Fluoridation Update 2014

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Abstract

This year, more than 4 million people living in 140 communities in Massachusetts will have the health and economic benefits of community water fluoridation. However, Massachusetts is ranked only 37th in the country for fluoridation, with just 62 percent of the population on a public water supply living in fluoridated communities. Nationally, more than 210 million Americans, about 74.6 percent of the U.S. population on a community water supply, live in fluoridated communities.

Although we have had community water fluoridation for nearly 70 years, fluoridation is still being challenged nationally and locally. In 2013, there were at least seven challenges in fluoridated communities in Massachusetts to discontinue fluoridation. Fortunately, these challenges did not prevail and these communities remain fluoridated.

On a daily basis, the public is being misinformed about the safety and effectiveness of fluoridation by the Internet and social media (see "Community Water Fluoridation on the Internet and Social Media" on page 32). Oral health professionals must do a better job of educating their patients and community leaders whether they live in fluoridated or non-fluoridated communities.

One of the goals of Healthy People 2020—the U.S. National Health Objectives to increase the quality and years of healthy life and to eliminate health disparities—is to have 79.6 percent of the U.S. population living in fluoridated communities by the year 2020. Unfortunately, it appears unlikely that Massachusetts will reach this goal. We can do better.

Introduction

In Massachusetts, more than 4 million people, about 62 percent* of the population on a public water supply, live in 140 fluoridated communities—ranking Massachusetts 37th in the nation. (See Table 1.) About 2.5 million residents in 150 communities do not have fluoridation, and of these, 170,000 residents in 60 communities do not have a public water supply.

In 2012, more than 210 million Americans—about 74.6 percent of the U.S. population on a public water supply—lived in fluoridated communities.[1] (See Table 2.) The Healthy People 2020 national objective is 79.6 percent. Although community water fluoridation has been used since 1945, it is still being challenged in Massachusetts and nationwide.

All of the 30 largest cities in the United States are fluoridated with the exception of Portland, Oregon, where a public vote in May 2013 defeated fluoridation 60.6 percent to 39.4 percent, although the Portland City Council supported it 5 to 0.[2] In Massachusetts, five of the 25 largest cities and towns are not fluoridated. (See Table 3.)

Fluoridation Quality Award for Massachusetts

Fluoridation quality in Massachusetts has been very well maintained, thanks to the state's Departments of Public Health and Environmental Protection, as well as individual fluoridating water systems. Massachusetts is the only state to have received the State Fluoridation Quality Award eight years in a row, beginning in 2006. It is awarded by the U.S. Centers for Disease Control and Prevention (CDC), Association of State & Territorial Dental Directors, and American Dental Association (ADA), and recognizes fluoridating systems that maintain fluoridation quality at optimal fluoride levels.

Why So Many Fluoridation Challenges?

Fluoridation is being challenged in Massachusetts and nationwide because a vocal minority has been adept at confusing and scaring the public on the safety and effectiveness of fluoridation. A recent study of the Internet and social media showed that a major anti-fluoridation website had more than 133,000 hits per month—5 to 60 times the monthly traffic on leading pro-fluoridation websites.[3]

The public is being misled daily on the Internet. Anti-fluoridationists continue to mislead, misinform, and scare the public with poorly done studies or misinterpreted results of studies conducted by reputable individuals, organizations, or institutions.

*Based on the current number of people on public water supplies and the Massachusetts population estimate from the Massachusetts Department of Public Health

Table 1. The 140 Massachusetts Public Water Systems Receiving Water Fluoridation

Fluoridated at 1 ppm: 1 part fluoride per million parts water (PPM) or mg/L

City/Town	Year of Start-Up	2010 Population
Acton	1970	21,924
Acushnet	2007	10,303
Amherst	1987	37,819
Andover	1969	33,201
Aquinnah (WHA Part)	1996	80(E)
Arlington*	1978	42,844
Ashburnham	1957	6,081
Athol	1952	11,584
Attleboro	1973	43,593
Bedford*	1978	13,320
Belchertown (Part)	1987	243(E)
Belmont*	1978	24,729
Berlin (Sp Mall Only)	1997	-
Beverly	1952	39,502
Billerica	1992	40,243
Boston*	1978	617,594
Bourne (Otis Ang)	1960	1,000(E)
Bridgewater (MCI)	1989	2,230
Brookline*	1978	58,732
Burlington	1993	24,498
Cambridge (Fl)*	1974	105,162
Canton*	1978	21,561
Charlton**		150(E)
Charlton (Part)	1996	150(E)
Chelsea*	1978	35,177
Cohasset	1956	7,542
Concord	1970	17,668
Danvers	1951	26,493
Dartmouth (Part)	2007	34,032
Dedham*	1977	24,729
Dighton (Part)	1971	2,200(E)
Dover (Part)	1997	159(E)
Dracut	1982	29,457
Dudley (Part)**		45(E)
Duxbury	1987	15,059
Essex	1970	3,504
Everett*	1978	41,667
Fall River	1973	88,857
Fitchburg	1975	40,318
Framingham (Fl)*	1970	68,318
Franklin	1970	31,635
Freetown***	1978/2007	5,000(E)
Gardner	1987	20,228
Gloucester	1981	28,789
Groveland	1995	6,459
Hamilton	1956	7,764
Hardwick-EHS**		150(E)
Haverhill	1971	60,879
Hingham	1953	22,157
Holden	1995	17,346
Holliston	1970	13,547
Holyoke	1970	39,880
Hudson	1985	19,063
Hull	1953	10,293
Ipswich	1971	13,175
Lawrence	1983	76,377
Lexington*	1978	31,394
Lincoln	1971	6,362
Longmeadow	1989	15,784
Lowell	1982	106,519
Lynn	1983	90,329
(Lynnfield Center)	1959	
Lynnfield (Fl)*	1972	11,596
Malden*	1978	59,450
Manchester by-the-Sea	1983	5,136
Mansfield	1997	23,184
Marblehead*	1978	19,808
Marlborough*	1982	38,499
Medford*	1978	56,173
Medway	1953	12,752
Melrose*	1978	26,983
Middleton	1951	8,987
Millis	1983	7,891
Milton*	1978	27,003
Nahant*	1978	3,410
Natick	1997	33,006
New Bedford	2007	95,072
Needham (Fl)*	1971	28,886
Newbury (Part)	1969	1,000(E)
Newburyport	1969	17,416
Newton (Fl)*	1963	85,146
Norfolk (Part)	1977	40(E)
North Andover	1975	28,352
North Attleboro	2002	28,712
Northborough*	2001	14,155
North Reading	1971	14,892
Norwood*	1978	28,602
Oak Bluffs	1991	4,527
Orange (Part)	1975	120(E)
Oxford	1987	13,709
Peabody*	1983	51,251
Pelham (Part)	1987	309(E)
Pembroke	1969	17,837
Plainville (Part)		
Quincy*	1978	92,271
Reading*	1970	24,747
Revere*	1978	51,755
Rockport (Part Natural)	1984	6,952
Royalston (Part) (Sric)**		400(E)
Rutland	1985	7,973
Salem	1952	41,340
Saugus*	1978	26,628
Scituate	1954	18,133
Seekonk	1952	13,722
Sharon	1953	17,612
Shrewsbury	1953	35,608
Somerset	1969	18,165
Somerville*	1978	75,754
Southborough*	1996	9,767
Southbridge	1971	16,719
Stoneham*	1978	21,437
Stoughton (Part)*	2004	26,962
Sturbridge	1990	9,268
Sudbury	1960	17,659
Swampscott*	1978	13,787
Swansea	1969	15,865
Taunton	1981	55,874
Templeton	1951	8,013
Tewksbury	1983	28,961
Topsfield	1953	6,085
Tyngsboro	1987	11,292
Wakefield*	1978	24,932
Walpole	1977	24,070
Waltham*	1978	60,632
Watertown (Fl)*	1971	31,915
Wayland	2000	12,994
Wenham	1967	4,875
Wellesley*	1987	27,982
Westborough	1974	18,272
Westfield (White Oak Sh)**		-
Westford	1994	21,951
Westminster	1968	7,277
West Newbury	1969	4,235
Weston (Fl)*	1973	11,261
Westport (Part)	1975	1,000(E)
Westwood*	1977	14,618
Weymouth	1972	53,743
Wilmington (Part)*	2009	1,000(E)
Winchester (Fl)*	1956	21,374
Winthrop*	1978	17,497
Woburn*	1978/2008	38,120
Worcester (Part)	1995	250(E)
Total Population Natural & Adjusted		**4,049,549**

* Members of the Massachusetts Water Resources Authority (MWRA) fluoridated in 1978 (old MDC)

** Naturally fluoridated at 0.7 or higher ppm.

*** Public water system that began receiving fluoridated water in two different years

(Part) - Communities partially fluoridated. Check with local water department/board of health.

(Fl) - Fluoridating prior to MDC

(E) - Estimated population served

Prepared by: Massachusetts Department of Public Health—Office of Oral Health

For additional information, email ***Oral.Health@state.ma.us*** or go to ***www.mass.gov/dph/oralhealth***.

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Table 2. Number of People in the United States Who Live in Fluoridated Communities, 1945–2012[1]

Year	Number of People
1945	231,930
1950	1,578,578
1955	26,278,820
1960	41,179,694
1965	58,369,355
1970	83,725,771
1975	94,627,294
1980	106,170,149
1985	120,100,100 (estimate)
2008	195,545,109
2010	204,283,554
2012	210,655,401

Table 3. Five of the 25 Most Highly Populated Massachusetts Cities and Towns That Are Not Fluoridated

City/Town	Population*
Barnstable	45,167
Brockton	94,316
Chicopee	55,333
Springfield	153,155
Worcester	181,631
Total	**529,602**

*Population estimates from the 2010 U.S. Census Bureau

Health professionals, community leaders, and public health and dental communities need to better educate patients and the public.

Massachusetts Challenges in 2013 and 2014

In 2013, fluoridation was challenged or questioned in at least seven Massachusetts communities. (See Table 4.) In five of these communities—Athol, Duxbury, Lincoln, Longmeadow, and Templeton—it was soundly voted in town meetings to not discontinue fluoridation. In each circumstance, it took an intense educational effort to update the community on the most recent science and benefits of community water fluoridation so they would vote in their best interest.

Templeton

In Templeton, fluoridation was challenged four years in a row at town meetings, but the challenge was soundly defeated each time. As a matter of fact, a dental hygienist who educated the community about the benefits of fluoridation the first two years was elected to the Templeton Board of Health in 2013. At the third town meeting in May 2013, three warrants—to add a fluoride warning to water bills, to discontinue fluoridation, and to adopt a bylaw requiring town meeting approval for community water fluoridation—were all defeated by voice vote. This could not have been accomplished without the dedication and hard work of well-intentioned dental and health professionals who live or work in the community.

Fluoridation was again brought up at town meetings in 2014, asking for a fluoridation warning to be sent to all residents and to change state law so that fluoridation is decided by town meetings, not boards of health. The current fluoridation law, which gives local boards of health authority to order fluoridation, was based on the recommendation of a Special Legislative Commission on Dental Health supported by a comprehensive fact-finding report.[4] In May 2014, the two warrants were defeated by margins of about 3 to 1 and 2.5 to 1.

Lincoln

In 2013, a few Lincoln residents petitioned the Selectmen to include a warrant for a public vote to discontinue fluoridation at their March town meeting. Prior to the town meeting, a Lincoln resident and Harvard Medical School professor wrote a guest commentary for the *Lincoln Journal* stating that fluoridation appears neither necessary nor effective, is unsafe, and provides uncontrolled drug delivery. Subsequently, the deans of Harvard Medical School, Harvard School of Dental Medicine, and Harvard School of Public Health signed a letter stating that fluoridation is a safe and effective public health measure for people of all ages. The majority voice vote at the Lincoln town meeting was in favor of continuing fluoridation. It took an intense educational effort to update the community on the science, safety, and benefits of fluoridation and to discredit the negative information.

Duxbury

In 2013, Duxbury Fluoride Choice, a residents group, proposed an article requesting the Selectmen to petition the state legislature to put the discontinuation of fluoridation up for a vote on the 2014 election ballot. The Selectmen voted unanimously to recommend approval of a town meeting warrant to end fluoridation. However, the Board of Health responded to this action and the petition was defeated 89 to 16 at the 2013 annual town meeting. Again, it took an intense educational effort to show the community that the arguments against fluoridation had no merit or substance.

Wayland

After much discussion at its September 2013 meeting, the Wayland Board of Health voted to decrease the fluoride level to 0.7 ppm—the recommended fluoride level proposed in 2011 by the U.S. Department of Health and Human Services—but it has not yet been finalized.

2014

By mid-2014, at least 11 fluoridated communities have had their fluoridation status questioned or challenged: Amherst, Cambridge, Cohasset, Gloucester, Hingham, Hull, Longmeadow, Newburyport, Oak Bluffs, Rockport, and Templeton. In the town meetings in Longmeadow and Templeton, the communities voted to keep fluoridation. In the other nine communities, no action had been taken as of early August.

Massachusetts Challenges 2004–2012

Between 2004 and 2012, a number of communities in Massachusetts became partially or completely fluoridated. (See Table 5.)

In 2007, New Bedford (population: 95,072) implemented fluoridation after a communitywide vote. Although the previous mayor supported fluoridation, the new mayor initially opposed it. There was an intense educational effort so the community would vote in their best interest.

In 2009, Amesbury (population: 16,535) discontinued fluoridation because of problems, claiming they had difficulty processing the fluoride into the water supply; no other fluoridated community has experienced similar problems.

In 2011, Groveland (population: 6,530) had an election ballot to discontinue fluoridation, but it was soundly defeated—probably because one of the town's den-

Table 4. Contested Fluoridated Communities in Massachusetts, 2013

City/Town	Population*	Year Fluoridated	Year Contested	Result
Athol	11,584	1952	2009	Town Meeting: Positive
			2013	Town Meeting: Positive
Duxbury	15,059	1985	2013	Town Meeting: Positive (89–16)
Lincoln	6,362	1971	2013	Town Meeting: Positive
Longmeadow	15,784	1989	2013	Town Meeting: Positive
Scituate	18,133	1954	2013	Board of Health: Positive
Templeton	8,013	1951	2011	Town Meeting: Positive (190–64)
			2012	Town Meeting: Positive
			2013	Town Meeting: Positive
Wayland	12,994	2000	2013	Board of Health: Reduce F Concentration (3–1)
Total	**87,929**			

*Population estimates from the 2010 U.S. Census Bureau

Table 5. Newly Fluoridated Communities 2004–2012

City/Town	Population	Year Fluoridated	Status
Stoughton	29,962	2004	Partial
New Bedford	95,072	2007	Complete
Dartmouth	34,032	2007	Partial
Freetown	5,000 (estimate)	2007	Partial
Woburn	20,615 (estimate)	1978	Partial through MWRA
	38,120	2008	Complete
Wilmington	1,000 (estimate)	2009	Partial
Total	**203,186**		

Source: Massachusetts Department of Public Health—Office of Oral Health

tists regularly educated his patients about fluoridation (Dr. David Archibald to me, personal communication, Spring 2011).

In 2012, the Mansfield (population: 23,284) Board of Health requested an update on fluoridation information and continued to fluoridate.

New Proposed Fluoride Level

In 2011, the U.S. Department of Health and Human Services (DHHS) proposed a new recommended fluoride level, 0.7 ppm, for fluoridating communities. At a 2011 press conference held in conjunction with the Environmental Protection Agency (EPA), the EPA announced that it would study the maximum contaminant fluoride level in naturally fluoridated communities, which at that time was 4 ppm. This created a lot of confusion, and anti-fluoridationists used this confusion to scare the public against fluoridation.

As of August 1, 2014, the new recommended fluoride level of 0.7 ppm for community water fluoridation has not been finalized by the DHHS. Once finalized, it is expected that anti-fluoridationists will attempt to convince the public that the recommended fluoride level is being lowered because fluoride is potentially dangerous, which is not true.

The previous recommended fluoride level had ranged from 0.7 to 1.2 ppm depending on the mean annual temperature of the community over a five-year period. However, recent studies demonstrate that water ingestion is the same regardless of climate temperatures, and thus this range was eliminated and the recommended level is a single number.[5]

Anti-Fluoridation Activities

In their efforts to convince the public that fluoridation is a health hazard, anti-fluoridationists have relied on questionable studies and articles to back up their claims. Here are the major studies/articles they use to misinform the public:

Harvard IQ Studies

A 2012 paper, which was a meta-analysis of 27 cross-sectional studies in naturally high-fluoridated communities in China, Iran, and Mongolia, stated a possible relationship between fluoridation and lower IQ.[6] However, these studies were done in poor, rural communities, and some were conducted as far back as 19 years ago. Also, the original study designs may not have adequately controlled for intervening variables (e.g., parents' education, socioeconomic status, pollution) that could influence IQ level. These studies have been severely criticized. There have been two formal reviews—one that delineates the weaknesses in these studies[7] and another that concludes that the biological plausibility for a link between fluoridated water and IQ has not been established.[8]

The anti-fluoridationists have used this paper worldwide to convince the public that fluoridation at the recommended level negatively affects IQ. No credible study conducted in the United States has confirmed this finding. In fact, a reputable study showed that fluoridation had no neurotoxic effect or significant health effect on rats even at levels up to 230 times the recommended concentration,[9] and an earlier study showed that fluoride causes no harm to children.[10]

Interestingly, the mean fluoride level of controls (areas with low fluoride concentration) in the Chinese studies was 0.7 ppm, which is the new proposed recommended fluoride level in the United States. Thus, their data can be interpreted such that those living in a community at the recommended fluoride level (0.7 ppm) will have a higher IQ, which is the opposite of what the authors of this study and anti-fluoridationists are claiming. In a media statement, the authors of this meta-analysis said:

> "These results do not allow us to make any judgment regarding possible levels of risk at levels of exposure typical for water fluoridation in the [United States]. On the other hand, neither can it be concluded that no risk is present. We therefore recommend further research . . ."[11]

Lancet Neurology *Article*

In February 2014, the article "Neurobehavioural Effects of Developmental Toxicity" by Grandjean and Landrigan was published in *Lancet Neurology*.[12] This article quoted the Harvard IQ study—which Grandjean co-authored—and included fluoride in a list of five toxic chemicals that may have a neurotoxic effect on the world population, especially in developed countries.

Surprisingly, the only study the authors reference to support the addition of fluoride to their list is Choi et al.'s

IQ study,[6] of which Grandjean is a co-author—making this a self-citation. (The many flaws in the IQ study are described in the previous section.) It's interesting to note that Dr. Landrigan, the *Lancet Neurology* article's co-author, was quoted in the *Atlantic* as saying:[13]

> "Fluoride is very much a two-edged sword. . . . There's no question that, at low doses, it's beneficial. . . . I think it's very good to have [fluoride] in toothpaste."

New Neurotoxicity Studies

Two recent comprehensive, prospective, and well-controlled studies have shown no neurotoxic effect from fluoridation. One, which was reported at the 2014 American Association for Dental Research meeting, showed no significant impact between prenatal or postnatal fluoride and cognitive development in the first three years of life for children (E. Angeles Martinez-Mier to me, personal communication, April 24, 2014). The other found that fluoridation is not neurotoxic for either children or adults, and does not have a negative effect on IQ.[14]

Osteosarcoma Study

In 2005, the article "Fluoridation, Cancer: Did Researchers Ask the Right Questions?" was published in the *Wall Street Journal*.[15] The article reported on a retrospective study conducted by a doctoral student showing an increase in the risk of osteosarcoma in boys living in fluoridated communities. At the time the article was written, the study had not yet been published or submitted for peer review, and had several limitations as stated by the author. This exploratory analysis was subsequently published, and again the author delineated the study's limitations.

The doctoral student's analysis was part of a larger, ongoing, prospective study done by Harvard researchers in the same department with bone assays of a much larger sample size. The larger, comprehensive study showed no relationship between fluoride and osteosarcoma.[16] In spite of that conclusion, anti-fluoridationists continue to claim that fluoridation causes cancer or osteosarcoma.

National Research Council Report

In 2006, the Report of the National Research Council, *Fluoride in Drinking Water: A Scientific Review of EPA's Standards,* recommended lowering the maximum permissible fluoridated levels (4 ppm) of naturally fluoridated communities.[17] The report's appendix included a number of allegations against fluoride from known anti-fluoridationists. Although Study Committee Chair John Doull, MD, PhD, has stated multiple times that this report is not applicable to community water fluoridation in the United States, anti-fluoridationists continue to use it to scare or mislead the public about water fluoridation. To quote Dr. Doull:

> "I do not believe there is any valid scientific reason for fearing adverse health conditions from the consumption of water fluoridated at the optimal level."[17]

Infant Formula and Fluoridation

Thanks to anti-fluoridationists, there is confusion in the public's eye regarding the use of fluoridated water to reconstitute dry infant formula. As a result, New Hampshire passed a law in 2012 requiring fluoridated communities to warn residents that infants under six months old who exclusively consume infant formula reconstituted with fluoridated water may have an increased chance for dental fluorosis. The CDC information on infant formula uses the term "mild fluorosis,"[18] which is usually imperceptible to the untrained eye, whereas the anti-fluoridationists eliminated the word "mild" to scare and confuse the public and will show pictures of severe fluorosis.

Parents who feed infants dry infant formula reconstituted with fluoridated water and who are concerned about the possibility of their child having very mild fluorosis should contact their child's pediatrician. Concerned parents can use bottled water to reconstitute infant formula or use fluoridated water intermittently.

Dental Fluorosis

Fluorosis may occur in non-fluoridated or fluoridated communities. Very mild or questionable fluorosis is not new, and may be due to various sources of fluoride, such as toothpaste consumption or unnecessary fluoride prescriptions. Cases of mild or moderate fluorosis in the United States usually only occur when very young children ingest large amounts of fluoride toothpaste over long periods in non-fluoridated or fluoridated communities, or when children consume prescribed systemic fluoride pills or drops despite living in fluoridated communities.[19] It is recommended that children age 6 years and younger have supervision when brushing their teeth, use no more than a pea-size amount of fluoride toothpaste, and use toothpaste that has no more than 1,000 ppm of fluoride.[20]

The anti-fluoridationists continue to alarm the public by saying that 41 percent of American adolescents have some form of fluorosis and by implying that it is due to fluoridation. There are no known, credible negative health effects of fluoride at the recommended levels. Anti-fluoridationists do not say that very mild fluorosis, which may occur, is usually imperceptible to the untrained eye and is not noticeable by most individuals unless they are trained oral health professionals.

As part of their campaign, anti-fluoridationsists will show pictures of severe fluorosis, which includes brown mottling and pitting of teeth, without indicating the level of fluorosis. Severe fluorosis occurs in countries like India, where water is naturally fluoridated at over 10 to 20 ppm, and is very rare in the United States, as we do not have any communities that are naturally fluoridated at such high levels.

Cancer

For years, anti-fluoridationists have alleged that cancer is a possible side effect of fluoridation. However, there are no repu-

Helpful Resources on Fluoridation

Massachusetts Department of Public Health: www.mass.gov/eohhs/gov/departments/dph/programs/community-health/oral-health/community-water-fluoridation.html

U.S. Centers for Disease Control and Prevention (available in multiple languages):

www.cdc.gov/fluoridation/

American Dental Association:

http://www.ada.org/en/public-programs/advocating-for-the-public/fluoride-and-fluoridation/ada-fluoridation-resources

American Academy of Pediatrics:

www.ilikemyteeth.org/fluoridation/

table studies that demonstrate this.[21] As a result of anti-fluoridation activity in 2011, the California State Carcinogen Identification Committee held hearings to determine whether fluoride should be added to the list of known carcinogens under the Safe Drinking Water and Toxic Enforcement Act. After lengthy hearings and data collection, they determined that fluoride is not a carcinogen. The Food and Drug Administration (FDA) in their hearing testimony stated, "We have determined that the available data do not support a conclusion that exposure to fluoride in FDA-regulated products causes cancer."[22]

The ADA, American Medical Association, American Public Health Association, American Cancer Society, National Cancer Institute, and more than 100 other credible national and international organizations all recognize the public health benefits of fluoridation to prevent tooth decay.

Recommendations

1. Oral health professionals must:
   - Be aware of the anti-fluoridation arguments and tactics used to scare or mislead the public
   - Have familiarity with credible studies that reaffirm the science behind fluoridation
   - Educate their patients, the public, and community leaders continually about the safety and benefits of fluoridation—it is a never-ending professional responsibility
2. In fluoridated communities, dental providers—including dental students—should tell each of their patients during a treatment plan and/or recall visit: "We are fortunate to live in a fluoridated community, as we have less tooth decay, infections, and lower dental bills."
3. In non-fluoridated communities, dental providers—including dental students—should tell each of their patients during a treatment plan and/or recall visit: "It is unfortunate that your/our community is not fluoridated, as you/we have more unnecessary tooth decay, infections, and higher dental bills."

   Dental schools and dental hygiene schools should also have their students educate their patients about fluoridation in this manner.
4. More dentists, dental hygienists, and other oral health advocates need to become involved in their local communities, local boards of health, and local school boards. Out of the 351 boards of health in Massachusetts, only four oral health professionals serve on their local board. We can, and we must, do better to educate our patients and the public on the safety and efficacy of fluoridation. ■

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More Information

Additional information on the status of fluoridation in Massachusetts, including a map of fluoridated communities, is availabled in the extended version of this article in the digital Journal. Read it at ***www.massdental.org/publications/journal***.

Figure 1. Fluoridation Map of Massachusetts Communities

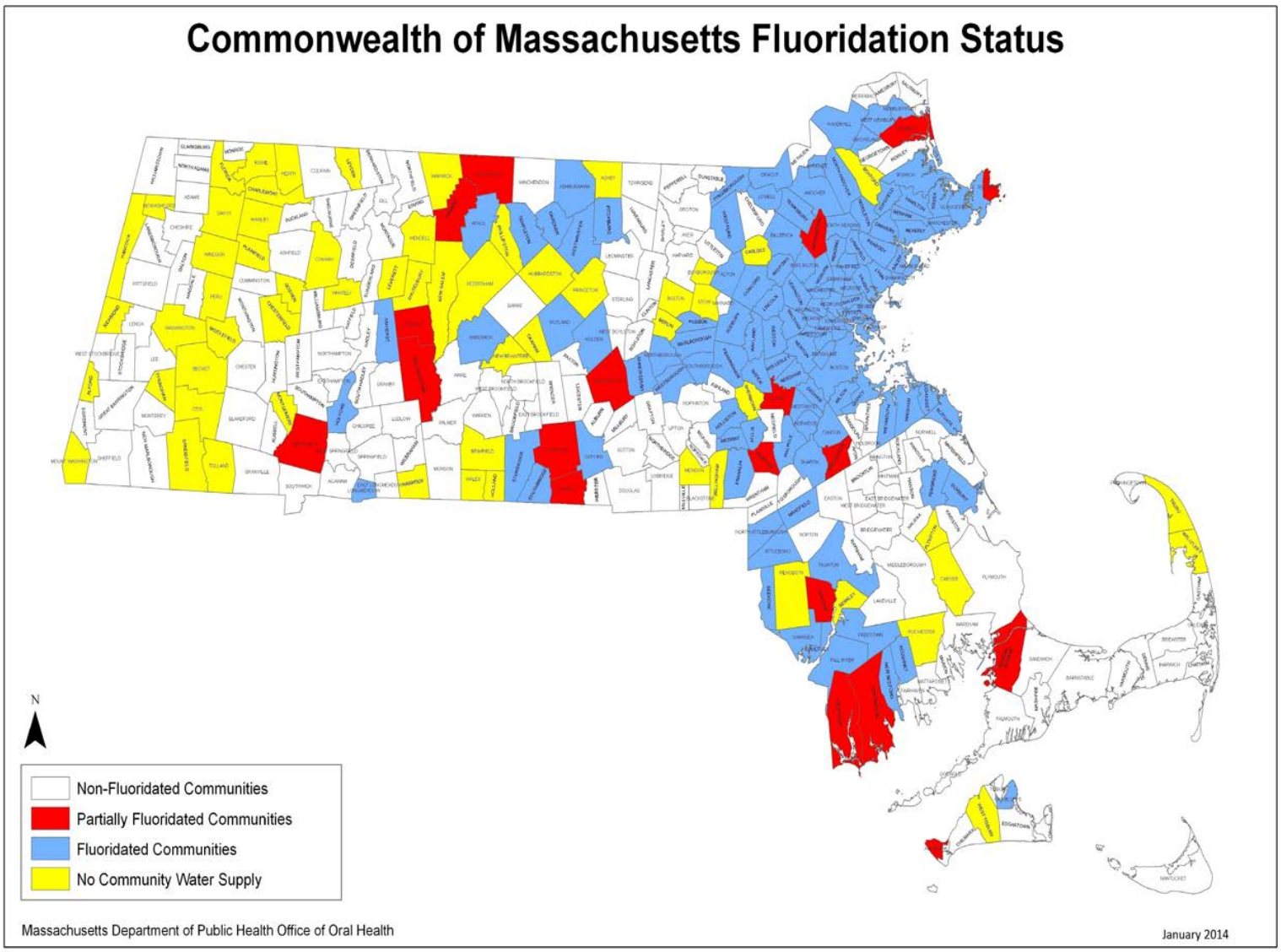

Table 6. National and International Organizations that Recognize the Public Health Benefits of Community Water Fluoridation for Preventing Dental Decay

Academy of Dentistry International	British Fluoridation Society
Academy of General Dentistry	Canadian Dental Association
Academy for Sports Dentistry	Canadian Dental Hygienists Association
Alzheimer's Association	Canadian Medical Association
America's Health Insurance Plans	Canadian Nurses Association
American Academy of Family Physicians	Canadian Paediatric Society
American Academy of Nurse Practitioners	Canadian Public Health Association
American Academy of Oral and Maxillofacial Pathology	Child Welfare League of America
American Academy of Orthopaedic Surgeons	Children's Dental Health Project
American Academy of Pediatrics	Chocolate Manufacturers Association
American Academy of Pediatric Dentistry	Consumer Federation of America
American Academy of Periodontology	Council of State and Territorial Epidemiologists
American Academy of Physician Assistants	Delta Dental Plans Association
American Association for Community Dental Programs	FDI World Dental Federation
American Association for Dental Research	Federation of American Hospitals
American Association for Health Education	Hispanic Dental Association
American Association for the Advancement of Science	Indian Dental Association (U.S.A.)
American Association of Endodontists	Institute of Medicine
American Association of Oral and Maxillofacial Surgeons	International Association for Dental Research
American Association of Orthodontists	International Association for Orthodontics
American Association of Public Health Dentistry	International College of Dentists
American Association of Women Dentists	March of Dimes Birth Defects Foundation
American Cancer Society	National Association of Community Health Centers
American College of Dentists	National Association of County and City Health Officials
American College of Physicians–American Society of Internal Medicine	National Association of Dental Assistants
	National Association of Local Boards of Health
American College of Preventive Medicine	National Association of Social Workers
American College of Prosthodontists	National Confectioners Association
American Council on Science and Health	National Dental Assistants Association
American Dental Assistants Association	National Dental Association
American Dental Association	National Dental Hygienists' Association
American Dental Education Association	National Down Syndrome Congress
American Dental Hygienists' Association	National Down Syndrome Society
American Dietetic Association	National Foundation of Dentistry for the Handicapped
American Federation of Labor and Congress of Industrial Organizations	National Head Start Association
	National Health Law Program
American Hospital Association	National Healthy Mothers, Healthy Babies Coalition
American Legislative Exchange Council	Oral Health America
American Medical Association	Robert Wood Johnson Foundation
American Nurses Association	Society for Public Health Education
American Osteopathic Association	Society of American Indian Dentists
American Pharmacists Association	Special Care Dentistry
American Public Health Association	Academy of Dentistry for Persons with Disabilities
American School Health Association	American Association of Hospital Dentists
American Society for Clinical Nutrition	American Society for Geriatric Dentistry
American Society for Nutritional Sciences	The Children's Health Fund
American Student Dental Association	The Dental Health Foundation (of California)
American Water Works Association	U.S. Department of Defense
Association for Academic Health Centers	U.S. Department of Veterans Affairs
Association of American Medical Colleges	U.S. Public Health Service
Association of Clinicians for the Underserved	Health Resources and Services Administration (HRSA)
Association of Maternal and Child Health Programs	Centers for Disease Control and Prevention (CDC)
Association of State and Territorial Dental Directors	National Institute of Dental and Craniofacial Research (NIDCR)
Association of State and Territorial Health Officials	World Federation of Orthodontists
Association of State and Territorial Public Health Nutrition Directors	World Health Organization

Community Water Fluoridation on the Internet and Social Media

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Abstract

Objectives: In the United States, 95 percent of teens and 85 percent of adults use the Internet. Two social media outlets, Facebook and Twitter, reach more than 150 billion users. This study describes anti-fluoridation activity and dominance on the Internet and social media, both of which are community water fluoridation (CWF) information sources.

Methods: Monthly website traffic to major fluoridation websites was determined from June 2011 to May 2012. Facebook, Twitter, and YouTube fluoridation activity was categorized as "pro-CWF" or "anti-CWF." Twitter's anti-CWF tweets were further subcategorized by the argument used against CWF.

Results: Anti-CWF website traffic was found to exceed pro-CWF activity five- to sixty-fold. Searching "fluoride" and "fluoridation" on Facebook resulted in 88 to 100 percent anti-CWF groups and pages; "fluoridation" on Twitter and YouTube resulted in 64 percent anti-CWF tweets and 99 percent anti-CWF videos, respectively. "Cancer, " "useless, " and "poisonous" were the three major arguments used against fluoridation.

Conclusions: Anti-fluoridation information significantly dominates the Internet and social media. Thousands of people are being misinformed daily about the safety, health, and economic benefits of fluoridation.

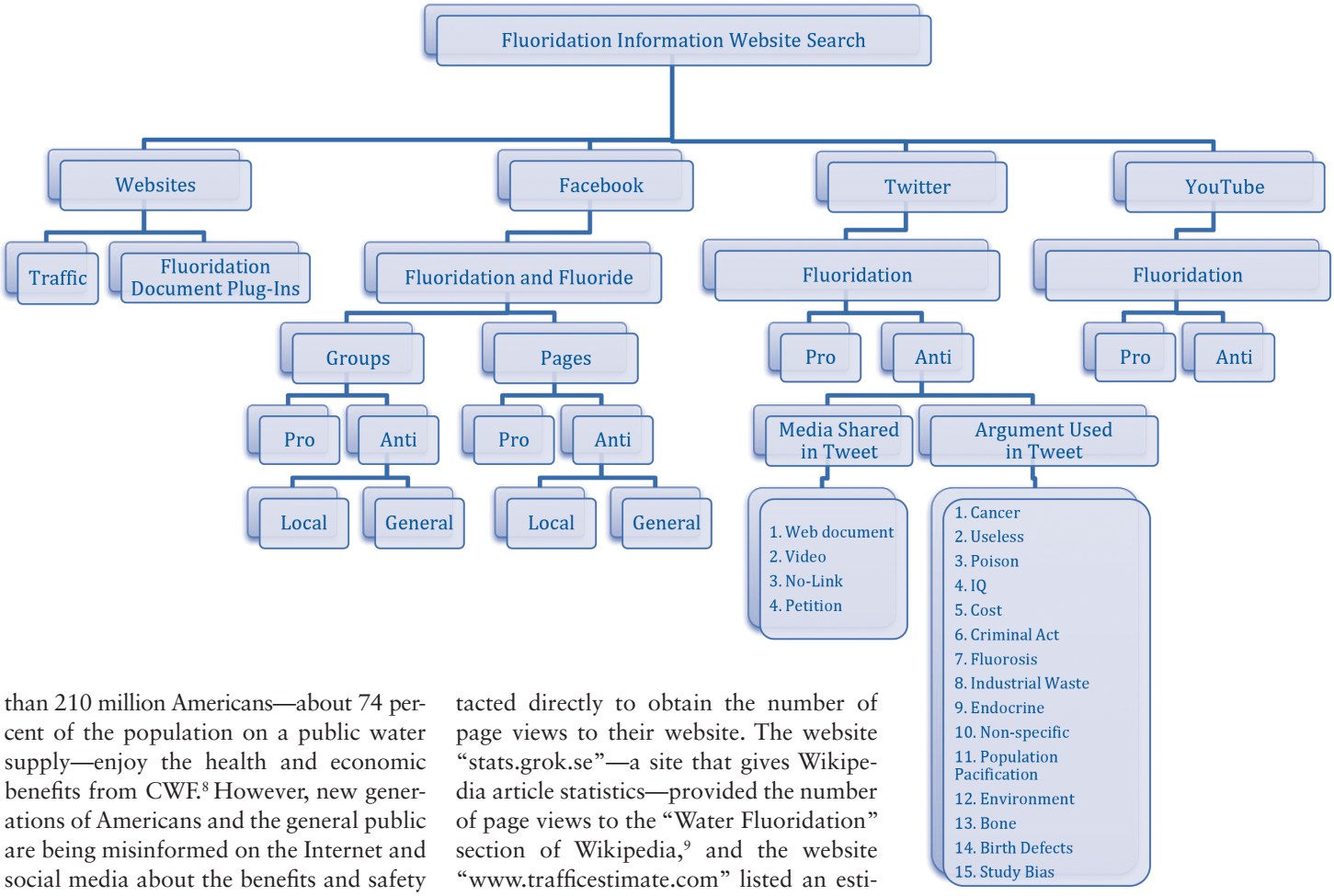
Introduction

To reach an audience of 50 million people, it took radio 38 years and television 13 years, but it only took the Internet under 4 years.[1] Facebook took only 8 years to reach more than 1 billion users, and Twitter took just 6 years to reach slightly under one-half billion users.[2-4] In the United States alone, Facebook and Twitter have 166 million and 140 million users, respectively.[3,4] The reach of the Internet and social media is unprecedented and almost unlimited.

According to the Pew Research Center, 97 percent of Americans 18–29 years old and 87 percent of adults over 18 use the Internet, with 72 percent of Internet users in 2013 utilizing it to look for health information.[5,6] Social media is used by 73 percent of adult American Internet users across the majority of all races, genders, income and education levels, geographic locations, and age groups, the only exception being for those over 65 (46 percent).[7]

Although community water fluoridation is a public health measure recognized by numerous reliable medical, dental, and health organizations as being safe and effective, most of the Internet and social media depict CWF negatively. Currently, more

Figure 1. Social Media and Fluoridation Study Design



than 210 million Americans—about 74 percent of the population on a public water supply—enjoy the health and economic benefits from CWF.[8] However, new generations of Americans and the general public are being misinformed on the Internet and social media about the benefits and safety of this proven public health measure. Anti-CWF activities online can potentially impact the continuation and implementation of CWF.

The purpose of this study was to determine the differences in pro- and anti-CWF traffic on the Internet and the differences in pro- and anti-CWF use of social media.

Methods

Monthly website traffic to major CWF websites was determined from June 2011 to May 2012. Facebook, Twitter, and YouTube fluoridation activity was categorized as pro- or anti-CWF, and Twitter's anti-CWF "tweets" were further categorized by the argument used against CWF. (See Figure 1.)

Website traffic to popular CWF websites and health organizations was determined by the number of page views to each website's fluoridation section on a monthly basis from June 2011 to May 2012. The American Dental Association (ADA) and the U.S. Centers for Disease Control and Prevention (CDC) were contacted directly to obtain the number of page views to their website. The website "stats.grok.se"—a site that gives Wikipedia article statistics—provided the number of page views to the "Water Fluoridation" section of Wikipedia,[9] and the website "www.trafficestimate.com" listed an estimate of the number of page views to the Fluoride Action Network (FAN) website, a leading anti-fluoridation organization.[10] The difference in number of page views between the ADA, CDC, and FAN was tested for statistical significance using ANOVA.

Fluoridation Information on Facebook

A cross-sectional search query of Facebook "Pages" and "Groups" was performed on April 3, 2012, using the search terms "fluoride" and "fluoridation." For each search term, the first 50 Groups and the first 50 Pages relevant to CWF were recorded as either pro- or anti-CWF and tested for statistically significant differences using a chi-square test of independence.

Fluoridation Information on Twitter

From March 1 to 14, 2012, and April 1 to 14, 2012, a search query of Twitter was conducted using the term "fluoridation." Data was collected from the same two time periods for two consecutive months to limit potential variation between months. The data set, which met the search requirements and relevance to CWF, were categorized as pro- or anti-fluoridation. The results were analyzed using a z-test.

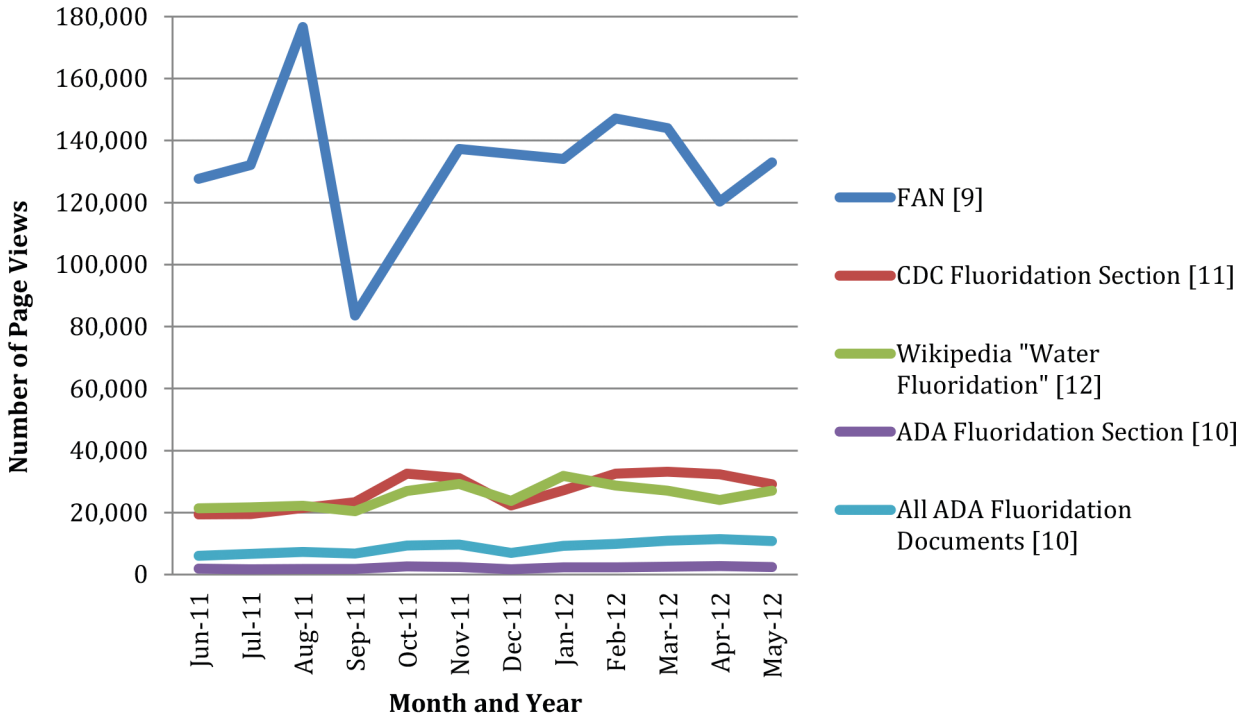
The tweets were then categorized into 15 mutually exclusive subject areas by the anti-fluoridation argument cited.

The categories were:
1. Cancer
2. Useless
3. Poison
4. IQ
5. Cost
6. Criminal Act
7. Fluorosis
8. Industrial Waste
9. Endocrine
10. Non-specific
11. Population Pacification
12. Environment
13. Bone
14. Birth Defects
15. Study Bias (Flawed/favoring fluoride)

Fluoridation Information on YouTube

On April 3, 2012, a search query using the term "fluoridation" was conducted on

Figure 2. Fluoridation Website Traffic by Number of Page Views Per Month, June 2011 to May 2012



YouTube. The resulting videos were categorized as pro- or anti-CWF and tested for a statistically significant difference using the chi-square test of independence.

Results

Website Traffic

An analysis of the top search results of CWF from the major search engines Google, Bing, and Yahoo shows four major contributors: FAN, the CDC's fluoridation section, the ADA's fluoridation section—as well as all ADA fluoridation information requests—and Wikipedia's "Water Fluoridation" article. (See Figure 2.)

FAN had statistically significantly more traffic to its website (***www.fluoridealert.org***) from June 2011 to May 2012 than the other leading fluoridation information websites ($p < 0.01$). (See Figure 2.) The organization also had an estimated average of 133,570 page views per month to its website ($\sigma = 23256$, $\alpha = 0.01$, CI: 110314-156826)[10]—60 times more than the ADA website's fluoridation section (***www.ada.org/fluoride.aspx***), which had a mean of 2,231 page views per month ($\sigma = 391$, $\alpha = 0.01$, CI: 1839-2622), 15 times more than all ADA fluoridation requests on its website, which had a mean of 8,794 page views per month ($\sigma = 1884$, $\alpha = 0.01$, CI: 6910-10677), and 5 times more than the CDC's fluoridation section of its website (***www.cdc.gov/fluoridation***), which had a mean of 27,040 page views per month ($\sigma = 5456$, $\alpha = 0.01$CI: 21584-32496).[11, 12]

Comparing the website traffic of informative CWF websites reveals much greater anti-CWF dominance on the Internet. Website traffic is indicative of where people search for CWF information, and which tends to contain static content, whereas social media provides relatively more recent information and is an interactive resource.

Facebook and Fluoridation

The first 50 Facebook Groups and Pages regarding CWF using the search terms "fluoride" and "fluoridation" were sorted on April 3, 2012, into pro- or anti-CWF categories. (See Table 1.) All 50 Groups and Pages using the term "fluoride" were anti-CWF. The term "fluoridation" resulted in a total of 49 Groups relevant to community water fluoridation, and all were anti-fluoridation. Of the 50 "fluoridation" Pages, 44 were anti-CWF, none were pro-CWF, and six were neutral links to Wikipedia articles regarding CWF.

Twitter and Fluoridation

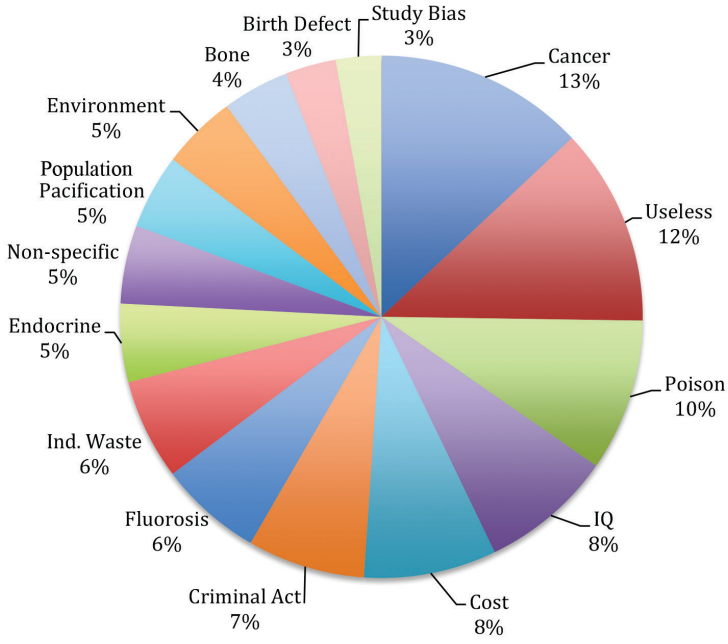
A Twitter search query was conducted from March 1 to 14, 2012, and from April 1 to 14, 2012, using the search term "fluoridation" to determine the general attitude toward CWF on Twitter. The tweets retrieved were first grouped as pro- or anti-CWF (see Table 2) and then by anti-CWF argument used (see Figure 3).

The search term "fluoridation" resulted in 657 total tweets in the first two weeks of March and 363 in the first two weeks of April for a total of 1,020.

Table 1. Fluoride and Fluoridation Facebook Groups and Pages—Top 50 Search Results, Conducted April 3, 2012

Fluoride	Anti	Pro
Groups	50	0
Pages	50	0
Fluoridation	**Anti**	**Pro**
Groups	49	0
Pages	44	0
Total	**193**	**0**

Figure 3. Frequency Distribution of the 15 Most Common Anti-Fluoridation Tweet Arguments for March 1–14, 2012, and April 1–14, 2012



Note: *N* = 1,815, because some tweets have more than one argument.

(See Table 2.) For the first two weeks of March, 367 tweets (56 percent) were anti-CWF and 290 (44 percent) were pro-CWF. In the first two weeks of April, 343 tweets (95 percent) were anti-CWF and 20 (5 percent) were pro-CWF. This resulted in a total of 710 (70 percent) anti-CWF and 310 (30 percent) pro-CWF tweets for the four weeks, with a statistically significant difference of more anti-CWF activity ($p < 0.001$).

Out of the 290 total pro-CWF tweets in the first two weeks of March 2012, 281 (97 percent) were linked to an article in the March 2, 2012, issue of the *New York Times* titled "In New Jersey, a Battle Over a Fluoridation Bill, and the Facts."

The anti-CWF tweets were further grouped by the argument used against CWF. (See Figure 3.) "Cancer" was the most frequently cited argument (13 percent), followed by "Useless" (12 percent), and "Poison" (10 percent). Considering that cancer is the second most common leading cause of death, it is not surprising that it is used so often in anti-CWF arguments.[13]

YouTube and Fluoridation

Of the three social media outlets, YouTube had the largest pro- and anti-CWF discrepancy. On April 1, 2012, a search query of "fluoridation" resulted in 3,690 videos. Not one of the videos retrieved was pro-CWF and 3,645 (99 percent) were anti-CWF. The 45 remaining videos were not related to community water fluoridation. Because no videos retrieved were pro-CWF, a chi-squared test was not performed.

Discussion

Anti-CWF websites are visited 5 to 60 times more frequently than pro-CWF websites, which means the public retrieves most of its online information about CWF on anti-CWF websites. Regarding social media, all Facebook Groups and Pages were against CWF, the majority of tweets on Twitter were anti-CWF, and the majority of YouTube videos were anti-CWF, thereby demonstrating that anti-CWF organizations use networking on social media much more often and more effectively than do pro-CWF organizations. How this translates to implementation or discontinuation of CWF is unknown. During the study period in March 2012 when there was a favorable article on CWF in a reputable newspaper (i.e., the *New York Times*), there were more positive tweets for CWF.

More people are now using social media to convey personal health information and sentiments, which can significantly influence others on a daily basis.[14,15] Health professionals must recognize this and adapt to social networking to not only better inform the public about CWF, but also to collect data and study attitudes about CWF. In addition, it is the responsibility of public health professionals to adapt to new forms of media to educate the public to improve community health at the national, state, and local levels. Since the study was done, more reputable fluoridation information organizations, including the CDC and ADA, are using social media to convey pro-CWF information.

Future Action: Improve Social Media Use and Better Inform Patients

The goal of this article is to bring awareness to the dental, health, and public health professions to show that the Internet and social media are used much more effectively by anti-CWF organizations than by pro-CWF organizations. Hopefully, this will provide an impetus for health professionals providing fluoridation information to become more effective at optimizing their website presence on the Internet and in using social media. Additionally, proponents of fluoridation need to use social media resources to spread the word of upcoming fluoridation events, news, and reliable information to social media users. Individual dental practitioners and health providers also need to educate their patients, as well as their legislators and other policy makers, about fluoridation so they will not be misinformed by anti-fluoridation information.[16]

Continued on page 36

Table 2. Twitter Fluoridation Search Results for March and April 2012

	March 1–14, 2012	April 1–14, 2012	Total
Pro-CWF	290* (44 percent)	20 (5 percent)	310 (30 percent)
Anti-CWF	367 (56 percent)	343 (95 percent)	710 (70 percent)
Total	**657**	**363**	**1,020**

***281 of the pro-CWF tweets in March cited the *New York Times* article from March 2, 2012, "In New Jersey, a Battle Over a Fluoridation Bill, and the Facts."**

Conclusion

The Internet and social media are misinforming thousands of people daily about the safety, health, and economic benefits of community water fluoridation. The leading anti-fluoridation website had 5 to 60 times more traffic than the two leading pro-fluoridation health organizations. All Groups and Pages analyzed on Facebook were against fluoridation, while 99 percent of the videos searched on YouTube and the majority (70 percent) of fluoridation tweets on Twitter were anti-CWF fluoridation.

Pro-fluoridation organizations need to have a better presence on the Internet and utilize social media to educate the American people about the facts on fluoridation. Individual dental and health practitioners need to educate their patients about fluoridation, so their patients will not be easily misguided by misinformation on the Internet and social media. ■

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