

Contents lists available at [ScienceDirect](#)

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

From the American College of Epidemiology

Science, politics, and communication: The Case of Community Water Fluoridation in the US

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ARTICLE INFO

Article history:

Received 21 December 2016

Accepted 8 May 2017

Available online xxx

Keywords:

Fluoridation

Dental caries

Oral health

Water

Epidemiology

Health policy

Prevention and control

ABSTRACT

Community water fluoridation (CWF) and its effect in reducing the burden of dental caries (tooth decay) is considered one of the 10 public health achievements in the 20th century. In the U.S., three-quarters (74.4%) of people on community water supplies have optimally fluoridated water, and each year approximately 90 communities actively consider starting or discontinuing CWF. CWF exists within the policy environment and includes actions taken by local community councils, health and water boards, and groups; state legislatures and health departments; national regulatory and science agencies; independent science entities; and professional and nonprofit organizations. Epidemiologists have been in the forefront of CWF. Experience with the past 70 years reveals that the coming decades will bring additional questions, recommendations, and challenges for CWF. The continued involvement of epidemiologists as part of multidisciplinary teams is needed in research, surveillance, peer review of studies, assessment of systematic review findings, and in the translation and communication of science findings to audiences with limited science/health literacy. This chapter's purpose is to 1) examine how epidemiologic evidence regarding CWF has been translated into practice and policy, 2) examine how recommendations for and challenges to CWF have affected epidemiologic research and community decision-making, and 3) identify lessons learned for epidemiologists.

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Introduction

Community water fluoridation (CWF) was named by the Centers for Disease Control and Prevention (CDC) as one of the 10 great public health achievements in the 20th century [1,2]. CWF is recognized for its ability to prevent the occurrence (incidence) and

reduce the burden (prevalence) of dental caries (tooth decay), the most common chronic disease among both children and adults [3]. Dental caries was extremely prevalent in the mid-century and one that persists today at high levels, especially in vulnerable and compromised populations. The primary prevention of dental caries reduces pain, infection, and the need for, the cost of, and trauma related to treatment. CWF's safety, effectiveness, ease and low cost of implementation, and its ready access to all who reside in the community, regardless of socioeconomic status, are the key attributes that reflect an intervention that supports health equity. As its name implies, CWF is a community-wide intervention that reflects

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<http://dx.doi.org/10.1016/j.annepidem.2017.05.014>

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the critical interface between science, policy, and practice. As such, CWF exists within an extensive policy environment and includes actions at local, state, and national levels. Findings from early clinical trials starting in the 1940s demonstrated that adjusting the fluoride concentration of the water supply prevented between 50% and 70% of dental caries in the community's population of children over the subsequent years. These findings, and others, have informed community-level policy-maker decisions to adjust ("add") fluoride in their community water supply to an optimal concentration. Despite CWF's role in addressing some of the inequalities in dental caries prevalence in communities throughout the United States (and elsewhere) for over 70 years, this intervention still requires the active engagement of epidemiologists working with others in research, surveillance, policy, education, and communication. The purpose of this article is to examine how epidemiologic evidence regarding CWF has been translated into practice and policy; examine how recommendations for and challenges to CWF have affected epidemiologic research and community decision-making; and to identify lessons learned from this community-wide intervention. The CWF-specific lessons learned are interspersed throughout the article, identifying what epidemiologists can and should do to help maintain and continue to build the science base for water fluoridation. In addition, this case highlights general lessons learned that have relevance to other long-standing community-based preventive interventions.

Background

Fluoride and dental caries

Fluoride is a naturally occurring ion found in soil and water, usually in very low concentrations. Dental caries is a destructive and potentially life-threatening disease in which acids, produced by bacterial breakdown of dietary carbohydrates in dental plaque, dissolve (deminate) the surfaces of teeth. Fluoride acts in a variety of ways to protect teeth from the continued challenges of bacterial acids. Epidemiologic research has determined the concentration of fluoride in water needed to protect teeth, while minimizing the prevalence of dental fluorosis. Dental fluorosis is a change in the appearance of the tooth enamel, most commonly appearing as symmetrical lacy white markings in its milder forms. Most dental fluorosis from CWF is mild and not noticeable to the layperson. Noticeable fluorosis (i.e., moderate or severe) is usually due to the chronic use of naturally occurring high fluoride concentrations in drinking water, chronic excess fluoride toothpaste ingestion, or inappropriate fluoride prescriptions for children. Dental fluorosis only develops while the teeth are growing in young children and does not progress to be more noticeable; older children and adults cannot acquire dental fluorosis. CWF is the process of upwardly adjusting the amount of fluoride occurring naturally in community water supplies to achieve the current recommended level of fluoride in the water supply, which is 0.7 mg/L (parts per million [ppm]) [4]. CWF contributes to dental caries prevention through all ages, and prevents the occurrence (incidence) of dental caries and reduces the burden (prevalence) of dental caries in children and adults by about 25% [5].

Role of epidemiologists and other key players

Epidemiologists have played, and continue to play, many roles in the implementation and dissemination of science, policy development, and communication (see Fig. 1). Epidemiologists have contributed to the evidence-based foundation: identifying the role of fluoride in water and association with dental fluorosis, dental caries and dental caries prevention; monitoring and

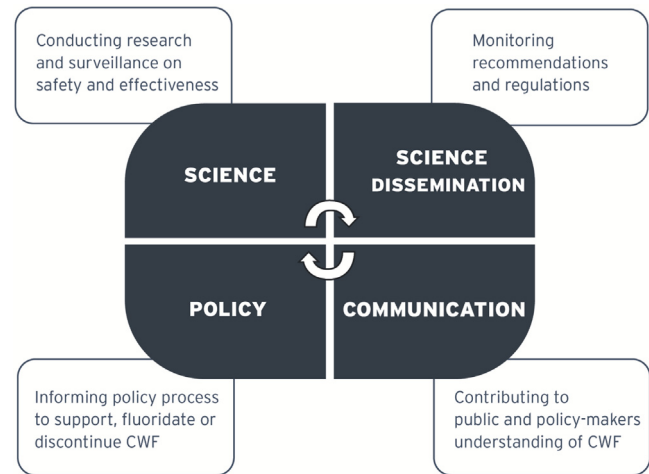


Fig. 1. Landscape of CWF science and policy is ever-changing. Epidemiologists have taken, and will take, part in all of these areas/processes.

documenting trends; establishing the scientific basis for safety and effectiveness of CWF; studying emerging issues; and communicating findings. They have been primary developers of research methods (including epidemiologic disease indices) and have been lead or coinvestigators of numerous studies. Epidemiologists remain key members of multidisciplinary teams contributing to ongoing surveillance, regulatory science, review of scientific manuscripts, and communication to the public, providers, and policy-makers. With the increased focus on dissemination and implementation science, epidemiologists are also involved in studying and testing strategies that would support integration of evidence-based approaches into clinical and community settings. It is important to note that the research outcomes of epidemiology are routinely used by public health—trained dental and other health professionals and others who use the evidence-base of CWF to recommend policy and communicate results to the public and to policy-makers.

Many other key players and organizations contribute to CWF, and reveal the extent of the policy environment in which CWF exists. For purposes of this article, policy is defined broadly and includes actions taken by local health and water departments, community councils and groups; state health departments and legislatures; national regulatory and science agencies; independent science entities; and professional and nonprofit associations. Given that the community water supply, a public utility, provides the delivery method for fluoride, the public has a major role in supporting or rejecting CWF, working with and through their state and local governments, elected officials, and community decision-makers. Once CWF is approved, trained water engineers play a critical role in implementation, operation, and maintenance according to set protocols. Regulation of water safety is under the direction of the U.S. Environmental Protection Agency (EPA), the agency responsible for setting standards for drinking water quality as specified by the Safe Drinking Water Act [6]. Research, surveillance, and critical scientific review is in the domain of the Department of Health and Human Services (U.S. Public Health Service and agencies, Centers for Disease Control and Prevention, and National Institutes of Health). These agencies contribute to the conduct and funding of these activities. In addition, nonprofit organizations and foundations provide support for educating the public and for CWF implementation. Professional organizations integrate the science and regulatory input and develop guidelines for care, resulting in recommendations for public education and patient clinical care for use by healthcare providers.

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