through Age 5 Years,](#) Topic Page. U.S. Preventive Services Task Force. <http://www.uspreventiveservicestaskforce.org/uspstf/uspdsnch.htm>. Accessed June 16, 2014.
- ⁵⁶ American Academy of Pediatrics. Policy Statement: [Preventive Oral Health Interventions for Pediatricians.](#) Section on Pediatric Dentistry and Oral Health. *Pediatrics* 2008;122;1387; originally published online November 17, 2008. DOI: 10.1542/peds.2008-2577.
- ⁵⁷ Pierce KM, Rozier GR, Vann WF [Accuracy of Pediatric Primary Care Providers' Screening and Referral for Early Childhood Caries](#) *Pediatrics* 2002; 109:5 e82; doi:10.1542/peds.109.5.e82.
- ⁵⁸ Anusavice KJ. [Present and future approaches for the control of caries.](#) *J Dent Educ.* 2005 May;69(5):538-54.