

INFORMATION REPORT

TO: Mayor and Members Board of Health	WARD(S) AFFECTED: CITY WIDE
COMMITTEE DATE: April 16, 2012	
SUBJECT/REPORT NO: Water Fluoridation: New Data and Recent Developments BOH08024(c)(City Wide)	
SUBMITTED BY: Elizabeth Richardson, MD, MHSc, FRCPC Medical Officer of Health Public Health Services Department	PREPARED BY: Dr. Chris Mackie (905) 546-2424 Ext. 5581
SIGNATURE:	

Council Direction:

The Board of Health, at its meeting on April 26, 2011 directed “That staff be directed to provide annual reports to the Board of Health on Water Fluoridation.”

Information:

Previous reviews by Public Health Services of the research on water fluoridation determined that water fluoridation is safe and effective in preventing dental cavities (caries)^{1,2}. For this report, a systematic review was conducted of the peer-reviewed medical literature published since the last Public Health Services report on water fluoridation in 2011. A basic environmental scan was also conducted to identify recent decisions by municipal bodies to fluoridate or not to fluoridate drinking water supplies as well as any potential policy changes at the provincial or national level. Details of findings are below; background information is in the final section of this report.

Summary:

- Some municipalities in Ontario and elsewhere made decisions to begin or continue water fluoridation and others made decisions to discontinue.

- A search of the scientific literature published since 2011 supports that fluoride is an effective and cost-efficient method to prevent dental caries. No study identified new harms.
- Health Canada raised its recommended optimal concentration of fluoride in drinking water for health benefits to 0.7 mg/L³. Hamilton water is fluoridated to 0.6 mg/L³.
- Recent analysis indicates that if water fluoridation was discontinued in Hamilton, this would translate into 180,000 additional cavities in Hamilton over 10 years.

Part 1: Municipal Water Fluoridation Decisions

These are communities that have made decisions about water fluoridation during the past 12 months. There is no registry for such events, so this list may be incomplete. For a list of communities that have made decisions prior to this, please see our 2011 report, BOH 08024(b)¹.

a) Some communities have introduced or continued adding fluoride to their drinking water:

- Halton Regional Councillors (Ontario) voted in favour of continuing fluoridation after 10 hours of presentations from delegates (January 2012)⁴.
- Peel Region Council voted to continue to carry on with the 40-year practice of fluoridated drinking water after hearing arguments from more than 20 delegates representing both sides of the fluoride debate (April 2011)⁵.
- The Toronto Core Services Review KPMG Report suggested that within Toronto Water, the city should consider eliminating fluoridation of city water⁶. But it said the potential savings are low at five per cent of the cost of fluoridation, and that “It is very likely that dental health of Toronto residents would decline.” Toronto Public Health board members voted unanimously for the continued fluoridation of the water (April 2011)⁷.
- Maquoketa, Iowa City Council members agreed to keep fluoride in the city's water (January 2012)⁸.
- The Pinellas Park (Florida) City Council voted unanimously in favour of adding fluoride to community water supplies (January 2012)⁹.
- Arkansas passed the Arkansas Act 197 which mandates that water systems serving 5,000 or more people must fluoridate their water (February 2011)¹⁰
- Port Macquarie-Hastings joined 95% of New South Wales (Australia) in delivering fluoridated water through its water supply system (February 2012)¹¹.

b) Some communities have removed fluoride from their drinking water systems:

- Amherstburg, Ontario voted to remove fluoride from the drinking water system. The town suspended water fluoridation awaiting information on upgrades and repairs to the system and methodology in providing fluoridation (April 2011). In January 2012, the decision was sustained, when town council passed a moratorium against adding fluoride¹².
- Lakeshore (which neighbours Amherstburg) town council decided to stop adding fluoride at the Stoney Point water treatment plant (November 2011)¹³.
- Williams Lake, BC and Lake Cowichan, BC voted separately to end fluoride (November 2011)¹⁴.

Part 2: Review of Scientific Literature

Research Question and Search Strategy

We conducted a review of the medical literature to identify if there was any new data about the safety or effectiveness of water fluoridation published since our last review in 2011. Our main research questions were:

- Is water fluoridation still beneficial for dental health in the current context?
- Is there any new evidence suggesting that water fluoridation is harmful?

A summary of our search strategy is found in Table 2: Search Strategy.

Our search for primary research studies and reviews of research studies about “water fluoridation” generated 14 articles in Medline and 70 articles in EMBASE. Three of these studies are discussed below. Also discussed below is a Canadian review. Studies not discussed did not relate to community water fluoridation, were not applicable to the Canadian setting, were general reviews of the topic with no new primary research information, or were policy statements rather than scientific research.

An Australian study¹⁵ evaluated the effectiveness of public water fluoridation in reducing children’s dental disease by comparing caries experience in areas with negligible fluoride concentrations in water and optimally fluoridated areas. Caries in baby teeth and adult teeth (deciduous and permanent teeth) were respectively 28.7% and 31.6% higher in low-fluoride communities.

Another Australian study¹⁶ modelled the cost-effectiveness of fluoridation of drinking water for children less than 15 years of age in Brisbane. If fluoridation was implemented there would be a savings of \$10,437 disability-adjusted life-years (DALYS, i.e., years of life lived with dental disability) and a substantial cost savings of \$666 million Australian dollars for state and private expenses.

An American study¹⁷ sought to estimate the association between community water fluoridation (CWF) and tooth loss at various stages of life. It found that CWF at birth was associated with having 0.26 more teeth 20 years later. The impact was larger for individuals of lower socio-economic status.

At the request of the Public Health Agency of Canada, Dr. McLaren, of the University of Calgary, published (April 2011) a synthesis of the literature pertaining to drinking water fluoridation in Canada¹⁸. The review focused on literature in academic and professional journals. The main findings include as follows:

- There is evidence beginning as early as 1945 for the effectiveness of drinking water fluoridation in the prevention of dental caries.
- Research consistently shows an association between exposure to drinking water fluoridation and increased risk of fluorosis. This illustrates the importance of monitoring fluoride concentrations, particularly in rural areas.
- Water fluoridation is an effective method to provide fluoride to all, including those who cannot afford or access dental care and other sources of fluoride. As such it is a practical way to address oral health inequities.
- Two empirical studies of public opinions about fluoridation suggested that the majority of various Canadian populations are supportive of, or at least not opposed to, fluoridation. This was echoed by a survey (2009) in the Region of Halton which showed the 64 percent of adults supported adding fluoride to the water¹⁹.

Part 3: New Guidelines and Impact of Fluoridation in Hamilton

a) New Health Canada Guidelines for Fluoride in Drinking Water:

Health Canada (June 2011) released its publication “Guidelines for Canadian Drinking Water Quality: Guidelines Technical Document Fluoride”. This placed the optimal concentration of fluoride in drinking water for health benefits at 0.7 mg/L³. The U.S. Department of Health and Human Services did likewise²⁰. Currently, the City of Hamilton sets the concentration at 0.6 mg/L¹.

The Guideline also establishes the maximum acceptable concentration (MAC) for fluoride in drinking water as 1.5 mg/L to protect from mild fluorosis. This was based on the segment of the population most at risk for developing dental fluorosis, children under 4. Fluorosis is a condition caused by a child receiving too much fluoride during tooth development. In its mildest form, fluorosis may affect the look of a tooth but will not affect its function. Mild fluorosis can lead to white stains or mottling on the teeth²¹ and is not noticeable to most people.

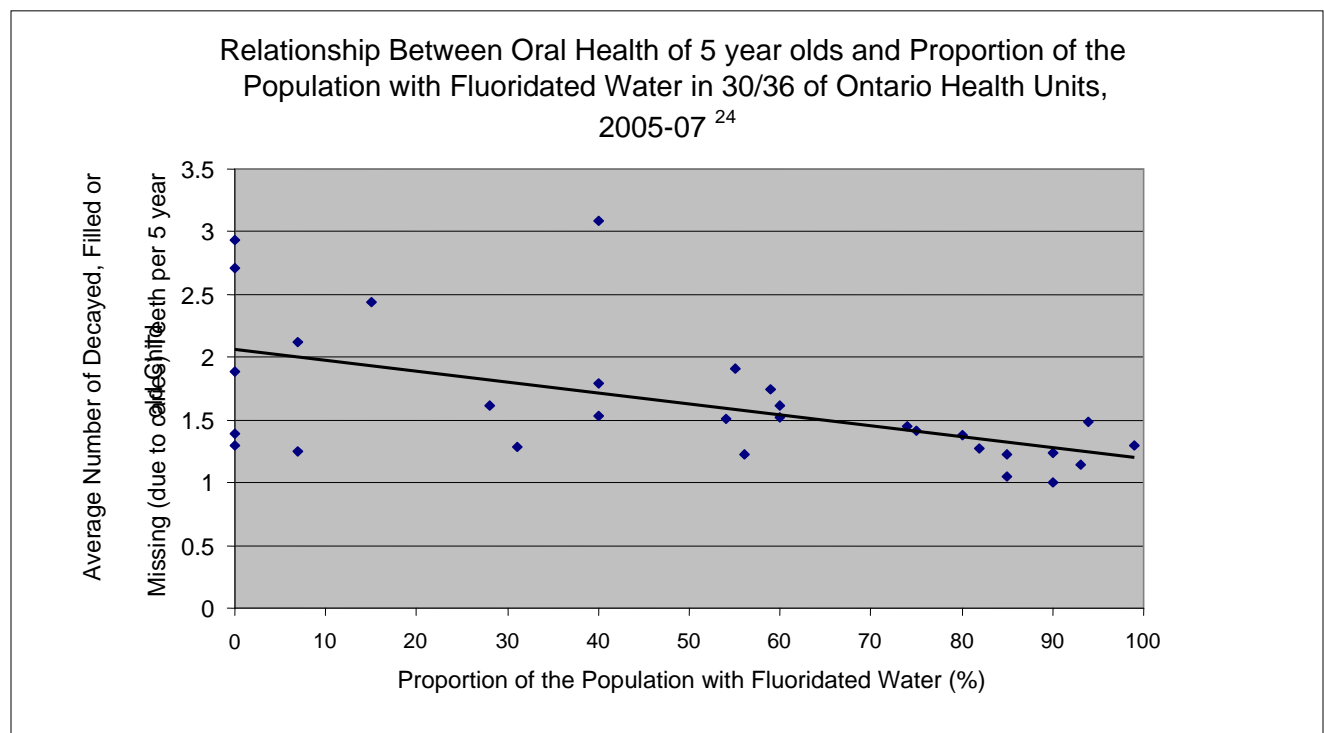
This guideline reaffirms that evidence does not support a link between exposure to fluoride in drinking water at or below 1.5 mg/L and any adverse health effects. The guideline specifically states that this level has not been associated with cancer, toxic effects to the immune, reproductive, genetic or neurological system nor been linked to intelligence quotient deficits³.

b) Impact of Removing Fluoride from Community Water Systems:

Removing fluoride from community water systems has been shown to increase the prevalence of caries within the community. In Dryden²², dental caries increased 26% overtime after fluoride was removed from the water in 2001. Grade 5 students were screened for dental caries in the year prior to discontinuing fluoride and counts were compared to current rates²³.

As shown in Figure 1 below, communities in Ontario with higher rates of water fluoridation have better teeth. This data, from the 2008 Ontario Association of Public Health Dentistry Survey²⁴ of Ontario Health Units, looked at the relationship between oral health of 5-year-olds and the percentage of the population with fluoridated water by Ontario public health units.

Figure 1



In 2002 the US Task Force on Community Preventive Services, supported by the Centers for Disease Control, systematically reviewed the literature to review interventions to promote and improve oral health²⁵. Starting community water

fluoridation decreased dental caries among children by a median of 50.7% during 3 to 12 year follow-up. Stopping community water fluoridation was associated with a median 17.9% increase in caries over 6 to 10 year follow-up.

The 2010 Canadian Health Measures Survey¹⁷ reports that the average Decayed, Filled, or Missing Teeth (DFMT) for adolescents in Canada is 2.49. DFMT is an indicator of the severity of disease. For example, a DFMT of 4 denotes that four teeth are decayed, filled or missing.

Applying this information to Hamilton, estimating conservatively 2 cavities per person and Hamilton's population of 500,000, there would be 1 million cavities currently. If we consider this 18% increase over 10 years to apply, again conservatively, only to the 385,000 people in Hamilton who live on homes serviced by the Woodward Avenue Water Treatment plant, we can estimate the number of cavities that would be caused over the next 10 years if fluoridation were discontinued in Hamilton.

Based on this information, an additional 138,600 additional cavities would occur in Hamilton residents over the next 10 years if fluoride was removed from Woodward water supply. This estimate is consistent with those derived from the Ontario data shown in Figure 1.

Background:

Fluoride is a mineral that is found in soil, water and various foods. It has a positive effect on oral health by making the tooth more resistant to decay. Fluoride can also prevent or even reverse tooth decay that has already started¹⁷.

Water fluoridation is the practice of adding small amounts of fluoride to municipal water supplies in order to prevent dental caries (cavities). Hamilton has fluoridated its municipal water supply since two referendums in the 1960's indicated public support. The cost of water fluoridation is less than \$3 per person per year, and is paid by users through the capital component of the water rate.

In Ontario, the Fluoridation Act and the Municipal Act define various processes by which a municipality may initiate or discontinue water fluoridation. The decision to fluoridate the community water system is left to the municipality, unless 10% of the electorate petitions for a referendum²⁶.

As of 2009, over 70% of the population of Ontario had access to fluoridated water²⁷. Water fluoridation has been described as one of the ten great public health achievements of the 20th century²⁸, in part because it helps improve the oral health of the entire population, including those who cannot afford dental care. Water fluoridation is supported by over 90 Canadian and international medical and dental organizations.

Table 1: Sample of organizations supporting water fluoridation to reduce occurrence of tooth decay

Canada	International
Health Canada Canadian Medical Association Ontario Medical Association Canadian Public Health Association Canadian Paediatric Society Association of Local Public Health Agencies, Ontario Ontario Dental Association Canadian Dental Hygienists Association	World Health Organization (WHO) Centers for Disease Control and Prevention, USA Pan American Health Organization European Organization for Caries Research American Dental Association British Medical Association British Dental Association Australian Dental Association

Like many substances, acute or chronic exposure to large doses of fluoride can have health risks. However, water fluoridation at the low levels used in Canada is considered safe, and is associated primarily with very mild and mild fluorosis. Fluorosis is a condition caused by a child receiving too much fluoride during tooth development, i.e., under the age of 6. In the mild form that may occur at low levels of fluoride exposure such as through fluoridated drinking water, fluorosis may affect the look of a tooth but will not affect its function. For example, mild fluorosis can lead to white stains or mottling on the teeth¹⁷. This occurs in less than 20% of the Canadian population²⁹ and is not noticeable to most people.

To produce serious health effects, extremely large amounts of water would need to be consumed. See Figure 2 for a summary of estimates. Many claims have been made that water fluoridation causes serious health risks, but existing scientific evidence refutes these claims.

Figure 2: Exposure required for various health impacts

Exposure	Required quantity of water fluoridated at 0.6 mg/L (Hamilton water)	Health Impact
Drinking water at 2.0 mg/L	Child (under the age of 8 years) consumes 17 glasses of water daily for a prolonged period,* and swallows no toothpaste†	Mild dental fluorosis
Drinking water at 8.0 mg/L	Child or adult consumes 67 glasses daily for a prolonged period*	Skeletal fluorosis
16 mg oral/kg body weight	A 20 kg child drinks 2666 glasses of water, or 333 jugs of orange juice (2 litre) in one sitting*	Acute lethal dose (child)
2,500-10,000 mg oral	An adult male would need to consume at least 4167 litres of water (28 bath tubs) in one sitting*	Acute lethal dose (adult)

* Water consumption of this magnitude would result in severe illness directly from the effects of the water before approaching levels required for severe fluoride effects.

† Toothpaste contains concentrated fluoride. Swallowing toothpaste poses the greatest risk of fluorosis.³⁰ Table adapted from UK MRC³¹ and TPH Reports.³²

In summary, water fluoridation is a safe way to improve dental health. Fluoridation is inexpensive and is a way to provide health protection for the entire population, regardless of income, age or access to dental care.

Search Strategy

Table 2: Search Strategy

Date of Search:	March 1, 2011
Databases:	PubMed, Embase (peer-reviewed scientific health literature)
Search Term:	“water fluoridation”
Date Span Searched:	2011 – March 1, 2012
Search Limits:	<p>(Pubmed) Include the following study types:</p> <ul style="list-style-type: none"> • Clinical Trial • Meta Analysis • Review • Comparative Study • Evaluation Study <p>(Embase) Include the following study types:</p> <ul style="list-style-type: none"> • Evidence Based Medicine • Clinical Trials • Clinical Queries
Relevance Criteria:	Focused on primary research studies or reviews of primary research devoting attention to safety or effectiveness of water fluoridation.

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