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Looking Back at Fluoridation*

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Introduction

Fluoridation was the first technology after World War II to arouse widespread public opposition. With the controversy over smoking and cancer, it opened in 1950 an era of modern politics marked by disputes between experts over factual matters of risk and benefit. The scientific debate over smoking is virtually settled, but scientific arguments continue over fluoridation, making this the longest running technical controversy in the public eye.[1]

In the 1930s it was noticed that people living where the drinking water naturally contained fluoride had teeth that were often discolored but were also relatively free of cavities. Further work showed that the benefit of cavity prevention could be enjoyed with little discoloration if the concentration of fluoride was as low as one part per million (ppm). In 1945, the U.S. Public Health Service (PHS) supported experimental addition of fluoride at this concentration to the drinking water of a few cities, intending over the next ten years to compare their cavity rates to those of control cities. Some Wisconsin dentists, enthusiastic over the low cavity rates reported during the first years of the study, urged that mass fluoridation be promoted immediately. The PHS first resisted, saying it would wait until the completion of the ten-year experiment, but in 1950 it recommended fluoridation across the nation. By 1951, the American Dental Association and the American Medical Association had added their endorsements to mass fluoridation.[2]

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1 Compare the web sites www.ada.org/public/topics/fluoride/fluoride.html and www.fluoridealert.org.

2 *See* Donald McNeil, *America's Longest War: The Fight over Fluoridation, 1950-,* 9

Almost immediately, politically conservative citizen groups in Wisconsin protested against adding a toxic chemical to their drinking water. They argued that fluoride, in higher doses, was a rat poison. They also argued that involuntary fluoridation amounted to mass medication, which was considered a step toward socialism. The movement spread across the United States, gaining strength from concerns that the federal government was susceptible to communist influences, then to other nations, though my treatment is limited to the American case. When American communities voted in referenda whether or not to fluoridate, usually the measure lost.[3]

There is an exaggerated stereotype of the antifluoridationist as a kook or a fanatic right-winger, as represented by the mad General Jack D. Ripper in Stanley Kubrick's film, *Dr. Strangelove.* Few "neutral" commentators gave serious consideration to the arguments of the opponents because they had been successfully painted by establishment proponents as irrational extremists. Psychologists of the time called opposition to fluoridation an "anti-scientific attitude," and social scientists viewed referendum defeats as democracy gone astray.[4]

However, among the opponents of fluoridation were respectable scientists, physicians, and others sensibly cautious about chronic toxic effects, and they were not all political conservatives. From a modern perspective, it was reckless of the PHS and other health organizations to promote mass fluoridation as early as they did. Fluoride is a known poison at high dosage, and data on humans then used to evaluate the health risk of adding a small amount to drinking water were limited to crude comparisons of vital statistics among selected communities with varying levels of naturally occurring fluoride, and to pediatric examinations on children in one of the experimental cities exposed to fluoride for three or four years.[5] Health organizations in 1951 were

Wilson Q. 140 (1985).

3 Robert Crain, Elihu Katz & Donald Rosenthal, The Politics of Community Conflict (1969).

4 *See* Berbard Mausner and Judith Mausner, *A Study of the Anti-scientific Attitude,* 192 Sci. Am. 35 (1955); Am. Dental Ass'n, *Comments of the Opponents of Fluoridation*, 71 J. Am. Dental Ass'n 1156 (1965).

5 *See* Edward Schlesinger, David Overton & Helen Chase, *Newburgh-Kingston Caries-Fluorine Study*, 40 Am. J. Pub. Health 725 (1950); James Shaw, Fluoridation as a Public Health Measure (1954).

not as concerned as we are now about chronic exposure to trace poisons.

By the mid-1950s, a second scientific controversy occupied the nation. It concerned the harmful effects of radioactive fallout from nuclear weapons testing in the atmosphere. Stopping testing was a liberal cause. Since the protesters against fluoridation and weapons testing usually occupied opposite ends of the political spectrum, few activists belonged to both movements. However, their risk messages were essentially the same. Both objected to involuntary chronic exposure of large populations to low doses of agents known to be very dangerous at higher doses. Both regarded distant and misguided leaders of government and industry as the responsible parties placing populations at risk. Both accused these parties of ignoring accumulating scientific evidence of chronic toxicity from low-level exposure. Both envisioned the poisons emanating from technology as insidiously contaminating the purity of nature. Both emphasized the process of bio-concentration, by which some trace poisons become increasingly concentrated as they are consumed by species higher up the food chain. Both saw in chemical pollution a symptom of the moral decay of society. Both worried particularly about cancer.

The arguments against fluoridation and radiation are so similar as to be virtually interchangeable. These are, furthermore, exactly the elements that constitute the ideology of Rachel Carson's *Silent Spring*, which in 1962 would warn of DDT and other pesticides[6] and resembles today's concerns about genetically modified food. Despite the commonality of messages, there was an intellectual disdain for antifluoridationists that never extended to opponents of atmospheric testing or of DDT. Perhaps this reflects the antifluoridationists' greater distance from the intellectual centers of the nation.[7]

Risk Assessment

Much of the literature evaluating fluoridation is intended to either promote or discredit water treatment. This enables a researcher to locate reports of virtually any effect that is desired. A sensible overview of this work requires attention to reliable findings from methodologically strong studies, rather than anecdotal or anomalous

6 Rachel Carson, Silent Spring (1962).

7 *See* Allan Mazur, A Hazardous Inquiry (1998).

claims. Also, the credibility of sources is important.

According to the Centers for Disease Control (CDC), early studies reported cavity reductions from fluoridation ranging from 50% to 70%, but studies during the 1980s showed reductions of only 8% to 37% among adolescents. This trend has been attributed to the use of fluoride even in unfluoridated communities through bottled and processed food and beverages and the use of fluoride toothpaste.[8]

Responding to a request from the United States Environmental Protection Agency (EPA) to determine whether its maximum contaminant level of 4 ppm fluoride in drinking water is appropriate, a subcommittee of the National Research Council, the principal operating agency of the National Academy of Sciences, in 1993 reviewed the health effects of ingested fluoride. This review provides the basis for the remainder of this section.[9]

Fluoride at recommended levels produces some dental fluorosis, usually as a barely discernible white spotting on the enamel, but occasionally brown staining or pitting occur. The prevalence of mottling has increased, though there is disagreement whether in moderate form this is a health effect or a cosmetic problem.

The effect of fluoride on bone strength and hip fractures has been addressed in experimental studies on humans and animals and in epidemiological comparisons of fracture rates in populations of elderly people that differed in their exposure to natural or added fluoride in drinking water. These studies yield inconsistent results, with some showing a weak association between fluoride in drinking water and the risk of hip fracture. There is little indication that fluoride strengthens bones. In view of conflicting results and methodological weaknesses, the subcommittee found no basis for recommending that the EPA lower the current standard for fluoride, but the subcommittee did recommend more research on fractures.

High exposure to fluoride is known to cause a variety of adverse health effects in experimental animals, but the subcommittee found no indication that exposure below the EPA contaminant level of 4 ppm produced kidney disease, gastrointestinal or immune system problems,

8 *See* Centers for Disease Control, *Achievements in Public Health, 1900-1999: Fluoridation of Drinking Water to Prevent Dental Caries*, 283 JAMA 1283-86 (2000).

9 *See* National Research Council, Health Effects of Ingested Fluoride (1993).

adverse reproductive effects, or genotoxicity.

More than 50 epidemiological studies have examined the relation between fluoride in drinking water and human cancer. Most of these compare geographic or temporal patterns of cancer rates with fluoride levels. This body of work had already been reviewed by several independent expert panels of epidemiologists, including the International Agency for Research on Cancer (IARC),[10] thus the subcommittee elected to summarize prior findings, also considering eight recent studies, rather than undertaking another comprehensive review. The subcommittee reaffirmed earlier conclusions that this research provides no credible evidence for an association between fluoride in drinking water and the risk of cancer in humans. If a link does exist, it must be very weak. It also found available laboratory data insufficient to demonstrate a carcinogenic effect of fluoride in animals. Nonetheless, more and better-designed epidemiological research was recommended to more fully evaluate the relationship between fluoride exposure and cancer at various sites.

In denying any empirical link between fluoride and cancer, the subcommittee flatly contradicted studies by Yiamouyiannis – highly publicized by antifluoridationists – showing correlations among American cities between fluoride in water and cancer mortality.[11] As noted by the IARC and other critics, those studies did not adjust adequately for age, race and sex in the groups that were being compared. For example, comparing fluoridated cities with older populations – hence high cancer mortality – with unfluoridated cities having younger populations – hence low cancer mortality – gives a spurious association of fluoridation with mortality, when in fact it is the age difference that explains the differing mortality rates.

Overall, the subcommittee found EPA's maximum contaminant level of 4 ppm fluoride in drinking water to be appropriate as an interim standard, pending new research results, while recognizing it would give a small percentage of the U.S. population moderate to severe dental fluorosis.

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10 *See* International Agency for Research on Cancer, *Inorganic Fluorides*, 27 Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans 235 (1982).

11 *See* John Yiamouyiannis & Dean Burk, *Fluoridation and Cancer: Age-Dependence of Cancer Mortality Related to Artificial Fluoridation,* 10 Fluoride 102 (1977).

There have been infrequent reports of community outbreaks of acute fluoride poisoning due to overfluoridation of public water supplies. In one documented case, a faulty feed pump in a treatment plant of a small community allowed excessive fluoride into the tap water, with one sample measuring 200 ppm. The day before the error was discovered, fourteen people reported to the local hospital with acute nausea or vomiting.[12]

Dynamics of Controversy

Now 50 years old, the fight over fluoridation continues with no end in sight. Like classic theater, the polarized structure of its plot is invariant, but the cast changes. As older actors die or retire, new players speak more or less the same lines, voicing arguments and rejoinders that mesh as if scripted.[13] Unlike a play, the actors hardly ever switch parts and there is no resolution.

Cogent evaluation of scientific evidence seemingly has little effect on partisan positions in a controversy as polarized as this. A profluoridationist recently chastised opponents for linking water treatment "to a laundry list of aliments including ... even stained teeth," oblivious to the fact that stained teeth is a demonstrated consequence of fluoridation.[14] On the other side, John Yiamouyiannis reiterated in a 1999 interview that fluoride "definitely" causes cancer.[15] Stalwarts fit any new evidence into prior conclusions. The opposition journal *Fluoride*, editorializing on new studies showing neurotoxicity in rats fed water with low concentrations of fluoride, noted "paradoxically" that the same studies found toxicity significantly lower as fluoride concentration increased. Nonetheless the editorial concluded adverse effects are "clear-cut."[16]

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12 *See* Alan Penman, Bruce Brackin & Randal Embrey, *Outbreak of Acute Fluoride Poisoning Caused by a Fluoride Overfeed, Mississippi, 1993*, 112 Pub. Health Rep. 403 (1997).

13 *See* Brian Martin, Scientific Knowledge in Controversy (1991).

14 Charles Mahtesian, *Tooth Squads*, 40 Governing Mag. (June 1997).

15 *See* Peter Chowka, *A Pioneering Health Researcher Speaks Out*, *at* www.naturalhealthvillage.com/newsletter/990915/yiamouyiannis. Yiamouyiannis believes stress is probably the major contributing cause of cancer and is co-author with Dr. Peter Duesberg of a book, AIDS: The Good News is that HIV Doesn't Cause It (1995), which denies that HIV causes AIDS.

16 *See* Bruce Spittle & Albert Burgstahler, *Death Knell for Fluoridation?* 31 Fluoride 59-60 (1998).

Recalcitrants need not be poor scientists. Albert Einstein famously opposed quantum theory, denying that "God plays dice with the universe" until the day he died, perhaps then learning the truth. Intransigence is a reminder that scientific evidence is never irrefutable — scientific claims cannot be established beyond all logical doubt.

What does change from year to year is the intensity of the controversy, whether measured by the number of active opponents, the amount of news coverage about fluoridation, or the percentage of people who say in opinion polls that they oppose fluoridation. All indicators rise during years of national concern about larger issues relevant to antifluoridationists, because this is when activists and journalists are the most readily energized. Periods when Americans were especially fearful of communism and socialized medicine in the United States, reflected in the popularity of Senator Joseph McCarthy in the early 1950s and the presidential candidacy of Barry Goldwater in 1964, were times of peak antifluoridation activity. Another peak, around 1970, was tied to the incipient Environmental Movement and its concern with trace "poisons" such as DDT, mercury, and fluorides.[17] Like a surfer catching a wave, opposition rises with these larger concerns, then diminishes as they wane. In recent decades, fluoridation activity, pro and con, has been relatively quiet at the national level, though it continues to inflame individual communities and there remains high likelihood, given a referendum, for treatment to be rejected.

Half the U.S. population has fluoride added to its drinking water, about the same portion as in the 1970s, while another few percent have naturally fluoridated water. Martin estimated in 1991 that about 100 million people outside the United States drank water with added fluoride.[18] Today the number may be as high as 300 million, but in any case water fluoridation has not become widespread. Several countries in Europe and Latin America add fluoride to table salt, a voluntary medium that seemingly evokes less dissent.

17 *See* Allan Mazur, Dynamics of Technical Controversy 113 (1981).

18 *See* Martin, *supra* note 13, at 193.