

Perspectives on the Science Supporting Florida's Public Health Policy for Community Water Fluoridation

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INTRODUCTION:

Community water fluoridation has been utilized for more than 60 years as the principal public health measure to prevent the ravages of dental caries, a chronic infectious disease commonly referred to as dental cavities or dental decay. Dental caries can ultimately lead to acute or chronic dental infections (abscesses), pain, loss of teeth, speech impediments, compromised nutrition, systemic infections, complications for other chronic diseases, and occasionally death. Children are frequently absent from school because of the pain from acute dental infections or for dental treatment. The treatment of dental decay also results in substantial direct and indirect costs to individuals, their employers, insurance companies, consumers, and taxpayers. Community water fluoridation is one of the safest, most effective, and most economical programs that public officials can provide for their constituents in order to prevent the pain, suffering, and costs of dental caries.

Community water fluoridation is generally easy and inexpensive to implement - costing public water systems, on average, about 50 cents per person per year in large communities to \$3.00 per person a year for small communities to operate^{1-2, 55}. The return on investment is tremendous - with various studies reporting \$38-\$80 in dental treatment cost savings for each dollar invested in community water fluoridation^{1-2, 6, 55}. Few taxpayer-financed programs, result in such a large amount of savings for such a small investment. Moreover, since fluoridation has proven to be a safe, effective, efficient, economical, and environmentally sound means to prevent dental caries in children and adults, its implementation by public and private water systems serves as an excellent example of good public policy at work.

What Is Fluoride And Why Is It Necessary?

Fluoride is a naturally occurring substance that is present in virtually all sources of drinking water in the United States. It serves as an essential trace element necessary for the proper development of teeth and bones, and for the protection of teeth once they have erupted into the mouth^{3-9, 39-48}. Therefore, fluoride not only benefits children before their teeth have erupted, but it also protects the teeth of children and adults after all of their teeth are present in the mouth^{3-9, 32-48}. Those fortunate enough to have had access to community water fluoridation experience 40-60% fewer dental cavities^{3-9, 32-48}.

Community water fluoridation is the precise adjustment of the existing naturally occurring fluoride levels in drinking water to a safe level that has been determined to be ideal for the prevention of dental caries in children and adults. There are even some locations in the United States where naturally occurring fluoride levels are adequate for the prevention of dental caries - these communities do not have to fluoridate their drinking water. However, most communities in the U. S. have insufficient levels of fluoride for effective prevention of dental caries and therefore require the addition of very small amounts of fluoride to achieve the optimal level for good health.

Community water fluoridation mimics a naturally occurring process and can be considered to be a form of enrichment or supplementation of the drinking water. The process of fluoridation as a measure to prevent dental caries is very similar in concept to the supplementation of: milk and breads with Vitamin D to prevent rickets; fruit drinks with Vitamin C to prevent scurvy; table salt with iodine to prevent goiter; breads and

pastas with folic acid to prevent certain birth defects; various foods with calcium to prevent osteoporosis; and cereals with many different vitamins and minerals in order to provide for proper human development and to promote good health.

Why Use The Public Water System To Provide Fluoride?

First of all, public water systems have been used for the purpose of preventing diseases in the United States since the 1840's. The original reason for the establishment and widespread use of community water systems by cities and villages was to prevent the outbreak of serious diseases like cholera, hepatitis A, giardiasis, and typhoid fever. These and many other diseases, including dental caries, are prevented through the treatment of drinking water. Water treatment for disease prevention is considered to be a primary public health activity and is essential for the control of many diseases that would otherwise plague modern society.

Don't We Have Other Ways Of Getting Fluoride?

There are other ways to provide fluoride, but none are as effective as community water fluoridation for the prevention of dental decay in children and adults⁴⁻⁹. Fluoride benefits teeth in two general ways - there are (1) benefits from systemic sources and (2) benefits from topical sources.

(1) Systemic Sources of Fluoride: Benefits from systemic sources are gained when one drinks water and eats food that contain fluoride. Systemic benefits can also be obtained by taking fluoride tablets or vitamins with fluoride that have been prescribed by a family's physician or dentist. More permanent in nature, the fluoride obtained from systemic sources actually becomes part of the tooth structure as baby teeth and permanent teeth develop under the gums of infants and children⁴. These teeth are then considerably stronger and resist dental decay much better once they have erupted into the mouth. This protection, gained from getting fluoride from systemic sources, generally stays with the teeth throughout life.

Systemic sources of fluoride also benefit older children and adults^{4-5,56-57}. Fluoride from food and drink eventually ends up in a person's saliva. The fluoride in the saliva constantly bathes the teeth so that the teeth are protected continuously through exposure to small amounts of fluoride. For those older children and adults fortunate enough to live in fluoridated communities, this constant protection of the teeth by saliva containing small amounts of fluoride is substantial⁵. The fluoride from saliva not only prevents some cavities from ever starting, but it also repairs early dental decay through a process called remineralization^{5,56-57}. With remineralization, some very small cavities are not only prevented from getting larger, they actually can "heal" or repair themselves because of the action of these low levels of fluoride present in the saliva^{5,56-57}. Fluoride in saliva also inhibits attachment, metabolism, and reproduction of the bacteria implicated in the decay process, such that it inhibits the ability of these bacteria to produce enamel-destroying acids⁵⁶⁻⁵⁷.

It should be noted that community water fluoridation is much more effective, much safer, and much more economical than the use of prescribed fluoride supplements (fluoride tablets or fluoride vitamins)^{4-9,57}. Community water fluoridation is always the best choice to prevent dental decay in children and adults, not only because it is safer, more effective, and more economical, but because it benefits all people using the public water system, regardless of age, race, ethnic background, or socioeconomic status^{4-9,57}.

Fluoride tablets or vitamins with fluoride can and should be used in the absence of community water fluoridation, but are meant only as a temporary substitute until a community's water system can be fluoridated. Because they must be prescribed by a

physician or a dentist, fluoride tablets or vitamins with fluoride often are only available to people fortunate enough to be able to afford regular visits to a family dentist or physician.

(2) Topical Sources of Fluoride: Benefits from topical sources tend to be temporary and are accrued when fluoride from external sources comes into direct contact with the surfaces of the teeth^{4,8,57}. Topical benefits can be obtained through use of such things as fluoride toothpaste, fluoride mouthrinses, fluoride varnishes, and fluoride treatments that are provided in dentists' offices.

Fluoride toothpaste does a great job in helping to prevent dental decay, but only provides a temporary topical benefit to the tooth surfaces. Fluoride toothpaste, by itself, also does not prevent decay as well as fluoride from the previously mentioned systemic sources^{3-4,6-8,56-57}. Readily available from grocery stores, drug stores, and other commercial establishments, fluoride toothpaste is safe and should be used according to directions on the label. Fluoride toothpaste can be used by children and adults in areas served by fluoridated community water systems and does provide additional protection to teeth.

Fluoride mouthrinses are effective in preventing dental decay, but also only provide a temporary benefit and are not as effective as fluoride from systemic sources^{3-4,6-8,57}. They are available over the counter (grocery stores, drug stores, etc.) or by prescription from dentists and physicians. Fluoride mouthrinses may be used at the same time that people are getting fluoride from systemic sources (community water fluoridation or fluoride tablets/vitamins with fluoride), however fluoride mouthrinses should only be used in these situations after consulting with the family's dentist or physician.

Fluoride varnishes and topical fluoride treatments from a family's dentist also provide a temporary topical benefit to the tooth surface^{4,6-8,57}. These topical fluoride treatments may be used at the same time that an individual is receiving fluoride from systemic sources, but only if the dentist has determined that there is a need for a fluoride varnish or topical fluoride treatment because of the level of decay present in that individual.

It is important to remember that fluoride from topical sources, while effective in preventing dental decay, is not nearly as effective as fluoride from systemic sources^{4,8}. Moreover, fluoride from topical sources should never be considered to serve as an adequate substitute for fluoride from systemic sources. The gold standard for dental disease prevention is community water fluoridation^{4,8,55-57}. Community water fluoridation should be implemented whenever it is technically feasible. Fluoride tablets are meant to be used as a temporary substitute for community water fluoridation only until a community water system can be fluoridated. Topical sources of fluoride (fluoride toothpaste, fluoride mouthrinses, and fluoride treatments provided in dental offices) are only meant to be used as adjuncts to systemic sources of fluoride.

How Much Fluoride Is Added To The Drinking Water?

Only a very small amount of fluoride is added to the drinking water to achieve the desired maximum benefits. The existing natural fluoride levels in drinking water supplies are adjusted slightly in order to raise them to between 0.7 and 1.2 parts per million^{10,57}. This very small amount of fluoride being added is considered to be a trace amount. The precise level of fluoride calculated to be appropriate for each individual community is determined based on that community's annual average daily temperature^{11,57}. Depending on the precise calculation, each community's water fluoride levels will be adjusted to between 0.7 and 1.2 parts per million depending on where the community is

located and what type of climate it has^{11,57}. Florida typically adjusts fluoride levels in its community water systems to 0.8 parts per million.

Whichever level of fluoride is determined to be the correct level for an individual community, it bears repeating that only a very small amount of fluoride is ultimately added to the drinking water. It also is important to remember that the optimal amount of fluoride in fluoridated drinking water has been calculated to take into account the fluoride the people get from other sources, like food and drink. Fluoridated drinking water provides only about one-third to one-half the amount of fluoride that an individual should be getting on a daily basis¹².

Is The Amount Of Fluoride In Fluoridated Water Systems Safe?

The amount of fluoride present in fluoridated community water systems is miniscule and has been determined to be safe for all individuals, regardless of age, race, gender, or health status^{13, 39-48,57}. In other words, community water fluoridation is safe for infants, children, teenagers, young adults, mature adults, and senior citizens^{13, 39-48,57}. It is safe for everyone, even those with chronic diseases^{13, 39-48,57}. Community water fluoridation harms no one and it is also effective in preventing dental decay in people of all ages, races, ethnic groups, or socioeconomic backgrounds^{13, 39-48,57}.

Fluoride, like many other substances that are required to sustain life and promote health, is beneficial in small amounts and harmful in large amounts. Such common substances as vitamins, minerals, table salt, food, even water, are helpful in the correct amounts and harmful in excessive amounts. For example, fluoride levels in fluoridated water are so low that an adult would have to consume 660 gallons of fluoridated water in a 2 to 4 hour period in order to get a toxic level of fluoride that would cause death¹⁴. It is physically impossible for an adult to ever consume that amount of water - the adult would die of other causes long before they were able to accumulate enough fluoride to cause a problem¹⁴. Likewise, a 12-18 month old child would have to drink 85 gallons of fluoridated water in a 2 to 4 hour period in order to get a toxic level of fluoride that would cause death, again a physical impossibility¹⁴.

In order to suffer chronic skeletal effects of too much fluoride, an adult would have to consume roughly 6 to 14 gallons of fluoridated water every day for 10 to 20 years - again physically impossible for virtually all adults¹⁴. Most adults drink far less than 1 gallon of water or other liquids a day, more likely drinking about a quart per day. Children consume even much lower amounts of liquids than do adults on a daily basis.

A lifetime of exposure to water fluoridated at the optimum level (0.7 to 1.2 parts per million) results in no adverse effects to any individual or group of individuals^{13, 39-48,56-57}. Thousands of scientific studies have been completed which looked at individuals and groups who used water with optimum levels of fluoride their entire lives^{13, 39-48,56-57}. Lifetime exposure to fluoridated water caused no diseases, no disabilities, nor any other adverse conditions for any group or individuals^{13, 39-48,56-57}. Lifetime exposure to fluoridated water only resulted in benefits - lower rates of dental decay and lower health care bills^{13, 20-21,56-57}.

How Widespread Is The Practice Of Community Water Fluoridation In The United States and in Florida?

Currently over 152 million Americans are benefiting from community water fluoridation^{15,58}. Another 10 million Americans are fortunate enough to live in communities with adequate levels of naturally occurring fluoride^{15,58}. That means that over 162 million Americans and more than 67 percent of those with access to community water systems currently benefit from fluoridation's continuous protection against dental decay^{15,58}. In addition, over 12 million people in Florida are benefiting from water fluoridation^{15,58}. This represents 76.8% of Florida's population having access to public

water supplies^{15,58}. While in 2002 Florida ranked 31st among the 51 recognized jurisdictions (50 states + the District of Columbia) in the percentage of those on community water systems benefiting from fluoridation, recent implementation of fluoridation by a number of communities appears to place Florida about 24th out of 51 jurisdictions reporting to CDC's Water Fluoridation Reporting System (WFRS)^{15,58}.

Florida's fluoridation efforts began more than half a century ago, with Gainesville commencing fluoridation in 1949, the same year that the Florida Department of Health strongly endorsed its use^{15,58}. Miami and Dade County's population (currently numbering over 2.4 million people) has had access to the health benefits of community water fluoridation since 1952^{15,58}. Other large counties in Florida provide fluoridated water to the majority of their citizens (Broward, 1.6 million; Duval, 902,000; and Hillsborough, 780,000; just to name a few)^{15,58}.

The 162 million Americans benefiting from fluoridation live in more than 10,500 communities that are served by over 14,300 water systems^{15,58}. In addition, 46 of the 50 largest cities in the United States are currently fluoridating their water systems^{15,58}. It is also important to remember that some communities in the United States have been fluoridating their public water systems since 1945, many since the 1950's and 1960's. We have over 60 years experience adjusting fluoride levels in community water systems.

Are There States That Require Fluoridation of Some Community Water Systems?

Many states have passed legislation requiring community water systems to provide the benefits of water fluoridation for their customers. California, Connecticut, Delaware, Georgia, Illinois, Minnesota, Nebraska, Nevada, Ohio, and South Dakota require certain communities to fluoridate their public water systems^{16,17}. Both the Commonwealth of Puerto Rico and the District of Columbia have also legislatively mandated fluoridation¹⁶. Additionally, Kentucky requires statewide fluoridation by administrative regulation¹⁸. Moreover, many local governments, including local governments in Florida, have required fluoridation through laws, regulations, and ordinances.

Who Benefits From The Cost Savings That Result From Fluoridation?

The total cost to the nation for dental treatment services reported in 1997 was \$50.6 billion, while \$60.7 billion was spent in 2000, and the total has climbed to \$78.2 billion in 2004 - a substantial amount usually paid for by individuals, employers, government agencies, and insurance companies^{19,59}. Nationally, the tax-funded Medicaid program paid \$2.1 billion for dental services in 1998, \$3.0 billion in 2001, and \$4.4 billion in 2004⁵⁹. Florida's Medicaid Dental Program expended \$94.7 million of taxpayers' money in FY 2001-2002 at a utilization rate of 18.3% for children and only 8.3% for adults (which means that if all eligible patients sought services, the total annual cost for the program could be four to ten times the current rate). In FY 2002-2003, the Medicaid Dental Program expended \$84.7 million - \$10 million lower than the previous year's total because all adult dental services (except emergency services) were eliminated as an attempt to lower program costs. Interestingly, while approximately \$20 million was saved by eliminating adult services (which totaled \$4.9 million for the year), the cost of children's dental services increased by over \$10 million to \$79.8 million for the year. Utilization rates for children had risen to 21.4%, while adult utilization rates plummeted to 3.0%. Better utilization rates would yield much higher costs, but more widespread use of community-based prevention measures, such as community water fluoridation, goes a long way toward moderating the need for such expenditures.

There are a number of ways in which individuals and groups benefit from the costs savings brought on by community water fluoridation, costs which are avoided

because of the need for less dental treatment. For example, taxpayers benefit because public programs paying for dental care for disadvantaged populations require fewer local, state, and federal tax dollars for each person covered by the program²⁰. It is expected that in the Florida communities that implement water fluoridation, Medicaid dental costs would be reduced by at least one half. Other states have demonstrated significant cost savings in their Medicaid programs as a result of community water fluoridation⁵²⁻⁵³. The Federation of American Societies for Experimental Biology, in testimony before the Congressional Biomedical Research Caucus (U.S. Congress) in February 1995, documented that the national cost savings resulting from fluoridation totaled \$3.84 billion each year⁵⁵. In addition, employers benefit because their costs for prepaid dental care fringe benefits for their employees are lower²⁰. Employers also avoid the extra costs required when their employees are absent from work due to personal or family visits for dental care²⁰.

Consumers benefit because they pay lower costs for consumer goods since employers' costs for insurance and employee absences is lower²⁰. In other words, the cost of doing business in a fluoridated community is lower for employers. Additionally, all patients benefit in several ways. First, their overall health care bills and insurance premiums are lower in fluoridated communities because there are fewer expensive hospital emergency room visits for dental emergencies, costs of which are usually passed on to everyone able to pay through their health care bills and insurance premiums²⁰. Secondly, patients in fluoridated communities avoid having to pay higher health care bills, dental bills, and insurance premiums that often result from the need for physicians, dentists, and hospitals to pass on their extra costs for uncompensated care to those who can pay²⁰.

It is most apparent that everyone wins with fluoridation. Not only do individuals benefit because of their improved oral health, but they benefit greatly because cost savings resulting directly and indirectly from a community's decision to fluoridate. Fluoridation ultimately promotes lower health care costs, lower insurance costs, lower tax-supported costs for public programs, lower business costs for employers, and lower costs for consumer goods and services²⁰.

What Other Impact Is Water Fluoridation Having On Consumer Or Taxpayer Costs?

The extensive use of community water fluoridation in the United States has contributed substantially to decreasing consumer and taxpayer costs for supporting dental education. Because of lower levels of dental decay in the U. S. population, fewer dentists are needed to care for those currently in the health care system. As a result, seven dental schools have ceased operations since 1985²¹. In addition since 1980, enrollment reductions in the remaining dental schools have been equivalent to the closure of another 20 average size dental schools²¹.

Community water fluoridation has also had an impact on the costs of dentists' malpractice insurance. Dentists practicing in fluoridated communities pay significantly lower malpractice insurance premiums than dentists practicing in non-fluoridated communities²². These lower malpractice insurance rates occur for several reasons. First, since the population suffers from much less decay in fluoridated communities, dentists do not spend as much time providing extensive reparative procedures and therefore are less likely to run into treatment complications. Secondly, dentists also require less use of general anesthesia and other forms of premedication in fluoridated communities because there are fewer cases of rampant decay in young children.

Who Supports Community Water Fluoridation?

Most legitimate organizations representing health professionals, public health agencies, and scientists strongly support community water fluoridation. The American Medical Association, American Public Health Association, American Nurses Association, American Osteopathic Association, American Academy of Pediatrics, American Academy of Family Physicians, American Dental Association, American Dental Hygienists Association, Association of State & Territorial Health Officials, National Association of County & City Health Officials, American Dietetic Association, U. S. Public Health Service, National Institutes of Health, Centers for Disease Control, World Health Organization, American Water Works Association, and National Rural Water Association represent just a few of the hundreds of organizations that support fluoridation²³.

It is important to note that these broadly based organizations represent millions of health practitioners, scientists and other professionals. These credible and respected organizations have also been working to improve the lives of Americans for many years. They are organizations and agencies with established administrative offices, some with state and local chapters, and many publishing peer-reviewed scientific journals.

Community water fluoridation has also been repeatedly shown to have wide support of the American public²⁴⁻²⁵. Most recently, a national scientific poll taken by the prestigious Gallup Organization documented that 70% of Americans thought community water systems should be fluoridated, 12% did not know, and only 18% thought that community water systems should not be fluoridated²⁴.

Who Opposes Community Water Fluoridation?

While there is a small, very vocal, minority of the population that opposes the implementation of community water fluoridation, no credible national scientific or professional organization opposes the practice^{16,26}. Individuals who oppose fluoridation are often called 'antifluoridationists.' Most groups that claim to oppose fluoridation have few members, have no history because they have been organized for relatively short periods of time, have no established offices because they often operate out of individuals' homes, and have unfamiliar names and spokespersons^{16,26}. These groups have been granted no professional credibility or scientific standing by the scientific or health care communities, publish no accepted scientific journals, and frequently use multiple names in order to appear to have more support for their position than actually exists^{16,26-31}. Most of the groups lack any stability, disbanding and reforming periodically as interest in their movement periodically increases or subsides^{16,26-31}. The antifluoride groups often publish pseudoscientific propaganda pieces which, when vigorously reviewed and investigated, lack any basis in science^{16, 26-31}. Many of these organizations operate exclusively through the Internet where there is little in place to protect consumers from their scientifically invalid claims and their extensive propaganda²⁹⁻³¹.

Summary and Conclusions

Community water fluoridation has served the American public extremely well as the cornerstone of dental caries prevention activities for more than 60 years. The dental health and general health benefits associated with the consumption of water-borne fluorides have been documented for over 100 years. Ongoing research, often conducted in response to the repeated allegations by those opposed to fluoridation, continues to confirm the safety, effectiveness, efficiency, cost-effectiveness, and environmental compatibility of community water fluoridation.

Fluoridation also continues to be acclaimed as an important contributor to the health of the nation, most recently being named as one of the twentieth century's ten greatest public health achievements⁴⁹. Dr. David Satcher, previously the Assistant

Secretary for Health and the Surgeon General of the United States, reconfirmed the support of his office for community water fluoridation as part of his focus on America's oral health⁵⁰⁻⁵¹. In addition, Vice Admiral Richard H. Carmona, the current Surgeon General of the United States, stated: "Policy makers, community leaders, private industry, health professionals, the media, and the public should affirm that oral health is essential to general health and well being and take action to make ourselves, our families, and our communities healthier. I join previous Surgeons General in acknowledging the continuing public health role for community water fluoridation in enhancing the oral health of all Americans."⁵⁴

The adoption of community water fluoridation by local communities and state legislatures represents an excellent example of good public policy. Communities throughout the United States continue to exhibit sound decision-making and evidence their continued trust and faith in science and the health professions by adopting fluoridation. The acceptance of community water fluoridation by public officials ensures that all citizens of a community, regardless of age, race, ethnic background, religion, gender, educational status, or socioeconomic level, receive the same substantial dental disease prevention benefits currently available to the 162 million Americans on fluoridated water systems.

REFERENCES

1. Garcia AI. Caries incidence and costs of prevention programs. *J Public Health Dent* 1989; 49(5):259-71.
2. U. S. Centers for Disease Control & Prevention. Public health focus: fluoridation of community water systems. *MMWR: Update* 1992; 41(21):372-5.
3. Murray JJ. Efficacy of preventive agents for dental caries. *Caries Res* 1993; 27(Suppl 1):2-8.
4. Newbrun E. Fluorides and dental caries, 3rd ed. Springfield, IL; Charles C. Thomas, publisher, 1986.
5. Lambrou D, Larsen MJ, Fejerskov O, & Tachos G. The effect of fluoride in saliva on remineralization of dental enamel in humans. *Caries Res* 1981; 15:341-5.
6. Burt BA (ed.). The relative efficiency of methods of caries prevention in dental public health: proceedings of a workshop at the University of Michigan, Jun 5-8, 1978. Ann Arbor, MI; University of Michigan Press, 1978.
7. Burt BA (ed.). Proceedings for the workshop: cost effectiveness of caries prevention in dental public health, held at Ann Arbor, MI, May 17-19, 1989. *J Public Health Dent* 1989; 56(5, Spec Issue):249-344.
8. Murray JJ, Rugg-Gunn AJ, & Jenkins GN. Fluoride in caries prevention, 3rd ed. Oxford, England, UK; Wright, publisher, 1991.
9. Levy SM, Kiritsy MC, & Warren JJ. Sources of fluoride intake in children. *J Public Health Dent* 1995; 55(1):39-52.
10. U. S. Centers for Disease Control & Prevention. Water fluoridation: a manual for water plant operators. Atlanta, GA; The Agency, Apr 1994.
11. Galagan DJ & Vermillion JR. Determining optimum fluoride concentrations. *Public Health Rep* 1957; 72:491-93.
12. National Academy of Sciences, Institute of Medicine (Food & Nutrition Board). Dietary reference intakes for calcium, phosphorous, magnesium, vitamin D, & fluoride, report of the standing committee on scientific evaluation of dietary reference intakes. Washington, DC; National Academy Press; 2000.
13. U. S. Department of Health & Human Services, Public Health Service. Review of fluoride benefits and risks: report of the Ad Hoc Subcommittee on Fluoride of the Committee to Coordinate Environmental Health and Related Programs. Washington, DC; The Agency; Feb 1991.
14. Burt BA & Eklund SA. Dentistry, dental practice, & the community, 4th ed. Philadelphia, PA; W. B. Saunders Company, publisher, 1992. pp.146-147.

15. U. S. Centers for Disease Control. Fluoridation Census, 2000. Atlanta, GA; The Agency; 2001..
16. Easley, MW. The status of community water fluoridation in the United States. *Public Health Rep* 1990; 105(4):348-353.
17. Delaware State Senate, 139th General Assembly. Senate Bill No. 173 - An act to amend title 16 of the Delaware Code relating to fluoridation of water supplies. Delaware Online Legislative Information Service at <http://www.state.de.us/govern/agencies/legis/lis/139/bills/107796.htm>.
18. Kentucky Administrative Regulations. Title 401, Chap. 8 - Public Water Supply; 401 KAR 8:650 - Supplemental Fluoridation.
19. Palmer C. Dental spending exceeds \$50 billion. *Am Dent Assoc News*, 1998; 29(22):1,30.
20. White BA, Antczak-Bouckoms AA, Milton C, & Weinstein MC. Issues in the economic evaluation of community water fluoridation. *J Dent Educ* 1989; 53(11):646-657.
21. Nash, DA. And the band played on. *J. Dent Educ*, 1998; 62(12):964-974.
22. Conrad DA, Whitney C, Milgrom P, O'Hara D, Ammons R, Fiset L, & Vesneski W. Malpractice premiums in 1992: results of a national survey of dentists. *J Am Dent Assoc*, 1995; 126:1045-1056.
23. American Dental Association (Council on Access, Prevention, & Interprofessional Relations). *Fluoridation Facts*. Chicago, IL; The Organization, 2005. 70p.
24. Am. Dent A. (Survey Center). 1998 consumers' opinions regarding community water fluoridation. Chicago, IL; The Organization, Aug 1998.
25. Gallup Organization, Inc. A Gallup study of parents' behavior, knowledge, and attitudes toward fluoride. Princeton, NJ; The Organization, 1991.
26. Easley MW. The new antifluoridationists: who are they and how do they operate? *J Public Health Dent* 1985; 45(3):133-141.
27. Barrett S & Rovin S (eds.). *The tooth robbers: a pro-fluoridation handbook*. Philadelphia, PA; George F. Stickley Company, 1980.
28. Wulf CA, Hughes KF, Smith KG, & Easley MW. *Abuse of the scientific literature in an antifluoridation pamphlet (2nd ed.)*. Baltimore, MD; American Oral Health Institute Press; 1988.
29. Easley MW. Celebrating 50 years of fluoridation: a public health success story. *British Dent J* 1995; 178(2):72-5.
30. Easley MW. Fluoridation: a triumph of science over propaganda. *Priorities (J American Council on Science & Health)* 1996; 8(4):35-39.
31. Easley MW. Community water fluoridation. p.48-49, in *American Council on Science & Health. Facts versus fears, special report: a review of the greatest unfounded health scares of recent times*. New York, NY; The Organization, 1998.
32. McGuire S. A review of the impact of fluoride on adult caries. *J Clin Dent* 1993; 4(1):11-13.
33. Melbert JR & Ripa LW. Fluoride in preventive dentistry: theory and clinical applications. Chicago, IL; Quintessence; 1983:41-80.
34. Grembowski D, Fiset L & Spadafora A. How fluoridation affects adult dental caries: systemic and topical effects are explored. *J Am Dent Assoc* 1992; 123:49-54.
35. Stamm JW, Banting DW & Imrey PB. Adult root caries survey of two similar communities with contrasting natural water fluoride levels. *J Am Dent Assoc* 1990; 120:143-149.
36. Newbrun E. Prevention of root caries. *Gerodont* 1986; 5(1):33-41.
37. Am. Dent A. (Council on Access, Prevention, & Interprofessional Relations). Caries diagnosis and risk assessment: a review of preventive strategies and management. *J Am Dent Assoc* 1995; 126(Suppl).
38. Brown LJ, Winn DM, & White BA. Dental caries restoration and tooth conditions in U. S. adults, 1988-1991. *J Am Dent Assoc* 1996; 127:1315-1325.

39. Rugg-Gunn AJ. Nutrition and dental health. New York, NY; Oxford University Press; 1993.
40. Kaminsky LS, Mahoney MC, Leach J, Melius J, & Miller MJ. Fluoride: benefits and risks of exposure. *Crit Rev Oral Biol Med* 1990; 1:261-281.
41. National Academy of Sciences (Committee on Animal Nutrition and the Subcommittee on Fluorosis). Effects of fluorides in animals. Washington, DC; The Organization; 1974.
42. Pendrys DG & Stamm JW. Relationship of total fluoride intake to beneficial effects and enamel fluorosis. *J Dent Res* 1990; 69(Spec Issue):529-538.
43. Olson RE (ed.). Fluoride in food and water. *Nutr Rev* 1986; 44(7):233-235.
44. Leone NC, Shimkin MB & Arnold FA, et al. Medical aspects of excessive fluoride in a water supply. *Public Health Rep* 1954; 69(10):925-936.
45. Whitford GM. The metabolism and toxicity of fluoride (2nd rev. ed.) in Monographs in oral science. Basel, Switzerland; Karger; 1996. (Vol. 16).
46. Dean HT. The investigation of physiological effects by the epidemiological method in Moulton FR (ed.). Fluorine and dental health. Washington, DC; Am Assoc Advancement Sci Publ. No. 19; 1942:23-31.
47. Lewis DW & Banting DW. Water fluoridation: current effectiveness and dental fluorosis. *Community Dent Oral Epidemiol* 1994; 22:153-158.
48. National Research Council. Health effects of ingested fluoride: report of the Subcommittee on Health Effects of Ingested Fluoride. Washington, DC; National Academy Press; 1993.
49. U. S. Centers for Disease Control & Prevention. Ten Great Public Health Achievements: United States, 1900-1999. *Morbidity & Mortality Weekly Report*; 48(12):241-243. April 2, 1999.
50. Satcher D. (U.S. Surgeon General). Letter to Collins, TR (Chairman, California Fluoridation Task Force). October 19, 1998.
51. Satcher D. (U.S. Surgeon General). Oral Health in America: A Report of the Surgeon General. Rockville, MD; U.S. Department of Health & Human Services; June 2000. 311p.
52. Barsley, R. Sutherland J. & McFarland L. Water Fluoridation and the Costs of Medicaid Treatment for Dental Decay, Louisiana, 1995-1996. *Morbidity & Mortality Weekly Report*, 48(34):753-757. September 3, 1999.
53. Texas Department of Health. Water Fluoridation Costs in Texas: Texas Health Steps (EPSDT-Medicaid). Austin, TX; The Agency; May 2000. 14p.
54. Carmona, RH. (U.S. Surgeon General). Official Signed Statement on Community Water Fluoridation. Press Release from the U.S. Department of Health & Human Services, Centers for Disease Control & Prevention. Atlanta, GA; July 28, 2004.
55. Silverstein, SC. Testimony Before Congressional Biomedical Research Caucus, U.S. Congress. Rayburn House Office Building, Capitol Hill, Washington, DC. February 10, 1995.
55. Griffin, SO. Jones, K., Tomar, SL.. An Economic Evaluation of Community Water Fluoridation. *J. Public Health Dent* 2001;61(12):78-86.
56. Jones, S. Burt, BA. Petersen, PE. & Lennon, MA. The Effective Use of Fluorides in Public Health. *Bull World Health Organization*. Sept 2005. pp.670-676.
57. Am Dent A. Fluoridation Facts. Chicago, IL, The Association. 2005. 70p.
58. Centers for Disease Control. Water Fluoridation Reporting System (WFRS), 2005.
59. USDHHS/CMS. Health Accounts: National Health Accounts/national Health Expenditures (Table 3) and National Health Expenditure Projections 2003-13 (Table 8). <http://cms.hhs.gov/statistics/nhe/>

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