



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.

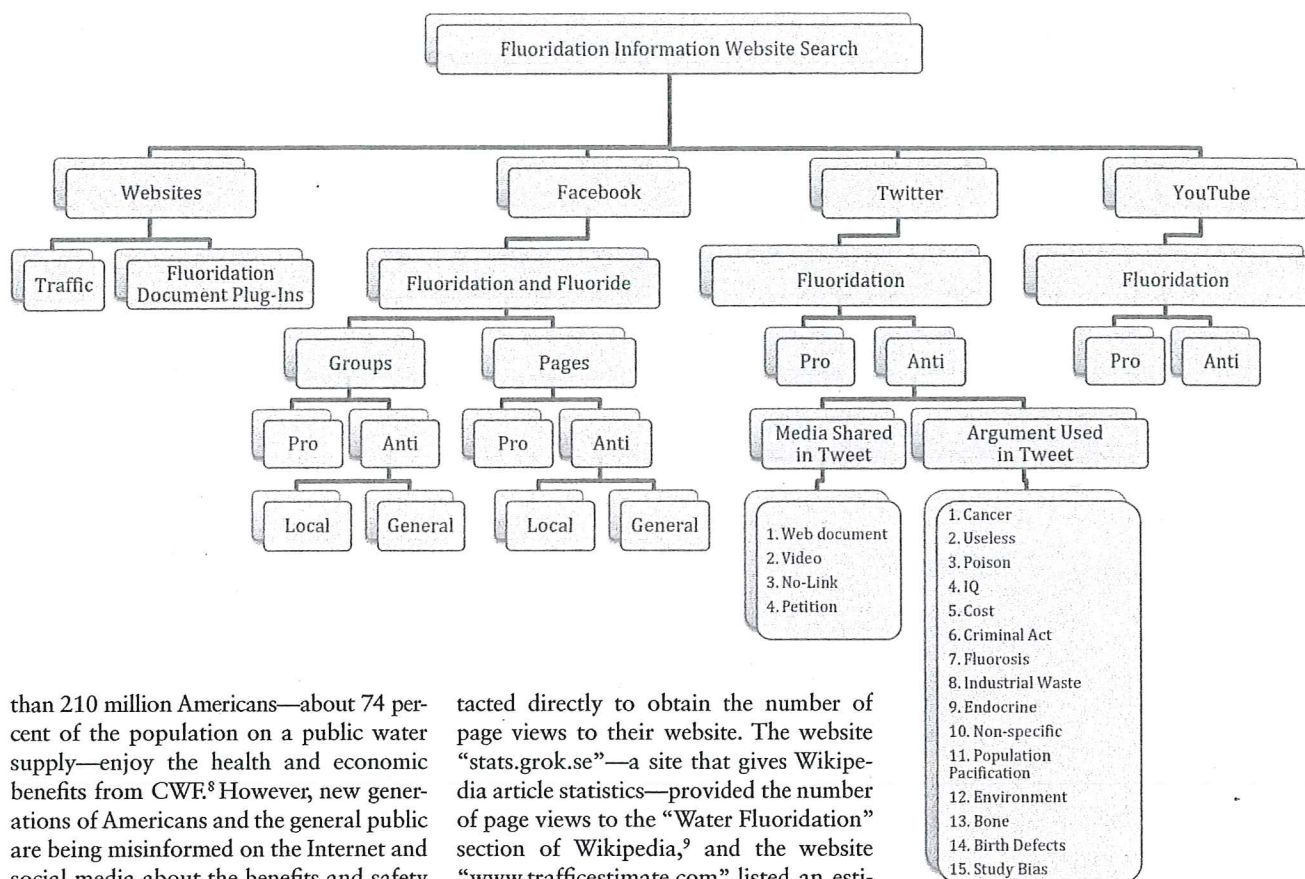
Introduction

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 con-

tacted 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.trafficeestimate.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.

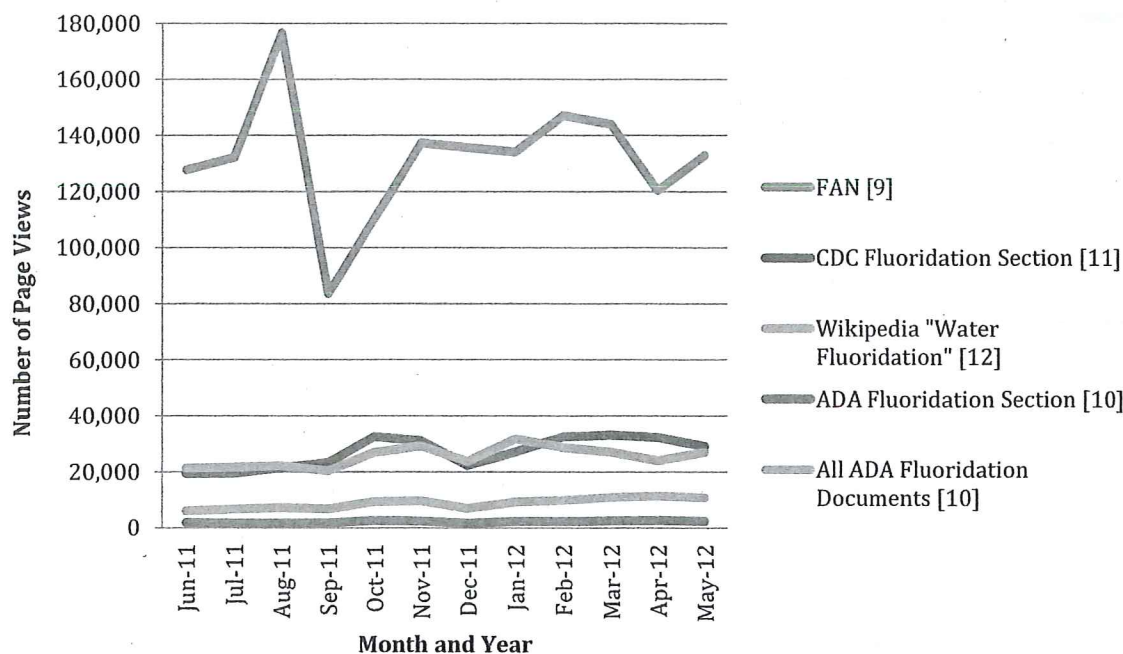
The categories were:

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).

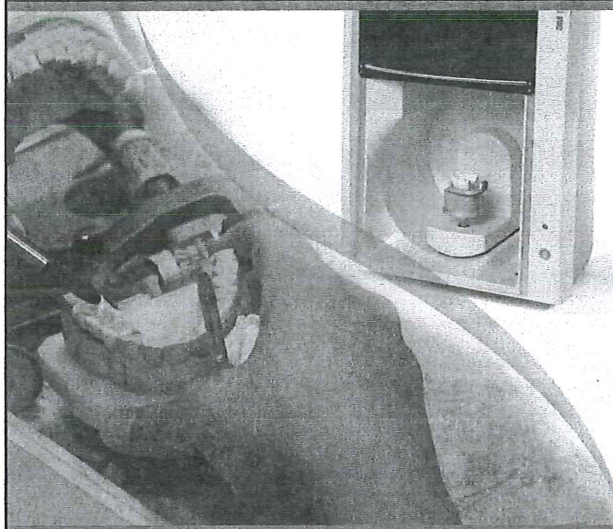
The search term "fluoridation" resulted in 657 total tweets in the first two weeks of March and 363 in the first two weeks of April for a total of 1,020.

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

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Conclusion

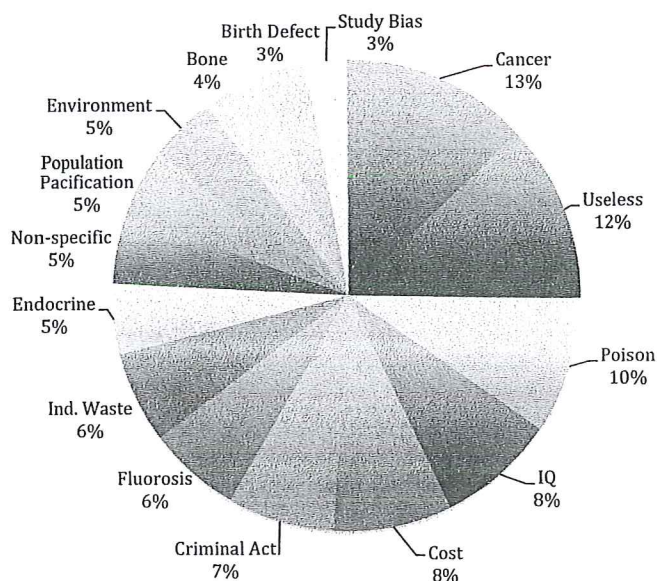
The Internet and social media are misinforming thousands of people daily about the safety, health, and economic benefits of community water fluoridation. The leading anti-fluoridation website had 5 to 60 times more traffic than the two leading pro-fluoridation health organizations. All Groups and Pages 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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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

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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.”