

A Best Practice Approach Report describes a public health strategy, assesses the strength of evidence on the effectiveness of the strategy, and uses practice examples to illustrate successful/innovative implementation.

Date of Report: June 2003
Updated: July 2018

Best Practice Approach Report Use of Fluoride in Schools

- I. Description (page 1)
 - Approaches
 - Mouthrinses
 - Supplements
 - Varnish
 - Toothpaste
 - School Fluoridation
 - Silver Diamine Fluoride
- II. Guidelines and Recommendations (page 4)
- III. Research Evidence (page 6)
 - Mouthrinses
 - Supplements
 - Varnish
 - Toothpaste
 - School Fluoridation
 - Silver Diamine Fluoride
- IV. Best Practice Criteria (page 9)
- V. State Practice Examples (page 11)
- VI. Acknowledgements (page 11)
- VII. Attachments (page 13)
 - A. Summary of Fluoride Program Effectiveness and Costs
 - B. Fluoride Supplement Dosage Schedule
 - C. State Fluoride School Program Table
- VIII. Resources (page 17)
- IX. References (page 19)

I. Description

Fluoride as a Preventive Measure

Fluoride prevents tooth decay (dental caries) and slows or reverses its progression. Fluoride ion has a high affinity for calcium; therefore fluoride is mainly associated with calcified tissues (i.e., teeth and bones). All fluoride products work best to prevent tooth decay when a constant, low level of fluoride is maintained in the mouth. While pre-eruptive fluoride is beneficial, its most important preventive effect is after the teeth erupt (post-eruptive).^{1,2} Fluoride enhances remineralization and inhibits demineralization of tooth enamel, and reduces the activity of bacteria that causes tooth decay. Effectiveness of fluoride products is dependent upon reapplication. Topical fluoride is relatively more effective in preventing tooth decay on the smooth surfaces rather than the pits and fissures of teeth.^{3,4, 5}

Fluoridated community drinking water and fluoride toothpaste are the most common sources of fluoride in the United States (U.S.). The Centers for Disease Control and Prevention (CDC) recommends all people drink water with an optimal fluoride concentration of 0.7ppm and brush their teeth twice a day with fluoride toothpaste. As of 2014, nearly 75% of people served by public water systems in the U.S. received fluoridated drinking water, equivalent to about two-thirds of the population. The remainder of the general population is served by private wells, or other water sources that cannot be fully monitored and integrated into this summary. More than 90% of the U.S. population uses fluoride toothpaste, contributing to the widespread decline in tooth decay since the 1950s.

School-based Fluoride Programs

A school-based fluoride program is defined as the coordinated use of fluoride in a school with students from age six to age 18. School-based fluoride mouthrinse, supplement and toothpaste programs were designed during the 70s and 80s to be delivered to all children in schools as alternatives to community water fluoridation. For a summary of the cost and effectiveness of common school fluoride program models. (See Attachment A)

Fluoride products have become widely available since the 1990s, tooth decay rates have declined, and more targeted strategies are balancing decay reduction while minimizing dental fluorosis. Most evaluation studies were done prior to 2000 and more recent published evaluations are limited. The use of caries risk assessment at the population level (e.g., low socioeconomic status, limited access to dental services, low use of dental care services) and/or the individual level (e.g., dental visit in the last year, past decay experience, active tooth decay) is critical for establishing baseline information most likely to demonstrate successful outcomes attributed to selected fluoride products.^{5,6}

The effectiveness and efficiency of school fluoride programs are highly reliant upon participation of school children over a period of two or more years.² All school programs require approval of the school administration prior to implementation. To develop an effective program plan, administrators should strategize activities designed to reduce barriers and gain parental consent for students to receive services. The use of a [program planning model](#) is highly recommended to improve evaluation of health outcomes when fluoride is used in school communities.⁷

Obtaining signed parental consent forms is a critical component of a successful school-based program. Child participation is contingent upon meeting legal consent requirements for fluoride treatment of a minor in absence of a parent, which is established by State Offices of Education and local school district administrators along with their legal advisors, in addition to state dental practice acts.^{8,9}

The Best Practice Approach Criteria found on page (9) may be a useful checklist of measurements to consider when planning a school-based program using fluoride.

Fluoride Mouthrinse Programs

In the U.S., fluoride mouthrinse programs are not recommended for children less than six years of age due to the potential to swallow vs. spit.

In a school-based fluoride mouthrinse program (FMRP), school teachers distribute and supervise children who participate in the weekly rinses using a 0.2% sodium fluoride solution. After rinsing, the child spits the fluoride solution into a cup, a napkin is used to absorb the solution, and both napkin and cup are placed in the trash.^{10,11} School personnel are trained by an appropriate health care professional in mouthrinse procedures and safe storage of fluoride according to individual state regulations.¹¹

The number of states reporting fluoride mouthrinse programs has fallen from 37 states in 2002 to 14

¹ Special waste management precautions are not required for daily use. Review the Material Safety Data Sheets (MSDS) for any fluoride products used in the school. Consult state and local authorities on waste management for local guidance on the disposal of expired and/or unused bulk supplies of fluoride rinse, or other fluoride products.

states in 2017.¹² Annual declines have been noted since the 1986 [Review of the National Preventive Dentistry Demonstration Program \(NPDDP\)](#), a national evaluation of school mouthrinse programs, was released. This report recommended targeting mouthrinse programs to at-risk populations in non-fluoridated communities and to primarily focus on dental sealants, reflecting the declining rate of decay on the smooth surfaces of teeth.¹³

Anecdotal remarks indicate that teacher compliance is a barrier for implementation as well as a reason for program discontinuation.¹⁴ Support and cooperation from dentists, dental associations and local public health jurisdictions play strong roles in acceptance, implementation and maintenance of fluoride rinse programs.¹⁵

Fluoride Supplement Programs

Fluoride supplements must be prescribed by a licensed health care professional as determined by each state's rules and regulations. Most fluoride supplements contain variable levels of sodium fluoride and are available as either tablets or lozenges. The supplements are dispensed daily under the supervision of a teacher to ensure children receive the supplement appropriately.

Knowledge of fluoridated water supplying homes of children attending the school is important in order to avoid providing supplements to children with fluoridated community water at home. Letters to parents should be sent home, along with consent forms, informing parents their children should not receive fluoride supplements at both home and school.

Supplements provide systemic and topical benefits for children at high-risk for tooth decay and whose primary drinking water has a low fluoride concentration. The dosage prescribed is dependent upon the amount of fluoride in the drinking water normally consumed and should be consistent with the [2010 fluoride supplement schedule recommended by the ADA](#).¹⁶ For children younger than six years of age, consideration of other sources of fluoride (e.g., at home or in child care settings or school, bottled water, fluoride vitamin solutions, topical fluoride or fluoride toothpaste), is needed to avoid unnecessary ingestion of fluoride associated with cosmetically evident dental fluorosis. (See Attachment B)

The number of states with school-based fluoride supplement programs has fallen from 11 states in 2000-2002 to six states in 2015.¹⁷ Challenges with teacher compliance, combined with the development of new products such as fluoride varnish, may explain the reduction in the use of fluoride supplement programs.

Fluoride Toothpaste and Brushing Programs

In school-based brushing programs, the use of toothpaste containing 1000-1500ppm of fluoride is recommended for the prevention of tooth decay in children older than six years of age. School personnel should supervise young (<8 yrs) children during daily brushing to minimize swallowing large amounts of toothpaste.^{18, 19,20,21,22,23} As of 2018, the number of schools with toothbrushing programs is not known.

School Water Fluoridation

School fluoridation is the incorporation of an individual fluoridation system, specifically to adjust fluoride concentration at individual schools. The fluoride concentration is allowed to be up to 4.5 times the optimal (0.7ppm) to compensate for fewer number of days in the school year. The use of school water fluoridation is no longer a common practice as there are other options available for children to receive fluoride for the prevention of tooth decay. At the peak of this practice, a total of 13 states had initiated school water fluoridation in 470 schools serving 170,000 children.⁵

Fluoride Varnish

Fluoride varnish containing 5% sodium fluoride (containing 22,600 ppm fluoride) in a resin base, is available by prescription and applied under the supervision of healthcare professionals as allowed by

state rules and regulations. Fluoride varnish provides a highly concentrated, temporary dose of fluoride when it is painted thinly on the surfaces of all teeth. This layer slowly disappears over the following 3-6 months.²⁴ Repeated varnish application is needed to maintain effectiveness.²⁵

Fluoride varnish does not require special equipment or significant cooperation by the child. The ADA has recommended fluoride varnish over other professionally applied topical fluoride products for use with children younger than age six who are at risk for tooth decay.² The safety and ease of fluoride varnish application, compared to fluoride gel/trays, has led to incorporation into existing school prevention programs. Following guidance from the ADA on fluoride and decay risk assessment for individuals, biannual fluoride varnish applications for at least two years, will generally move children from high to low risk.² Because fluoride varnish applications are relatively infrequent, generally at 3- to 12-month intervals, concentrated fluoride products such as varnish, pose little risk for dental fluorosis.

The number of states with a school-based fluoride varnish program has increased. In 2017, 35 states indicated they had such a program, compared to 30 in 2010.^{12,17} In a follow up survey highlighting elementary school use, many states indicated fluoride varnish is used in combination with dental sealant programs rather than as a stand-alone fluoride program.²⁶

Silver Ion Compounds

Silver ion compounds, specifically silver nitrate, had been used as bactericidal agents to arrest tooth decay in cavitated lesions over a century ago, but fell out of favor. With the recent emergence of silver diamine fluoride, these compounds are experiencing a resurgence in the U.S. After isolation of the teeth to be treated, the silver ion solution is painted directly on the affected tooth surface and allowed to absorb. Outside of the U.S., use of SDF and other silver compounds demonstrate significant success arresting decay compared to more costly dental treatment. U.S. clinical trials of SDF are currently underway for decay prevention and arrest following the Federal Drug Administration's (FDA) expedited clearance of SDF as a desensitizing agent in August 2014. It should be noted that silver products do not restore tooth structure.

In June 2018, the Association of State and Territorial Dental Directors (ASTDD) Synopses of State Dental Public Health Programs (2016-2017 data) identified Alaska, Florida, Georgia, Illinois and New Hampshire as initiating school programs utilizing silver diamine fluoride. In December 2016, an informal survey of state dental directors identified at least nine additional states establishing new regulations for incorporating SDF application and reimbursement.

Combinations

The hallmark of public health programs is consideration of the cost-effectiveness when selecting modalities and combinations of modalities for school programs (e.g., fluoride mouthrinse for a group already drinking fluoridated water or using fluoride toothpaste).^{27,28} Increasingly complex school-based service delivery models, may have significantly higher operational costs to achieve health improvements. At least 35 programs have been identified that combine fluoride varnish with dental sealants.²⁶

II. Guidelines & Recommendations from Authoritative Sources

A. American Academy of Pediatric Dentistry (AAPD)

The [American Academy of Pediatric Dentistry](#) (AAPD) endorses multiple fluoride modalities, including community water fluoridation, fluoride supplementation according to the ADA 2010 supplementation schedule, twice daily toothbrushing with fluoride toothpaste, and professionally-applied fluoride treatment (fluoride varnish, silver diamine fluoride or APF gel) for children at high risk for tooth decay.^{29,30}

B. American Academy of Pediatrics (AAP)

While the focus of AAP activity is on early childhood decay prevention, the organization has developed [policy, toolkits and resources](#) for oral health promotion.

C. American Dental Association

Since 2009, the ADA's [Center for Evidence-Based Dentistry](#) (EBD) connects the latest research with the daily practice of dentistry. The Center provides systematic reviews, critical summaries and clinical recommendations related to the use of individual fluoride products.

D. Centers for Disease Control and Prevention (CDC)

In 2001, [CDC](#) published recommendations covering the fluoride products used to prevent and control tooth decay in the United States.⁵ The review included current evidence and ratings for the use of school [fluoridation](#), over-the-counter fluoride toothpastes, dietary fluoride supplements, professionally applied fluorides ([gels, varnish, foams or highly concentrated toothpastes](#)) and combinations of fluoride. In 2014, The [U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries](#) balance the trends in availability of additional fluoride sources and contribution to very mild and mild dental fluorosis.

In 2014, the CDC and the [Association of Supervision of Curriculum Development](#) (ASCD) in collaboration with key leaders from the fields of health, public health, education, and school health, developed an expanded [Whole School, Whole Community, Whole Child](#) (WSCC) model designed to create a unified and collaborative approach to improve learning and health in our nation's schools. ASTDD fully [supports and endorses the integration of health education, prevention \(fluoride\) and treatment programs](#) into each component of the WSCC model and reflected in school health policies.

E. The Cochrane Library

The [Cochrane Library](#) systematically synthesizes published literature and maintains a database of their peer-reviewed and published reviews and protocols to provide the best evidence for guiding decision making. The Cochrane resource page contains links to other online databases, research centers and EBD organizations throughout the world. Search "fluoride" for reviews on fluoride supplements, varnish, mouthrinses, toothpaste and gel.

F. Community Preventive Services Task Force (CPSTF) – The Community Guide

The Community Preventive Services Task Force (CPSTF) is an independent, non-federal panel of public health and prevention experts that provides evidence-based findings and recommendations about community preventive services, programs, and other interventions aimed at improving population health. Its members represent a broad range of research, practice, and policy expertise in community preventive services, public health, health promotion, and disease prevention. The Community Guide recommends program strategies for [School-Based Dental Sealant Delivery Programs](#), [Community-Based Initiatives to Promote the Use of Dental Sealants](#) and [Community Water Fluoridation](#) designed to prevent tooth decay, providing useful guidance for developing school fluoride programs targeting populations rather than individuals.

G. National Maternal and Child Oral Health Resource Center (OHRC)

Launched in 1996, The [National Maternal and Child Oral Health Resource Center](#) (OHRC) provides support to the maternal and child health community by serving as a central convener, coordinator, and promoter of new oral health knowledge and skills. They publish and update a compendium of programs in schools: [Promoting Oral Health in Schools: A Resource Guide](#).

H. Society of Teachers of Family Medicine Group on Oral Health (STFM)

STFM developed [Smiles for Life](#): A National Oral Health Curriculum with specific education on the use of fluoride by primary care clinicians including physicians, physician assistants, and nurse practitioners.

I. Surgeon General's Report on Oral Health-2000

The [Surgeon General's Report on Oral Health-2000](#) identified school fluoride mouthrinse and supplement programs as effective strategies to prevent tooth decay. Experts recommend fluoride programs target high-risk children and groups.³¹ In 2003, the Office of the Surgeon General issued a follow up, [A National Call to Action to Promote Oral Health](#), emphasizing increased application of topical fluorides, especially for the 1/3 of Americans not benefitting from community water fluoridation.³² Two [Healthy People 2020 health objectives](#) related to the use of fluoride in school

programs continue the advance of the Surgeon General's reports, , recommending 10% reductions in the proportion of United States children aged 6 to 9 years and adolescents age 13-15 years with dental caries experience in primary or permanent teeth.

J. U.S. Preventive Services Task Force (USPSTF)

The USPSTF is an independent, volunteer panel of national experts in prevention and evidence-based medicine. The Task Force works to improve the health of all Americans by making evidence-based [recommendations](#) about clinical preventive services for primary health care professionals, including [fluoride supplements, fluoride varnish](#) and [Preventing Tooth decay in Children <5 Years](#).

K. World Health Organization (WHO)

At the end of [World Congress 2015](#), WHO called upon health policy-makers and professionals to significantly reduce the global disease burden, promote greater equity, and integrate oral health promotion into their chronic disease (non-communicable disease) prevention and control and developed an agenda. WHO has promoted the use of fluoride for population-based prevention of tooth decay since the late 1960s and developed guidelines and documents for [oral health promotion in schools](#).

III. Research Evidence

A. [Fluoride Mouthrinses](#)

School-based fluoride mouthrinse programs have been in place in the U.S. since the early 1970s and are used in other countries as well. A 2016 systematic review evaluated school fluoride mouthrinsing programs conducted in the 70s and 80s demonstrating consistent decay reductions of 27% in permanent teeth before the widespread adoption of community water fluoridation, fluoride toothpaste and increased availability of other fluoride products.^{33,34} Since the 1990s, U.S. school-based programs have largely depended on evaluations of school fluoride programs in countries outside the U.S. that often have higher rates of tooth decay and lower fluoride available in their communities.^{35,36,37,38,39,40} Once fluoride mouthrinsing is discontinued, the benefits disappear two or more years later, a reminder that all fluoride programs are dependent upon periodic reapplication for efficacy.^{41,42,43}

While the degree of effectiveness in the U.S. today may be debated, school mouthrinsing programs do remain a cost-effective choice for schools with children at high-risk for tooth decay.^{44,45,46} As demonstrated by a 2016 study, no difference in decay reductions in children using fluoride mouthrinsing versus fluoride varnish is evident.^{47,48} School fluoride mouthrinse programs are less expensive compared to professionally applied fluoride varnish, especially when volunteers are used. Cost estimates in 1988 ranged from \$0.52 to \$1.78 and in 2017 from \$1.08 to \$3.68 per child per school year for fluoride mouthrinsing, depending on whether paid staff or volunteers supervised the procedure.⁴⁹ In a 2010 ASTDD survey, states reported fluoride mouthrinse program costs between \$0.54 and \$2.54 and in 2017 from \$1.12 to \$5.25 per child per year.⁵⁰

B. [Fluoride Supplements](#)

The research evidence on the effectiveness of fluoride supplement programs is strong; however, as with fluoride mouthrinses, most studies were conducted in the 70s and 80s.^{51,52} Likewise, more recent evaluations of school-based fluoride supplement programs are from schools in countries outside the U.S. where decay rates are higher and other fluoride availability and practice are different.⁵³ Studies in which the supplements were chewed, swished and swallowed under supervision have reported decay reductions of 20% to 36% over two to six years.^{54,55} Most well-conducted randomized clinical trials with placebos and blind examiners have shown fluoride supplements benefit school-aged children. Higher decay reduction was reported from a study in which children initially aged 5.5 years, from lower socioeconomic groups, sucked a 1.0 mg fluoride tablet or a placebo under supervision in schools every school day for three years.⁵⁶

The opinion of the FDA's Dental Drug Products Advisory Committee in 1974 was that appropriate personnel for supervising the use of fluoride supplements and mouthrinse procedures included dental auxiliaries, nurses, teacher aides and volunteers who had received training by a dentist, dental

hygienist, or physician in the following procedures: proper and secure storage, correct dosage, distribution methods, and supervision of the preventive treatment procedure.⁵⁷

C. **Fluoride Toothpaste and Brushing Programs**

Children who brush their teeth at least once a day with at least a 1000 ppm fluoride toothpaste will have less tooth decay regardless of fluoridated drinking water consumption.^{58,2} Using a fluoride toothpaste twice a day increases the benefit. The amount of fluoride toothpaste and duration of brushing can influence effectiveness.⁵⁹

Toothpaste is by far the most widespread form of fluoride used; the average 24% decline in the prevalence of tooth decay in developed countries has been mainly attributed to its increased use.^{60,61} The benefits of fluoride toothpastes on the permanent dentition are firmly established and supported by more than half a century of research.^{62,63,64}

School-based daily brushing with an over-the-counter toothpaste (1000-1500 ppm) may be effective when targeting schools with a significant percentage of low income children, such as those on free or reduced school lunch programs.^{65,66,67} A 2015 report comparing the costs and benefits of 30 interventions found fluoride toothpaste and community water fluoridation consistently provided greater cost benefits than any professionally applied intervention, especially for interventions that target children at high risk, begin early and combine multiple strategies.⁶⁸

D. **School Water Fluoridation**

School water fluoridation was also initiated during the 1970s to 1980s demonstrating caries reductions among schoolchildren of approximately 40%; although, as with other fluoride modalities, these reductions may not be as pronounced today.⁵ The 1995 CDC operation and monitoring guidelines for fluoridated school public water supply systems (i.e., those serving <1000 persons) outlined practical and logistical challenges to the continuation of school fluoridation systems. For example, in addition to having staff who are responsible for written agreements between the state and schools, states were required to have one full-time school technician to monitor and maintain equipment annually, in addition to specified school staff responsible for more frequent and local monitoring.⁶⁹ As a result, school fluoridation systems in the U.S. have declined dramatically.

F. **Fluoride Varnish**

Fluoride varnish application provides another resource for use in schools.⁵ Fluoride varnish was introduced and has been widely used in Europe since the 1970s.^{70,71,72,73} Fluoride varnish is superior to fluoride gel in its safety, ease of application, fast setting time and high efficiency for children at high risk for tooth decay.^{74,75,76} It was not approved for use in the U.S. as an off-label desensitizing agent and cavity liner until 1994.⁷⁷ Biannual application of fluoride varnish is effective in preventing tooth decay in the permanent teeth.^{1,2,5,78}

Once children reach elementary school age, the primary teeth begin to exfoliate and permanent teeth begin to erupt, creating an ideal time for primary prevention for the permanent dentition. Twice yearly applications of fluoride varnish may be more acceptable in schools than the weekly fluoride mouthrinse programs.^{79,80} A Danish study found no difference in effectiveness between fluoride varnish programs provided semi-annually and fluoride mouthrinse programs offered weekly.^{81,82} However, evidence as to the effectiveness of school-based fluoride varnish programs from well-designed studies is limited in the US.⁴⁶ Caution is advised when directly comparing outcomes of U.S. school-based fluoride varnish application with countries where all children receive dental care at schools managed through national health care systems.^{83,84} The U.S. system of primarily privatized care means that most children receive dental care outside the school setting.⁸⁵

Fluoride varnish and the primary dentition

² Fluoride toothpastes in the U.S. contain either sodium fluoride at a concentration of 0.22%, stannous fluoride at 0.4% or monofluorophosphate (MFP) at 0.76%, which all produce 1000 ppm fluoride and are similar in decay prevention

Fluoride varnish has been proven to be efficacious in preventing decay, when applied biannually in children younger than six years old.^{1,2} While the literature is inconclusive on the effectiveness of professionally applied fluoride when applied more than biannually for school age children, for children under age three, applications at three month intervals yielded greater decay reductions after two years.⁸⁶

Primary prevention of decay in primary teeth is focused on early intervention, preferably beginning before three years of age and provides useful planning strategies for developing school fluoride program plans. However, children with lower decay risk may not receive additional benefits from professionally applied topical fluoride applications.^{1,2,27,77,87,88,89}

Implementation and evaluation of the North Carolina “Into the Mouth of Babes” program found delivering four or more fluoride varnish applications to children at risk for tooth decay before age five in medical offices reduced tooth decay and helped reduce oral health disparities for children at kindergarten.⁹⁰

Significant decay reduction in the primary teeth is attributed to the *multiple* efforts to increase access to early dental care, willingness of dental and medical professionals to provide care, and families to seek early dental care.⁹¹

Children who developed decay in their primary dentition had a very different decay trajectory in their permanent dentition compared to their decay-free contemporaries.⁹²

G. Silver Ion Compounds³

In clinical trials, silver diamine fluoride solution (SDF) applied directly to cavitated lesions outperformed fluoride varnish for the non-surgical arrest of decay in children and older adults.⁹³ In addition, SDF demonstrated impressive decay prevention to adjoining teeth not receiving direct application of SDF.^{94,95} At least 11 published reports of randomized clinical trials consistently demonstrated very high rates of arrested decay.^{96,97,98,99,100,101,102,103,104,105} A 2016 systematic review and meta-analysis of clinical trials in children concluded 38% SDF applied at least once per year effectively arrested more than 65% of active decay.¹⁰⁶ There is no consensus for the number and frequency of applications for optimal decay control. A critical summary of the systematic review, published in early 2017, called for more well-designed and well-conducted clinical trials comparing the effectiveness of SDF with no treatment or other decay management approaches in populations with varying decay risk, lesion severities, and other fluoride exposures.¹⁰⁷ In January and February of 2018, the California Dental Association published multiple articles on the review of silver ion compounds, including silver nitrate and silver diamine fluoride.¹⁰⁸

E. Combinations

The effect of combining fluoride mouthrinses, gels or varnishes with fluoride toothpaste on the permanent dentition suggests that their combined use is associated with no more than an additional 10% (95% CI, 2% to 17%) reduction in decayed, missing and filled tooth surfaces. A 10% decay reduction is not considered substantial.^{68,109,110} The scarcity of research on the cost-effectiveness of combinations of fluoride products limits the ability to draw detailed conclusions.^{76,111,112,113,114}

The National Preventive Dentistry Demonstration Program (NPDDP) 1986 analysis found the addition of dental health lessons, brushing and flossing, fluoride tablets (in non-fluoridated communities), and professionally applied topical fluorides, in addition to fluoride mouthrinsing, only slightly increased effectiveness suggesting these additions may not be cost-effective or efficient as applied in school programs.¹³ Fluoride mouthrinsing combined with dental sealants achieved greater decay reductions.^{115,116,117,118,119}

IV. Best Practice Criteria

The ASTDD Best Practices Project has selected five best practice criteria to guide state and community oral health programs in developing their best practices. For these criteria, initial review standards, are provided to help evaluate the strengths of a program or practice to prevent and control tooth decay.

1.) Impact/Effectiveness:

Non-fluoridated communities (less than 0.7 ppm)

- Population-based caries risk assessment used for school selection
 - Schools with at least 50% of students eligible for free or reduced-price lunch provided by the [National School Lunch Program](#).
 - Free or reduced-price lunches are a marker for socioeconomic status up to 185% of the federal poverty level. This would include schools eligible for Community Eligibility Provision (CEP), classification of schools with greater than 40% eligible for free lunches equivalent to children from families at or below 130% of the federal poverty level.
 - A high proportion of children have not had a dental or medical dental visit in the last six months
 - Schools with low access to routine dental care, including fluoride treatment, within school district boundaries
 - inadequate availability of medical or dental professionals
 - inadequate availability of medical or dental professionals accepting Medicaid
 - community health centers or other non-profit dental clinics are not available
 - no current school-based program
 - school children demonstrate high rates of untreated tooth decay
- Training of volunteers, school staff/teachers, and/or paid staff who manage the program
- Evaluation of appropriate service delivery through:
 - Documentation of service/program costs and benefits - process outcomes
 - Documentation of health outcomes for the community and school
 - Frequency is consistent with national guidelines for effectiveness for individuals according to caries risk

Fluoridated communities (greater than 0.6 ppm)

- Individual caries risk assessment is used for child selection

2.) Efficiency:

- . The program provides adequate training and quality assurance while using the expertise of various health care professionals, commensurate with individual state's health care provider laws and regulations. The program collects and analyses data to demonstrate program efficiencies and program cost-effectiveness, such as the:
 - Number of program visits to the school
 - Number of applications each child receives
 - Percent of children in school participating

3.) Demonstrated Sustainability

- The program or service has a consistent funding source without time limitation (e.g., funding limitation of a 2-year grant), and/or has a plan for fund-raising or long-term funding.

4.) Collaboration/Integration:

- Integration, collaboration, coordination and linkage are demonstrated.
 - Use of the [Whole School, Whole Community, Whole Child model](#) (WSCC) is demonstrated.¹²⁰Professional, school staff, parent and/or child satisfaction surveys
 - Coordination and collaboration with community clinic/dental providers for provision of comprehensive care
 - Percent of children completing recommended treatment and establishing a dental home to assure continuation of fluoride treatment.
- Partnerships to leverage resources are identified, such as the Medicaid program, state chronic disease program, dental and dental hygiene schools, medical or dental professional

organizations.

5.) Objectives/Rationale:

- Aim for objectives that are Specific, Measurable, Achievable, Relevant and Time Limited [SMART]
- Linkage of program goals/objectives to state and national oral health goals/objectives (e.g., state oral health plans, state policy agenda, health agency’s priorities, HP 2020 and/or state oral health objectives).

Evidence Supporting Best Practice Approaches

The ASTDD Best Practices Committee takes a broad view of evidence to support best practice approaches for building effective state and community oral health programs. Practices that are linked by strong causal reasoning to the desired outcome of improving oral health and total well-being in priority schools will be recommended by the Best Practices Committee. Strength of evidence from research, expert opinion and field lessons fall within a spectrum: on one end of the spectrum are **promising best practice approaches**, which may be supported by little research, a beginning of agreement in expert opinion, and very few field lessons evaluating effectiveness; on the other end of the spectrum are **proven best practice approaches**, supported by strong research, extensive expert opinion from multiple authoritative sources, and solid field lessons evaluating effectiveness.

Research may range from a majority of studies in dental public health or other disciplines reporting effectiveness to the majority of systematic reviews of scientific literature supporting effectiveness. Expert opinion may range from one expert group or general professional opinion supporting the practice to multiple authoritative sources (including national organizations, agencies or initiatives) supporting the practice. Field lessons may range from success in state practices reported without evaluation documenting effectiveness to cluster evaluation of several states (group evaluation) documenting effectiveness.

To access information related to a systematic review vs. a narrative review, see: [Systematic vs. Narrative Reviews.](#) (Accessed: 6/23/2016)

V. State Practice Examples

The following practice examples illustrate various elements or dimensions of the best practice approach of **Use of Fluorides in Schools**. These reported success stories should be viewed in the context of the states and program’s environment, infrastructure and resources. End-users are encouraged to review the practice descriptions (click on the links of the practice names) and adapt ideas for a better fit to their states and programs.

A. Summary Listing of Practice Examples

Table 1 provides a listing of programs and activities submitted by states. Each practice name is linked to a detailed description.

Table 1. State Practice Examples Illustrating Strategies and Interventions for Use of Fluorides in Schools			
#	Practice Name	State	Practice

1	Fluoride Varnish Application Program	IA	18002
2	Ready Set Smile	MN	26008
3	"Save Our Smiles" Voluntary Fluoride Mouthrinse Program	NJ	33004
4	New Mexico School-Based Prevention Program	NM	34001
5	School-Based Weekly Fluoride Mouthrinse Program	NC	36008
6	Statewide School Fluoride Program	OR	40001

B. Highlights of Practice Examples

Highlights of state practice examples are listed below.

IA [Fluoride Varnish Application Program](#) (Practice #18002)

The Iowa Department of Public Health (IDPH) contracts with 25 regional public and/or private non-profit organizations to provide Title V Maternal and Child Health (MCH) services in all 99 Iowa counties. Application of fluoride varnish by Title V contractors first began in 1999 after the IDPH developed a fluoride varnish protocol. Currently, dental hygienists and nurses employed by the contracted organizations provide oral screenings and fluoride varnish applications to low-income children and pregnant women.

MN [Ready Set Smile](#) (Practice #26008)

Ready Set Smile (RSS) is a community-based organization whose mission is to prepare and empower all children to care for their oral health through education and preventative services. RSS provides on-site atraumatic dental services and classroom education for under-resourced children in nine Minneapolis schools serving children from pre-K through 8th grade. Two atraumatic techniques are used to control active caries: silver diamine fluoride (SDF) and interim therapeutic restoration (ITR).

NJ ["Save Our Smiles" Voluntary Fluoride Mouthrinse Program](#) (Practice #33004)

The "Save Our Smiles" voluntary weekly fluoride mouthrinse program is funded by the New Jersey Department of Health. The program started in 1981 and served 20,000 children that year. During the 2016-2017 school year, approximately 70,000 students received oral health/hygiene education and oral health personal care resources and over 11,500 children participated in the voluntary school-based fluoride mouthrinse program. The cost that school year for one mix and pump fluoride mouthrinse kit was \$91.80. Each kit serves 75 students per school year. Program funding overall was \$80,000.

NM [New Mexico School-Based Prevention Program](#) (Practice #34001)

The New Mexico Department of Health (DOH), Office of Oral Health (OOH) conducts a Fluoride Varnish Program targeting pre-school aged children. The program consists of providing oral health education, a dental assessment, application of the fluoride varnish (3 times a year), parental notification recommending seeing a dentist if needed, and dental case management services for those with Class II or III caries. The Fluoride Varnish Program is supported by the State General Fund and CDC funds.

NC [School-Based Weekly Fluoride Mouthrinse Program](#) (Practice #36008)

The North Carolina Oral Health Section (NC OHS) funds a weekly school-based fluoride mouthrinse program (FMR) at no cost to NC school systems. The program consists of

supervised weekly rinsing with a .02% sodium fluoride solution. NC schools with 60% or more students eligible for the Free and Reduced Meals Program are eligible to participate. All classrooms of grades 1st through 5th/6th must participate to be compliant; kindergartners are not eligible. FMR supplies are ordered through the OHS, but school coordinators are responsible for safe storage and disposal of the fluoride, collection of necessary inventory information and also serve as the contact person for teachers and OHS hygienists.

OR [Statewide School Fluoride Program](#) (Practice #40001)

The Oral Health Unit of the Oregon Health Authority (OHA), Public Health Division administers the statewide School Fluoride Program, a school-based program providing weekly fluoride mouthrinses or daily chewable fluoride tablets to children in grades K-6. The fluoride mouthrinse program began statewide in 1974. Chewable tablets were added in 1987. The School Fluoride Program is supervised and coordinated statewide by a dental hygienist who serves as the School Oral Health Programs Coordinator. The fluoride is administered to the students by school nurses, teachers, health aides, school administrative staff, parents and/or volunteers as determined by each school. Funding for the program comes from the Maternal and Child Health Title V Block Grant.

VI. Acknowledgements

This report is the result of efforts by the ASTDD Best Practices Committee and the ASTDD Fluorides Committee to identify and provide information on developing successful application of fluoride practices in schools for improving the oral health of school-aged children. We would like to thank LeeAnn Hoaglin-Cooper as the primary writer.

This publication was supported by Cooperative Agreement 1U58DP004919-05 from CDC, Division of Oral Health.

Suggested citation: Association of State and Territorial Dental Directors (ASTDD) Best Practices Committee. Best practice approach: Use of Fluorides in Schools [monograph on the Internet]. Reno, NV: Association of State and Territorial Dental Directors; July 2018, 24p. Available from: <http://www.astdd.org>.

VII. Attachments

ATTACHMENT A

Summary of fluoride program effectiveness and costs

1. Evidence for effectiveness of each fluoride product varies significantly by population size, study period, caries risk and combinations of fluoride products and are not conclusive.

Product	Fluoride Concentration	Frequency Until low risk	Caries reduction ¹	~Annual Cost per person Adjusted from 2001 to 2017 dollars ²
Fluoride Mouthrinse sodium fluoride	0.2% 900 ppm	Weekly-Bi-weekly	Up to 30%	\$2.61 Indirect costs not included Weekly with supervision by teacher with program administration costs included
Fluoride Supplement	0.25, 0.5, or 1.0 mg dependent upon drinking water source(s) <0.6ppm	Daily	Up to 36% ³	\$5.17 Indirect costs not included Daily tablets supervised by classroom teacher
Fluoride Toothpaste	1000 ppm	Twice daily	Up to 30%	\$8.82-\$17.63 Used 2X daily- pea-size amount, 2 tubes annually depending on tube size, brand and source
Fluoride Varnish sodium fluoride Off Label- all products may not have same effects	5% 22,600 ppm	Biannually	Up to 40%	\$51.59-69.57 ⁵ Cost dependent upon professional salary and other services that may be required before application Median annual wage for dental hygienist= \$35 ⁴ per hour
School water fluoridation	4.5 ppm	Daily	Up to 40%	\$9.36
Silver Diamine fluoride Off Label – Cleared for use in U.S. in 2014 studies currently underway	38% 44,800 ppm	Biannually	Up to 40% prevention Up to 80% arrest	Unknown Cost dependent upon professional salary and other services required before application
Combinations of fluoride	Additive	As combined Daily, weekly, biannually	<10% additional	Costs are directly additive
Community water Fluoridation	0.7 ppm	Daily	Up to 25%	\$1.06+ depends on size of water systems

2. Centers for Disease Control and Prevention. [Recommendations for using fluoride to prevent and control dental caries in the United States](#). MMWR 2001;50(No. RR-14):[

3. Hsiu-Yueh Lie, et al. [Impact of 24-month fluoride tablet program on children with disabilities in a non-fluoridated country](#). Res Dev Disabil. 2013 Sep;34(9):2598-605.

4. Bureau of Labor Statistics. [Occupational Outlook Handbook](#). Healthcare. Dental Hygienists. 2016.
 5. Dudovitz RN. Et al. [A school-based public health model to reduce oral health disparities](#). J Public Health Dent. 2018 Dec;78(1):9-16.

ATTACHMENT B

Fluoride Supplement* Dosage Schedule - 2010

Approved by the American Dental Association, American Academy of Pediatrics and American Academy of Pediatric Dentistry

Age	Fluoride Ion Level in Drinking Water (ppm)*		
	<0.3 ppm	0.3-0.6 ppm	>0.6 ppm
Birth-6 months	None	None	None
6 months-3 years	0.25 mg/day**	None	None
3-6 years	0.50 mg/day	0.25 mg/day	None
6-16 years	1.0 mg/day	0.50 mg/day	None

*1.0 part per million (ppm) = 1 milligram per liter (mg/l)

** 2.2 mg sodium fluoride contains 1 mg fluoride ion.

Important Considerations When Using Dosage Schedule:

- If fluoride level is unknown, drinking water should be tested for fluoride content before supplements are prescribed. For testing of fluoride content, contact the local or state health department.
- All sources of fluoride should be evaluated with a thorough fluoride history.
- Patient exposure to multiple water sources can make proper prescribing complex.
- Ingestion of higher than recommended levels of fluoride by children has been associated with an increase in mild dental fluorosis in developing, unerupted teeth.
- Fluoride supplements require long-term compliance on a daily basis.

Attachment C

The following table represents all states where respondents indicated the use of a variety of fluoride programs in their state from 2016-2017 ASTDD Surveys of State Dental Public Health Programs. To see related trend tables go to the Annual State Synopsis Report in the Members Only section of the [ASTDD website](#).

STATES	MOU THRIN SE	SUPPLEMENT 2016	TOOTH PASTE	SCHOOL FLUORIDATION	SEALANT-COMBOS	VARNISH	SILVER DIAMINE-OTHER
ALABAMA						X	
ALASKA		X				X	X
ARIZONA	X				X	X	
ARKANSAS					X	X	
CALIFORNIA							
COLORADO					X		
CONNECTICUT					X		
DELAWARE					X	X	
DISTRICT OF COLUMBIA					X	X	
FLORIDA					X	X	X
GEORGIA	X	X			X	X	X
HAWAII							
IDAHO					X	X	
ILLINOIS					X	X	X
INDIANA				X			
IOWA					X	X	
KANSAS					X		
KENTUCKY		X			X	X	
LOUISIANA						X	
MAINE						X	
MARYLAND	X	X			X	X	
MASSACHUSETTS	X	X			X	X	
MICHIGAN	X				X	X	
MINNESOTA					X	X	
MISSISSIPPI					X	X	
MISSOURI					X	X	
MONTANA						X	
NEBRASKA						X	
NEVADA							
NEW HAMPSHIRE	X				X	X	X
NEW JERSEY	X						
NEW MEXICO					X	X	
NEW YORK	X				X		
NORTH CAROLINA	X				X	X	
NORTH DAKOTA					X	X	
OHIO	X				X		
OKLAHOMA						X	
OREGON	X	X			X		
PENNSYLVANIA	X	X			X	X	
RHODE ISLAND					X		
SOUTH CAROLINA					X	X	
SOUTH							

DAKOTA							
TENNESSEE					X	X	
TEXAS					X	X	
UTAH							
VERMONT					X	X	
VIRGINIA					X	X	
WASHINGTON							
WEST VIRGINIA	X	X			X	X	
WISCONSIN	X	X			X	X	
WYOMING							

VIII. Resources

- 1.) ASTDD
 - Fluorides Committee
 - [Community Water Fluoridation Policy Statement](#), 2015
 - [Fluoride Supplements Policy Statement](#), 2013
 - [Fluoride Toothpaste White Paper](#), 2016
 - [Fluoride Varnish: An Evidence Based Approach Issue Brief](#), 2014
 - [Fluoride Varnish Policy Statement](#), 2015
 - [Natural Fluoride Fact Sheet](#), 2016
 - [School-Based Fluoride Mouthrinse Programs](#), 2011
 - [Silver Diamine Fluoride Fact Sheet](#), 2017
 - [School-based Fluoride Varnish Program Report August 2015-2016 Reported 2017](#)
 - School and Adolescent Oral Health Committee
 - [School Dental Sealant Programs](#) (January 2016)
 - [Integrating Oral Health into the Whole School Whole Community Whole Child School Health Model](#) (Sept. 2015)
 - Best Practice Reports
 - ASTDD Best Practices Approach Report: [Improving Children's Oral Health through the Whole School, Whole Community, Whole Child Model](#) (March 2017)
 - ASTDD's Best Practices Approach Report: [School-Based Dental Sealant Programs](#) (updated Sept. 2014)2.)
- 2.) Journal of the California Dental Association
 - [January 2018](#) – The New Old: Silver diamine fluoride articles
 - [February 2018](#)- The Old New: Silver diamine fluoride articles
- 3.) Cochrane Reviews
 - [Topical silver diamine fluoride for managing dental caries in children and adults](#)
 - [Fluoride supplements \(tablets, drops, lozenges or chewing gums\) for preventing dental caries in children](#)
 - [Pit and fissure sealants versus fluoride varnishes for preventing dental decay in the permanent teeth of children and adolescents](#)
 - [Fluoride mouthrinses for preventing dental caries in children and adolescents](#)
 - [Combinations of topical fluoride \(toothpastes, mouthrinses, gels, varnishes\) versus single topical fluoride for preventing dental caries in children and adolescents](#)
 - [Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents](#)
 - [Fluoride gels for preventing dental caries in children and adolescents](#)
 - [One topical fluoride \(toothpastes, or mouthrinses, or gels, or varnishes\) versus another for preventing dental caries in children and adolescents](#)
 - [Fluoride varnishes for preventing dental caries in children and adolescents](#)
 - [Topical fluoride \(toothpastes, mouthrinses, gels or varnishes\) for preventing dental caries in children and adolescents](#)
 - [Fluoride toothpastes for preventing dental caries in children and adolescents](#)
- 4.) ADA
 - [Topical Fluoride for caries prevention: A systematic review and evidence-based recommendations](#), 2014
- 5.) AAPD
 - [Guideline on Fluoride Therapy](#) 2014
- 6.) CDC
 - Community Preventive Services Task Force Recommendations for [Improving Oral Health: Preventing Dental Caries \(Cavities\)](#)
 - Centers for Disease Control. [Recommendations for using fluoride to prevent and control dental caries in the United States](#). 2001
 - [Engineering and Administrative Recommendations for Water Fluoridation](#). 1995
- 7.) Whole School, Whole Community, Whole Child Model
 - [ASCD WSCC Resources](#)
 - [Journal of School Health – Special Supplement on Whole School, Whole Community, Whole Child, November 2015](#)
- 8.) Children’s Dental Health Project

- [School-Based Dental Sealant Programs: Recommendations](#)
 - [School Years and Beyond](#)
- 9.) Mobile and Portable Services
- American Association for Community Dental Programs [A Guide for Developing and Enhancing Community Oral Health Programs.](#)
 - [ASTDD Online Mobile-Portable Dental Manual](#)
 - Oral Health Workforce Research Center: [An Assessment of Mobile and Portable Dentistry Programs to Improve Population Oral Health.](#) 2017
 - ASTDD [Mobile and Portable Dental Services in Preschool and School Settings: Complex Issues.](#)
 - National Maternal and Child Oral Health Resource Center
 - [Integrating Sustainable Oral Health Services into Primary Care in School-Based Health Centers: A Framework](#)
 - [Safety Net Dental Clinic Manual](#)
 - [Seal America: The Prevention Invention](#)

IX. References

- ¹ American Dental Association Council on Scientific Affairs. [Professionally applied topical fluoride: Evidence-based clinical recommendations](#). *J Am Dent Assoc*. August 2006;137(8):1151-1159.
- ² Weyant RJ, et al. [Topical Fluoride for Caries Prevention; Full report of the updated clinical recommendations and supporting systematic review](#). American Dental Association 2013..
- ³ VanDorp CS, ten Cate JM. Preventive measures and caries progression: an in vitro study on fissures and smooth surfaces of human molars. *ASDS J Dent Child*. 1992;59(4):257-262.
- ⁴ Batchelor PA, Sheiham A. Grouping of tooth surfaces by susceptibility to caries: a study in 5–16 year-old children. *BMC Oral Health*. 2004;4:2.
- ⁵ Centers for Disease Control and Prevention. [Recommendations for using fluoride to prevent and control tooth decay in the United States](#). *MMWR* 2001;50(RR-14):1-42.
- ⁶ American Academy of Pediatric Dentistry and American Academy of Pediatrics. [Policy on early childhood decay \(ECC\): classifications, consequences, and preventive strategies 2011](#). American Academy of Pediatric Dentistry.
- ⁷ [CDC Program performance and Evaluation Office. CDC Evaluation Documents, Workbooks and Tools](#). November 4, 2016
- ⁸ US Department of Health and Human Services, US Department of Education. [Joint guidance on the application of the family Educational Rights and Privacy Act \(FERPA\) and the Health Insurance Portability and Accountability Act of 1996 \(HIPAA to Student Health Records](#). Nov. 2008.
- ⁹ National District Attorneys Association. [Minor Consent to Treatment Laws](#), January 2013
- ¹⁰ Centers for Disease Control. Division of Oral Health. National Center for Prevention Services. [Centers for Disease Control Position on Management of Waste Generated by Fluoride Mouthrinse Programs in Schools and Institutions](#). *JPHD*.54;(1)1995.
- ¹¹ Federal Drug Administration. Dental Drug Products Advisory Committee. *Statement of School-Based use of Various fluoride Preparations*. Federal Register 39: No. 94, p 17245. November 7, 1974.
- ¹² Association of State and Territorial Dental Directors. [2018 Synopsis of State Dental Public Health Programs Data for FY 2016-2017](#). June 2018.
- ¹³ American Public Health Association. Technical Report. [Review of the National Preventive Dentistry Demonstration Program](#). *Am J Public Health*. 1986 Apr;76(4):434-47.
- ¹⁴ Scheirer,MA. (1990). [The life cycle of an innovation: Adoption versus discontinuation of the fluoride mouth rinse program in schools](#). *J Health Soc Behav*. 1990 Jun;31(2):203-15.
- ¹⁵ Kobayashi S. et al. The status of fluoride mouthrinse programmes in Japan: a national survey. *Int Dent J*. 1994 Dec;44(6):641-7.
- ¹⁶ American Dental Association. Fluoride: Topical and Systemic Supplements. Available at <https://www.ada.org/en/member-center/oral-health-topics/fluoride-topical-and-systemic-supplements#dosschedule>. Accessed on March 21, 2018.
- ¹⁷ Association of State and Territorial Dental Directors. [Synopses of State and Dental Public Health Programs. Trend Tables Synopses Years 2012 to 2018 \(FY 2011 to FY 2017\)](#), June 2018. <https://www.astdd.org/docs/members-only/synopses-trend-tables-2012-2018.pdf>
- ¹⁸ Kay EJ, Locker D (1996). [Is dental health education effective? A systematic review of current evidence](#). *Community Dent Oral Epidemiol*. 24:231-235.
- ¹⁹ Curnow MT, Pine CM, Burnside G, Nicholson JA, Chesters RK, Huntington E. [A randomised controlled trial of the efficacy of supervised toothbrushing in high-decay-risk children](#). *Caries research*. , 2002, Vol.36(4), p.294-300.
- ²⁰ Santos NML, Hilgert JB, Hugo FN. [Effectiveness of oral health education on oral hygiene and tooth decay in schoolchildren: Systematic review and meta-analysis](#). *Community Dent Oral Epidemiol*. 2017 Aug 16.
- ²¹ Sambunjak D, Nickerson JW, Poklepovic T, Johnson TM, Imai P, Tugwell P, Worthington HV. [Flossing for the management of periodontal diseases and tooth decay in adults](#). *Cochrane Database Syst Rev*. 2011 Dec 7;(12):CD008829.
- ²² Sanz, M., et al. (2017) [Role of microbial biofilms in the maintenance of oral health and in the development of tooth decay and periodontal diseases](#). Consensus report of group 1 of the joint EFP/ORCA workshop on the boundaries between decay and periodontal diseases. *Journal of Clinical Periodontology*. 44:S18, 5–11.
- ²³ Swain JJ, Allard GB, Holborn SW. [The good toothbrushing game: A school-based dental hygiene](#)

-
- program for increasing the toothbrushing effectiveness of children.. *J Appl Behav Anal.* 1982 Spring;15(1):171-6.
- ²⁴ Beltran-Aguilar E, Goldstein 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.
- ²⁵ Association of State and Territorial Dental Directors. [Fluoride Varnish: An Evidence Based Approach Issue Brief.](#) 2014.
- ²⁶ Association of State and Territorial Dental Directors. [Fluoride Varnish Program Report.](#) Oct. 2017.
- ²⁷ Azarpazhooh A, Main PA. [Fluoride varnish in the prevention of tooth decay in children and adolescents: a systematic review.](#) *J Can Dent Assoc.* 2008 Feb;74(1):73-9.
- ²⁸ Marinho VC, Higgins JP, Sheiham A, Logan S. [One topical fluoride \(toothpastes, or mouthrinses, or gels, or varnishes\) versus another for preventing tooth decay in children and adolescents.](#) *Cochrane Database Syst Rev* 2004(1):CD002780.
- ²⁹ American Academy of Pediatric Dentistry and American Academy of Pediatrics. Council on Clinical Affairs. [Use of Fluoride.](#) *AAPD.* 2014.
- ³⁰ Crystal YO, Marghalani AA, Urles SD, et al. [Use of silver diamine fluoride for dental caries management in children and adolescents, including those with special health care needs.](#) *Pediatr Dent.* 2017;39:E135-E145.
- ³¹ 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.
- ³² U.S. Department of Health and Human Services. [A National Call to Action to Promote Oral Health.](#) Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and the National Institutes of Health, National Institute of Dental and Craniofacial Research. NIH Publication No. 03-5303, May 2003.
- ³³ Marinho VC, Chong LY, Worthington JV, Walsh T. [Fluoride mouthrinses for preventing tooth decay in children and adolescents.](#) *Cochrane Database Syst Rev.* 2016 Jul 29;7:CD002284.
- ³⁴ Cheng LL. [Limited evidence suggests fluoride mouthrinse may reduce tooth decay in children and adolescents.](#) *J Am Dent Assoc.* 2017 Apr;148(4):263-266.
- ³⁵ Chen CJ, Ling KS, Esa R, Chia JC, Eddy A, Yaw SL. [A school-based fluoride mouth rinsing programme in Sarawak: a 3-year field study.](#) *Community Dent Oral Epidemiol.* 2010 Aug;38(4):310-4. doi: 10.1111/j.1600-0528.2010.00529.x. Epub 2010 May 18.
- ³⁶ Levin KA, Jones CM, Wight C, Valentine C, Topping GVAm, Naysmith R. [Fluoride rinsing and dental health inequalities in 11 year old children: an evaluation of a supervised school-based fluoride rinsing programme in Edinburgh.](#) *Community Dent Oral Epidemiol.* 2009;37(1):19-26.
- ³⁷ Moberg Sköld U, Birkhed D, Borg E, Petersson LG. [Approximal decay development in adolescents with low to moderate decay risk after different 3-year school-based supervised fluoride mouth rinsing programmes.](#) *Caries Res.* 2005 Nov-Dec;39(6):529-35.
- ³⁸ Chikte UM, Lewis HA, Rudolph MJ. [The effectiveness of a school-based fluoride mouth rinse programme.](#) *J Dent Assoc S Afr.* 1996 Nov;51(11):697-700.
- ³⁹ Ohara S, Kawaguchi Y, Shinada K, Sasaki Y. [Evaluation of school-based dental health activities including fluoride mouth-rinsing in Hiraizumi, Japan.](#) *J Med Dent Sci.* 2000 Jun;47(2):133-41.
- ⁴⁰ Komiyama K, Kimoto K, Taura K, Sakai O. [National survey on school-based fluoride mouth-rinsing programme in Japan: regional spread conditions from preschool to junior high school in 2010.](#) *Int Dent J.* 2014 Jun;64(3):127-37.
- ⁴¹ Koch G. [Caries increment in school children during two years after end of supervised rinsing of the mouth with sodium fluoride solution.](#) *Odontol* 1969 20: 323-330.
- ⁴² Haugejorden O, Lervik T, Riordan PJ. [Comparison of decay prevalence 7 years after discontinuation of schoolbased fluoride rinsing or toothbrushing in Norway.](#) *CommRni!] Dent Oral Epidemiol* 1985 13: 2-6.
- ⁴³ Holland T J, Whelton H, O'Mullane OM, et al. [Evaluation of a fortnightly school-based sodium fluoride mouthrinse 4 years following its cessation.](#) *Caries Res* 1995 29: 431-434.
- ⁴⁴ Stamm JW, Bohannon HM, Graves RC, Disney, JA. [The efficiency of decay prevention with weekly fluoride mouthrinses.](#) *J Dent Educ.* 1984;48(11):617-626.
- ⁴⁵ Sterritt GR, Frew RA, Rozier RG. [Evaluation of Guamanian tooth decay preventive programs after 13 years.](#) *J Public Health Dent.* 1994;54(3):153-159.

-
- ⁴⁶ Kumar JV, Moss M. [Fluorides in dental public health programs.](#) *Dent Clin North Am.* 2008;52(2):387-401.
- ⁴⁷ Keller MK, Klausen BJ Twetman S. [Fluoride varnish or fluoride mouth rinse? A comparative study of two school-based programs.](#) *Community Dent Health.* 2016 Mar;33(1):23-6.
- ⁴⁸ Chestnut IG, et al. [Seal or Varnish: A randomized controlled trial to determine the relative cost and effectiveness of pit and fissure sealant and fluoride varnish in preventing dental decay.](#) *Health Technol Assess.* 2017 Apr;21(21):1-256.
- ⁴⁹ Sköld UM, Petersson, LG, Birkhed D. and Norlund A. [Cost-analysis of school-based fluoride varnish and fluoride rinsing programs.](#) *Acta Odontologica Scandinavica.*2008; 66:286-292.
- ⁵⁰ Garcia AI. [Caries incidence and costs of prevention programs.](#) *J Public Health Dent.* 1989;49(5 Spec No):259-271
- ⁵¹ Rozier RG, Adair S, Graham F, Iafolla T, Kingman A, Kohn W, Krol D, Levy S, Pollick H, Whitford G, Strock S, Frantsve-Hawley J, Aravamudhan K, Meyer DM. [Evidence-based clinical recommendations on the prescription of dietary fluoride supplements for decay prevention: a report of the American Dental Association Council on Scientific Affairs.](#) *J Am Dent Assoc.* 2010 Dec;141(12):1480-9.
- ⁵² 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.
- ⁵³ Hsiu-Yueh Lie, et al. [Impact of 24-month fluoride tablet program on children with disabilities in a non-fluoridated country.](#) *Res Dev Disabil.* 2013 Sep;34(9):2598-605
- ⁵⁴ DePaola PF, Lax M. [The decay-inhibiting effect of acidulated phosphate-fluoride chewable tablets: A two-year double-blind study.](#) *J Am Dent Assoc* 1968;76:554-7.
- ⁵⁵ Driscoll WS, Heifetz, SB, Korts DC. [Effect of chewable fluoride tablets on tooth decay in schoolchildren: Results after six years of use.](#) *J Am Dent Assoc* 1978;97:820-4.
- ⁵⁶ Stephen KW. Campbell D. [Caries reduction and cost benefit after 3 years of sucking fluoride tablets daily at school. A double-blind trial.](#) *Br Dent J* 1978;144:202-6.
- ⁵⁷ Federal Drug Administration. Dental Drug Products Advisory Committee. [Statement of School-Based use of Various fluoride Preparations.](#) Federal Register 39: No. 94, p 17245. November 7, 1974. (no direct link found)
- ⁵⁸ Wong MC, Clarkson J, Glenny AM, Lo EC, Marinho VC, Tsang BW, Walsh T, Worthington HV. [Cochrane reviews on the benefits/risks of fluoride toothpastes.](#) *J Dent Res.* 2011 May;90(5):573-9.
- ⁵⁹ Zero DT, et al. [The effect of brushing time and dentifrice quantity on fluoride delivery in vivo and enamel surface microhardness in situ.](#) *Caries Res.* 2010;44(2):90-100.
- ⁶⁰ Wong MC, Clarkson J, Glenny AM, Lo EC, Marinho VC, Tsang BW, Walsh T, Worthington HV. [Cochrane reviews on the benefits/risks of fluoride toothpastes.](#) *J Dent Res.* 2011 May;90(5):573-9.
- ⁶¹ Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VC, Shi X. [Fluoride toothpastes of different concentrations for preventing tooth decay in children and adolescents.](#) *Cochrane Database Syst Rev.* 2010 Jan 20;(1):CD007868.
- ⁶² Tenuta LM, Cury JA. [Laboratory and human studies to estimate antidecay efficacy of fluoride toothpastes.](#) *Monogr Oral Sci.* 2013;23:108-24.
- ⁶³ Twetman S, Axelsson S, Dahlgren H, Holm AK, Kallestal C, Lagerlof F, et al. [Caries-preventive effect of fluoride toothpaste: a systematic review.](#) *Acta Odontol Scand.* 2003;61:347-55.
- ⁶⁴ Marinho VC, Higgins JP, Sheiham A, Logan S. [Fluoride toothpastes for preventing tooth decay in children and adolescents.](#) *Cochrane Database Syst Rev.* 2003;(1):CD002278.
- ⁶⁵ Jackson R.J. · Newman H.N. · Smart G.J. · Stokes E. · Hogan J.I. · Brown C. · Seres J. [The Effects of a Supervised Toothbrushing Programme on the Caries Increment of Primary School Children, Initially Aged 5-6 Years.](#) *Caries Res.*2005;39:108-11.
- ⁶⁶ Pine CM, Curnow MM, Burnside G, Nicholson JA, Roberts AJ. [Caries prevalence four years after the end of a randomized controlled trial.](#) *Caries Res.* 2007;41(6):431-6. Epub 2007 Sep 7.
- ⁶⁷ Curnow MM¹, Pine CM, Burnside G, Nicholson JA, Chesters RK, Huntington E. [A randomized controlled trial of the efficacy of supervised toothbrushing in high-decay-risk children.](#) *Caries Res.* 2002 Jul-Aug;36(4):294-300.
- ⁶⁸ Edelstein BL, Hirsch G, Frosh M, Kumar J. [Reducing early childhood caries in a Medicaid population: a systems model analysis.](#) *J Am Dent Assoc.* 2015 Apr;146(4):224-32.

-
- ⁶⁹ CDC. [Engineering and administrative recommendations for water fluoridation](#), 1995. *MMWR* 1995;44(No. RR-13):1–40.
- ⁷⁰ Sköld UM. [Approximal decay increment in relation to baseline approximal decay prevalence among adolescents in Sweden with and without a school-based fluoride varnish programme](#). *Community dental health*. 2016,Vol.33(4), p.281-285.
- ⁷¹ Horowitz H, Ismail A. Topical fluorides in decay prevention. In: *Fluorides in dentistry*. 2nd ed. Copenhagen: Munksgaard; 1996. p.311--27.
- ⁷² Petersson LG. [Fluoride mouthrinses and fluoride varnishes](#). *Caries Res*. 1993;27 Suppl 1:35–42.
- ⁷³ Sharma G, Puranik MP, K.R. S. [Approaches to Arresting Dental Caries: An Update](#). *J Clin Diagn Res* 2015 May;9(5):ZE08-ZE11.
- ⁷⁴ Adair SM. [Evidence-based Use of Fluoride in Contemporary Pediatric Dental Practice](#). *Pediatr Dent*. 2006 Mar 1;28(2):133–42.
- ⁷⁵ ADA. [Professionally applied topical fluoride-evidence-based clinical recommendations](#). *J Am Dent Assoc*. 2006 Aug 1;137(8):1151–9.
- ⁷⁶ Drummond M, Manca A, Sculpher M. [Increasing the generalizability of economic evaluations: Recommendations for the design, analysis and report of studies](#). *J Public Health Dent*. 1989;49(5 Spec No):259-71.
- ⁷⁷ Mandel ID. [Fluoride Varnishes—a Welcome Addition](#). *J Public Health Dent*. 1994 Mar 1;54(2):67–67.
- ⁷⁸ Marinho, V.C.C. (2009). [Cochrane reviews of randomized trials of fluoride therapies for preventing tooth decay](#). *European Archives of Paediatric Dentistry* 10, 183-191..
- ⁷⁹ Bergström EK, Lingström P, Hakeberg M, Gahnberg L, Sköld UM. [Caries and costs: an evaluation of a school- based fluoride varnish programme for adolescents in a Swedish region](#). *Community Dent Health*. 2016 Jun;33(2):138-44.
- ⁸⁰ Sköld UM, Petersson, LG, Birkhed D. and Norlund A. [Cost-analysis of school-based fluoride varnish and fluoride rinsing programs](#). *Acta Odontologica Scandinavica*.2008; 66:286-292.
- ⁸¹ Keller MK, KluUSen BJ, Twetman S. [Fluoride varnish or fluoride mouth rinse? A comparative study of two school-based programs](#). *Community Dent Health*. 2016 Mar;33(1):23-6.
- ⁸² Neidell M, Shearer B, Lamster IB. [Cost-Effectiveness Analysis of Dental Sealants versus Fluoride Varnish in a School-Based Setting](#). *Caries Res*. 2016;50 Suppl 1:78-82.
- ⁸³ Brown JP. [Dental decay prediction to target high-risk individuals in community-based preventive programs is problematic](#). *J Evid-Based Dent Pract*. 2010 Dec;10(4):241–3.
- ⁸⁴ Jiang EM, Lo ECM, Chu CH, Wong MCM. [Prevention of early childhood decay \(ECC\) through parental toothbrushing training and fluoride varnish application: a 24-month randomized controlled trial](#). *J Dent*. 2014 Dec;42(12):1543–50.
- ⁸⁵ Mathu-Muju, R, Friedman JW, Nash DA. [Oral Health Care for Children in Countries Using Dental Therapists in Public, School-Based Programs, Contrasted with That of the United States, Using Dentists in a Private Practice Model](#). *Am J. Public Health*. 2013 Sep;103(9):e7-e1.
- ⁸⁶ Pahel BT, RG, Stearns SC, Quiñonez RB. [Effectiveness of preventive dental treatments by physicians for young Medicaid enrollees](#). *Pediatrics*. 2011 Mar;127(3):e682-9.
- ⁸⁷ Marinho VC, Higgins JP, Logan S, Sheiham A. Systematic review of controlled trials on the effectiveness of fluoride gels for the prevention of tooth decay in children. *J Dent Educ*. 2003;67(4):448-58.
- ⁸⁸ Marinho VC, Higgins JP, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing tooth decay in children and adolescents. *Cochrane Database Syst Rev* 2003(4):CD002782.
- ⁸⁹ Petersson LG, Twetman S, Dahlgren H, et al. Professional fluoride varnish treatment for decay control: a systematic review of clinical trials. *Acta Odontol Scand* 2004;62(3):170-6.
- ⁹⁰ Achembong LN, Kranz AM, Rozier, RG. Office based preventive dental program and statewide trends in dental caries. *Pediatrics*. 2014 Apr;133(4):3827-34.
- ⁹¹ Dye BA, Mitnik GL, Iafolla TJ, Vargas CM. [Trends in tooth decay in children and adolescents according to poverty status in the United States from 1999 through 2004 and from 2011 through 2014](#). *J Am Dent Assoc*. 2017 Jun 13.
- ⁹² Hall-Scullin E, Whitehead H, Milsom K³ Tickle M, Su TL, Walsh T. [Longitudinal Study of Caries Development from Childhood to Adolescence](#). *J Dent Res*. 2017 Jul;96(7):762-767.
- ⁹³ Clemens JC, Gold J, Chaffin J. [Effect and acceptance of silver diamine fluoride treatment on tooth](#)
-

-
- decay in primary teeth. *J Public Health Dent*. 2017 Jul 27.
- ⁹⁴ Rosenblatt A, Stamford TC, Niederman R. Silver diamine fluoride: a decay "silver-fluoride bullet." *J Dent Res*. 2009;88(2):116–125.
- ⁹⁵ Mei ML, Lo EC, Chu CH. Clinical use of silver diamine fluoride in dental treatment. *Compend Contin Educ Dent*. 2016;37(2):93–98.
- ⁹⁶ Zhang W, McGrath C, Lo EC, Li JY. Silver diamine fluoride and education to prevent and arrest root decay among community-dwelling elders. *Caries Res*. 2013;47(4):284–290.
- ⁹⁷ Santos Dos VE, de Vasconcelos FMN, Ribeiro AG, Rosenblatt A. Paradigm shift in the effective treatment of decay in schoolchildren at-risk. *Int Dent J* 2012;62(1):47–51.
- ⁹⁸ Chu CH, Lo ECM, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin decay in Chinese pre-school children. *J Dent Res*. 2002;81(11):767–770.
- ⁹⁹ Yee RC, Holmgren C, Mulder J, Lama D, Walker D, Helderma W. Efficacy of silver diamine fluoride for arresting decay treatment. *J Dent Res*. 2009;88(7):644–647.
- ¹⁰⁰ Lo EC, Chu CH, Lin HC. A community-based decay control program for pre-school children using topical fluorides: 18-month results. *J Dent Res*. 2001; 80(12):2071–2074.
- ¹⁰¹ Llodra JC, Rodriguez A, Ferrer B, Menardia V, Ramos T, Morato M. Efficacy of silver diamine fluoride for decay reduction in primary teeth and first permanent molars of schoolchildren: 36-month clinical trial. *J Dent Res*. 2005;84(8):721–724.
- ¹⁰² Zhi QH, Lo EC, Lin HC. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine decay in preschool children. *J Dent*. 2012;40(11):962–967.
- ¹⁰³ Li R, Lo EC, Liu BY, Wong MC, Chu CH. Randomized clinical trial on arresting dental root decay through silver diamine fluoride applications in community-dwelling elders. *J Dent*. 2016 Aug;51:15-20. doi: 10.1016/j.jdent.2016.05.005. Epub 2016 May 18.
- ¹⁰⁴ Fung MHT, Duangthip D, Wong MCM, Lo ECM, Chu CH. Randomized Clinical Trial of 12% and 38% Silver Diamine Fluoride Treatment. *Dent Res*. 2017 Aug 1:22034517728496.
- ¹⁰⁵ Milgrom P. et al. Topical Silver Diamine Fluoride for Dental Caries Arrest in Preschool Children: A Randomized Controlled Trial and Microbiological Analysis of Caries Associated Microbes and Resistance Gene Expression. *J Dent*. 2017 Aug 30. pii: S0300-5712(17)30212-9.
- ¹⁰⁶ Gao SS, Zhang S, Mei ML, Lo EC, Chu CH. Caries remineralisation and arresting effect in children by professionally applied fluoride treatment - a systematic review. *BMC Oral Health*. 2016;16:12.
- ¹⁰⁷ Cheng LL. Limited evidence suggesting silver diamine fluoride may arrest tooth decay in children. *J Am Dent Assoc*. 148(2) Feb 2017.
- ¹⁰⁸ Journal of the California Dental Association, [January 2019](#); [February 2018](#)
- ¹⁰⁹ Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing tooth decay in children and adolescents. *Cochrane Database Syst Rev*. 2003;(1):CD002278.
- ¹¹⁰ Twetman S, Axelsson S, Dahlgren H, Holm AK, Kallestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: a systematic review. *Acta Odontol Scand*. 2003;61:347–55. .
- ¹¹¹ Burt BA. Prevention policies in the light of the changed distribution of tooth decay. *Acta Odontol Scand*. 1998 Jun;56(3):179-86.
- ¹¹² Sköld UM, Petersson, LG, Birkhed D. and Norlund A. Cost-analysis of school-based fluoride varnish and fluoride rinsing programs. *Acta Odontologica Scandinavica*.2008; 66:286-292.
- ¹¹³ Keller MK, Klausen BJ, Twetman S. Fluoride varnish or fluoride mouth rinse? A comparative study of two school-based programs. *Community Dent Health*. 2016 Mar;33(1):23-6.
- ¹¹⁴ Brown JP. Dental decay prediction to target high-risk individuals in community-based preventive programs is problematic. *J Evid-Based Dent Pract*. 2010 Dec;10(4):241–3.
- ¹¹⁵ Wolff MS, Hill R, Wilson-Genderson M, Hirsch S, Dasanayake AP. Nationwide 2.5-Year School-Based School-based Public Health Intervention Program Designed to Reduce the Incidence of Caries in Children of Grenada. *Caries Res*. 2016;50 Suppl 1:68-77.
- ¹¹⁶ Marinho 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.
- ¹¹⁷ Takahashi N, Nyvad B. Caries ecology revisited: microbial dynamics and the caries process. *Caries Res*. 2008;42(6):409-18. Epub 2008 Oct 3.
- ¹¹⁸ Komiyama E, Kimoto K, Arakawa H. Relationship between Duration of Fluoride Exposure in School-Based Fluoride Mouthrinsing and Effects on Prevention and Control of Dental Caries. *ISRN Dent*.

2012;2012:183272.

¹¹⁹ Sakuma S, Yoshihara A, Miyazaki H, Kobayashi S. [Economic Evaluation of a School-based Combined Program with a Targeted Pit and Fissure Sealant and Fluoride Mouth Rinse in Japan.](#) *Open Dent J.* 2010;4:230-6.

¹²⁰ Centers for Disease Control and Prevention. [Whole School, Healthy Schools. Whole Community, Whole Child \(WSCC\).](#)