

The Real Cost Of Removing Water Fluoridation

A Health Equity Impact Assessment

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The Wellesley Institute engages in research, policy and community mobilization to advance population health.

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Executive Summary

Several municipalities have stopped water fluoridation and others may be considering it. This will have adverse and inequitable health impacts.

Fluoride is scientifically proven to prevent tooth decay and to aid in achieving and maintaining good oral health. Water fluoridation is a safe and cost-effective public health measure that is recommended by over 90 medical, dental, and health organizations at the national and international level.

Tooth decay is one of the most prevalent chronic diseases that result in pain, tooth loss, facial disfigurement, and impaired oral functioning. Rates of tooth decay disproportionately impact individuals with lower income, children and seniors. Water fluoridation is relevant even with the widespread availability of fluoridated toothpastes and mouthwashes because one quarter of Canadians do not have regular tooth brushing routines, nor can all go to dentists for fluoride treatment. Given the unreliability of consistent brushing and personal oral hygiene, universal programs such as water fluoridation provide protection for all.

Water fluoridation is also cost-effective. Treating tooth decay is costly to the individual and the public, not only through health insurance premiums and dental services but also through the indirect costs of time lost at work or school because of tooth pain or seeking dental care. A cost analysis by Public Health Services in Hamilton, Ontario, compared potential methods to deliver fluoride to the city's population and determined that fluoridating water would be the most cost-effective method.

The adverse impacts of removing water fluoridation will be inequitably distributed. Lower income and other health-disadvantaged populations experience poorer oral health overall and significant barriers to dental care. As a result, the removal of water fluoridation will be particularly damaging for health-disadvantaged populations and will worsen oral health inequities.

Due to the oral health benefits of fluoride and the safe, equitable, and cost-effective nature of water fluoridation, Wellesley Institute recommends that water fluoridation be continued by municipalities or instituted if it has not been. The provincial government also has a key role to play in ensuring that individuals have access to fluoridated water wherever they live and enabling municipalities across the province to be able to deliver it by subsidizing costs where necessary.

Introduction

Fluoridation of municipal water systems is a population health intervention that provides dental benefits for everyone who uses the water source. It prevents tooth decay and aids in achieving and maintaining good oral health for all. The health benefits of water fluoridation are scientifically proven and recommended by Health Canada and over 90 medical, dental, and health organizations at the national and international level.¹ Removing water fluoridation will result in adverse and inequitable oral health impacts.

The Policy Issue

In Canada, local governments decide on whether or not the drinking water is fluoridated. Rates of water fluoridation in Ontario – at 75.9% – are the highest of all the provinces.² Fluoridation of the water supply has recently become a contentious issue in many Ontario municipalities. The removal of water fluoridation in municipalities such as Windsor³ and Waterloo,⁴ as well as the ongoing debate in other regions are a cause of concern for the oral health of Ontarians.

Fluoride reduces dental caries (cavities or tooth decay) by making tooth enamel more resistant to decay and by aiding the reparation of a tooth at its early stages of decay.⁵ Fluoridation of drinking water at recommended concentrations is a safe and cost-effective public health measure proven to have positive effects on teeth and oral health.⁶ Even with the widespread availability of fluoridated sources such as toothpastes and mouthwashes, water fluoridation still plays an important role in maintaining good oral health.⁷ Removing water fluoridation will have an adverse effect on the general population; water fluoridation serves as a universal backup to inconsistent or inadequate tooth brushing and irregular or missed dental visits. Lower income and other health-disadvantaged populations face greater prevalence and impact of tooth decay and less equitable access to dental care including fluoride treatment. As a result, discontinuing water fluoridation will further worsen significant existing oral health inequities.

Applying A Health Equity Lens

Policy decisions made far beyond the health care system can have significant health implications. Decisions about social policy, housing, income, education, or other underlying determinants of health can create negative health outcomes that affect the population as a whole, but vulnerable or marginalized populations are often more severely impacted than other groups. It is therefore important to consider health and health equity when making policy decisions that may affect the determinants of health.

Health Equity Impact Assessment (HEIA) is a tool used to analyze a new program or policy's potential impact on health disparities and/or on health-disadvantaged populations. A simple health equity question should be applied to all policy decisions: could the proposal have an inequitable impact on some groups, and, if so, which groups would be disproportionately affected? If there is a health impact, HEIA then facilitates policy-makers and planners to make changes to the planned policy to mitigate adverse effects on the most vulnerable and to enhance equity objectives. Finally, the HEIA tool assists in setting targets and measurements to determine the policy's success.⁸

Background

Fluoride promotes oral health in a variety of ways:

- Fluoride in saliva or plaque fluid decreases the rate of enamel (outer layer of the tooth) demineralization and increases remineralization in early cavities;⁹
- Fluoride inhibits the process that metabolizes sugar to produce acid;¹⁰ and
- Ingesting small amounts of fluoride during early stages of tooth development strengthens tooth enamel, decreasing the likelihood of cavities later in life.^{11,12}

Globally, common fluoridation methods include the fluoridation of water, salt, or milk; fluoridated toothpastes and mouthwashes; and fluoride treatment at the dentist.¹³ Some research suggests that maintaining a constant, low-level of fluoride in the mouth is the most effective measure in cavity prevention, as opposed to infrequent high-concentration fluoride gels, foams, and varnishes administered by professionals.¹⁴ Water fluoridation is a method that promotes continuous low-levels of fluoride in the mouth.

Tooth Decay

Tooth decay is one of the most prevalent chronic diseases.¹⁵ In Canada, 57% of children, 59% of adolescents, and 96% of adults have been affected by tooth decay.¹⁶ Both transmissible and infectious,¹⁷ cavities weaken teeth and can result in pain, tooth loss, facial disfigurement, and impaired oral functioning.^{18,19} In turn, chewing problems lead to the inability to consume a variety of different foods, leading to poor nutritional status and gastrointestinal disorders.^{20,21} Tooth decay is an important factor in an individual's oral health, which is linked to serious conditions such as cardiovascular disease, diabetes, low birth weight babies, respiratory infections, osteoporosis, and rheumatoid arthritis.²² If severe, tooth loss and poor oral health can threaten job security and economic productivity,²³ and in turn, these stressors can impact overall physical and mental health.

Rates of tooth decay are not evenly distributed across the population. Compared to higher income Canadians, lower income Canadians have worse rates of decayed, missing, or filled teeth (DMFT) among adolescents; higher numbers of decayed (unfilled) and missing (due to disease) teeth among adults; and a greater prevalence of untreated coronal and root caries.²⁴ In Ontario, the proportion of people in the lowest-income group (those with household incomes under \$15,000) who have experienced tooth loss in the last year due to dental decay and/or gum disease is more than four times higher than those of the highest-income group (those with household incomes of \$80,000 or higher).²⁵

Children are also particularly at risk for tooth decay.²⁶ Tooth decay is the second most common cause of school absenteeism, and five times more common than asthma in children aged 5-17.²⁷ In 1999, 30% of 5-year-olds and 40% of 13-year-olds in Toronto had cavities, which is similar to the rate in Ontario.²⁸ Tooth decay may affect the growth of adult teeth and contribute to childhood obesity.²⁹ In addition, dental decay, particularly when serious, affects children's performance at school and their self worth.³⁰ Among all children, tooth decay is inequitably distributed; it is highly prevalent among Aboriginal children (84%), children living in families with public insurance (61%), and where the highest level of education obtained by parents or guardians is less than a degree or diploma (60%).³¹ Early Childhood Tooth Decay (ECTD)

usually involves the four front teeth and can cause pain, teeth spacing, and speech problems later in life.³² The cost of treating this condition ranges from \$228-\$7,000 per person.³³

Water Fluoridation vs. Oral Hygiene

Water fluoridation is associated with an increased proportion of children without cavities and reduces the prevalence of tooth decay by 14.6% (2.25 teeth) compared to non-fluoridated areas.³⁴ In Orillia – a town that has never fluoridated their water – elementary school children have the most severely decayed teeth among the 10 largest communities in Simcoe Muskoka, at a 66% higher decay rate than fluoridated areas in the region.³⁵

Water fluoridation continues to play an important role in good oral health despite the widespread availability of alternatives such as fluoridated toothpastes and mouthwashes.^{36,37,38} Public health interventions that focus on individual behaviours such as tooth brushing and oral hygiene routines are generally of limited success as they require compliance in the form of active participation and consistent application.³⁹ For instance, although the Canadian Dental Association recommends brushing teeth with toothpaste twice a day, only three in four Canadians with teeth do so.⁴⁰

There are also systemic differences in oral health behaviour. Privately insured individuals (usually covered by an employer) have higher rates of brushing compared to those who are publicly insured, at 76% and 60%, respectively.⁴¹ Groups who follow brushing recommendations at a high rate include individuals who have visited a dental professional within the last year (76%), non-Aboriginals (74%), and female adolescents (83%). Lowest rates are amongst 40-59-year-olds who are publically insured, at 44%.⁴² Wyatt and MacEntee also suggest that elderly individuals with physical and/or mental disabilities experience a particularly high risk of cavities due to poor oral hygiene and other factors.⁴³

Given the unreliability of consistent brushing and personal oral hygiene, universal programs such as water fluoridation provide protection for all.

Side Effects

The most common concern expressed about water fluoridation is dental fluorosis,⁴⁴ a change in the appearance of the tooth's enamel.¹ These changes can vary from barely visible white spots to, in its very severe form, brown stains and pitting.⁴⁵ Ontario's Ministry of the Environment established a Maximum Acceptable Concentration of fluoride in drinking water at 1.5 mg/L – a level the World Health Organization recommends⁴⁶ – under the Safe Drinking Water Act. The province's water system is very tightly controlled and regularly tested against the 158 health-based quality standards to ensure the safety of the drinking water.⁴⁷ At a 1.0mg/L level, 12.5% of individuals would have fluorosis that is aesthetically noticeable,⁴⁸ however, at these mild levels, there is no effect on tooth function.⁴⁹ In 2009, the Canadian Measures Survey sample of 1070 children aged 6 to 11 found that 4% had mild fluorosis and 12% had very mild fluorosis.⁵⁰

Furthermore, Health Canada recommends water fluoridation levels of 0.7 mg/L for optimal dental benefits.⁵¹ The Ontario Public Health Standards requires fluoride levels to be between 0.5-0.8 mg/L.⁵²

1 Go to http://www.inspq.qc.ca/pdf/publications/1422_AvisProjetFluorurationEauPotable_VA.pdf to read Quebec's Public Health Ethics Committee report regarding the ethics of community water fluoridation.

Both Peterborough and Durham region have levels maintained at 0.5-0.8 mg/L,⁵³ while Toronto's level is at 0.6 mg/L.⁵⁴

While some studies have also linked water fluoridation to other negative effects such as lower IQ levels, cancer, and bone problems, these findings are seen to be scientifically unsound and arising from low-quality methodology. A systematic review by McDonagh and colleagues reviewed 214 studies on the safety and efficacy of water fluoridation. Of these 214, 87 linked fluoridation to side effects other than dental fluorosis. The review found that these studies were of "poor quality"⁵⁵ and failed to reduce bias or use analytic techniques to control confounding factors. The authors conclude that there is "no clear evidence of other potential adverse effects."⁵⁶ Furthermore, the WHO and many other associations such as Health Canada, the Canadian Dental Association, and the Ontario Medical Association continue to support water fluoridation and reassure individuals that there are no credible links between water fluoridation and these other negative health effects.²

Cost-Effectiveness Of Water Fluoridation

Water fluoridation is an inexpensive method to promote good oral health. On the other hand, treating tooth decay can be costly to the individual and the public, not only through health insurance premiums, health departments, and community health clinics, but also through indirect costs of time lost at work or school because of tooth pain or seeking dental care.⁵⁷ A 2004 Canadian study concluded that every dollar invested in water fluoridation saves approximately \$38 in dental treatment costs.⁵⁸ Results from a Quebec study show the cost-effectiveness of water fluoridation even with the conservative estimation of a one percent decrease in cavities.⁵⁹ Along the same lines, the United States Centers for Disease Control and Prevention found that the costs of restorative care to avert disease outweighed the cost of water fluoridation in towns of any size, even with the widespread availability of many forms of fluoride today.⁶⁰ Under typical conditions, the annual per person cost savings in fluoridated communities is \$16 in communities of under 5,000 people and \$19 dollars in communities over 20,000.⁶¹ In Toronto, water fluoridation costs \$0.77 annually per person,⁶² while in Peterborough, costs are \$0.38.⁶³ The lifetime cost of water fluoridation for one person is less than the cost of one dental filling.⁶⁴

A cost analysis by Public Health Services in Hamilton, Ontario, found that water fluoridation reduces the costs for existing dental programs run by the city. The public health team compared four potential methods to deliver fluoride to the city's populations at high risk of oral problems, including children, seniors, and those with low income. The four models and associated costs are:⁶⁵

2 See http://health-evidence.ca/downloads/Fluoridation_Evidence_summarized_by_Health_Evidence_16.Dec.11.pdf for an example of an assessment of the methodological quality of four papers expressing concerns regarding water fluoridation.

Potential Program	One-Time Capital Costs	Annual Budget	Total Costs For Initial Year
1. Topical application of fluoride by Public Health Services employees in dental clinics	\$15,900,000	\$13,800,000	\$29,700,000
2. Topical application of fluoride in private dentists offices	\$272,000	\$29,800,000	\$30,072,000
3. Provision of free toothbrushes and fluoride-containing toothpaste through a mail out program with a supportive educational campaign	\$142,000	\$3,200,000	\$3,342,000
4. Fluoridation of the City of Hamilton drinking water supply (target of 0.7mg/L)	\$2,100,000	\$1,400,000	\$3,500,000

The costs of options 1 and 2 are significantly higher both in terms of the initial start-up cost and annual costs required to run the programs. Although options 3 and 4 have comparable total costs in the initial year, option 3 has a lower one-time cost and higher annual operating cost. Therefore, in the subsequent years after the first year, option 4 (fluoridation of the water supply) is the most cost-effective method that ensures high-risk populations are adequately exposed to fluoride.

The Overall Impact Of Removing Water Fluoridation

Removing fluoride from drinking water will have negative oral health impacts through increased tooth decay. A 2007 report by the Institut National de Sant Publique shows that in Dorval, Québec, the discontinuation of water fluoridation in 2003 led to the doubling of the percentage of kindergarten children at high risk of developing cavities by 2005.⁶⁶

Could the adverse effects of removing fluoridation be mitigated? The first question would be whether residents were aware of water fluoridation being removed. If they were not, they would not adjust their oral cleaning routine or increase dentist visits; rates of decay would likely increase within the population. Even if residents were made aware through a funded campaign that informed residents of changes required in personal oral hygiene, could it be expected that long-term changes would occur to compensate for the loss of water fluoridation? The history of health promotion campaigns suggests strongly that active participation behaviours such as tooth brushing and consuming high-sugar foods are difficult to alter. Frequent professional topical application of fluorides could mitigate the impact of water fluoridation removal. However, this also requires compliance on behalf of the individuals to seek professional dental care, and, would lead to increased personal and insurance costs. On the other hand, drinking fluoridated

water requires no changes in behaviour and easily modifies/decreases the multiple risk factors of tooth decay.

The Inequitable Impacts Of Removing Water Fluoridation

In addition to challenges of active participation and compliance with appropriate care practices, access to and use of dental services are uneven across the population.⁶⁷ Higher income individuals use more dental services, particularly preventative care such as annual check-ups.⁶⁸ Compared to higher income groups, lower income Canadians have:⁶⁹

- Lower rates of visiting within the last 12 months;
- Lower rates of annual check-ups, prevention, or treatment;
- Highest proportions avoiding dental visits because of costs; and
- Higher proportions declining recommended care due to costs.

Ontarians with lower income, less education, and no insurance made only half as many dental visits as the average rate in 2005.⁷⁰

Financial Barriers To Dental Care

High treatment costs and a lack of dental insurance are significant barriers to accessing dental care. Income and private insurance are very much related; those with higher income are four times more likely to have private insurance.⁷¹ In Ontario, 85% of high income earners have dental insurance, while rates for those with lower income are at 40%.⁷²

The universal health care system provides coverage for hospital and physician services; however, only 6% of dental services are publically funded,⁷³ and are often restricted to individuals on social or disability assistance.⁷⁴ Even when individuals are eligible, coverage is mainly for children and adolescents (e.g. Children in Need of Treatment, Healthy Smiles Ontario), while benefits for adults, such as Ontario Works, are widely variable and discretionary.^{75,76} Both low-income individuals and dentists identified the high costs and the inadequacy or inaccessibility of public insurance as major obstacles for low-income individuals to access dental services.⁷⁷ The need for patients to pay the fee difference not covered by public benefits poses a problem, as does the process of paying for dental services upfront and subsequently being reimbursed.⁷⁸ In fact, walk-in clinics, doctor's offices, and emergency rooms have become a source of dental care for low-income people.⁷⁹

Financial barriers are not restricted to the lowest income Canadians. Those who are just above the lowest income group – the working poor⁸⁰ – do not qualify for publically subsidized dental services, and are generally not provided with private dental insurance through their employer.⁸¹ Furthermore, those working in lower paying jobs often do not have the benefit of time off from work to visit the dentist; therefore, if dental offices have restricted office hours, individuals would lose wages due to the need to take time off of work. Individuals of lower and lower-middle income groups report the greatest cost barriers to dental care.⁸²

Some populations are particularly vulnerable. A dental health survey of homeless individuals in Toronto's shelters reveal that 70% had no insurance coverage for dental care, 36% had their last visit to the dentist four or more years ago, and 88% had tooth decay or required the replacement of existing fillings.⁸³ Their

inadequate dental care led some to experience discomfort while eating, while 35% had avoided eating due to mouth problems.⁸⁴

Furthermore, visibly missing teeth due to severe dental decay results in more negative feelings and substantially impacts daily life activities.⁸⁵ Missing teeth can hinder employment opportunities,⁸⁶ reinforcing individuals' inability to pay for dental treatment.

These data demonstrate that access to professional dental care is greatly shaped by ability to pay for treatment (whether covered by insurance or out-of-pocket).⁸⁷ Given the inequitable access and lower utilization of dental services,⁸⁸ those with lower income will be less able to ensure adequate fluoride exposure if water fluoridation is removed.

Other Barriers

Some populations, such as the elderly and individuals with physical disabilities, face specific accessibility barriers. Elderly Ontarians (65 and older) are the least likely group to have visited a dentist in the last year, at 58.6%.⁸⁹ Although they are the least likely age group to have dental insurance (36%), they are also the least likely to report that cost was a barrier to accessing dental services. Therefore, transportation, accessibility and other barriers may be at play. Elderly individuals residing in chronic care facilities may be underserved by dentists,⁹⁰ and may also be unwilling to be transported offsite to a dental office.⁹¹

Some dentists face difficulties treating patients in wheelchairs and/or long-term care facilities⁹² as they may have inadequate knowledge and training and a lack of proper equipment.⁹³ For example, the chair for dental treatments may not be appropriate and/or comfortable for patients with physical disabilities, arthritis, or back problems.⁹⁴ Furthermore, those suffering from incontinence and diabetic patients requiring constant blood sugar levels may be limited in the duration of dental treatment they can tolerate, and those with heart problems and associated breathlessness should not be in a horizontal position for treatment.⁹⁵

Conclusion

Debate continues on water fluoridation in many of Ontario's municipalities. Opponents highlight the known side effect of dental fluorosis, but the observed effects are often minor and aesthetically unnoticeable. The scientific evidence related to other suggested side effects of water fluoridation is weak, of low quality, and unsupported by national and international dental and health associations. Proponents emphasize the proven, cost-effective nature of water fluoridation in aiding the prevention of cavities and promoting good oral health.

The weight of evidence and consensus of professional expert opinion is that water fluoridation is a safe and effective public health measure that continues to play a significant role in achieving and maintaining good oral health.

Removing water fluoridation will have general adverse oral and overall health effects. Alternate oral health measures will not be as effective and will be much more expensive. Improved brushing and personal oral hygiene is difficult to ensure and access to dental services – due to a myriad of factors – is uneven among the population. Water fluoridation is a universal method to ensure adequate levels of fluoride exposure for all.

The negative impacts of removing water fluoridation will be inequitably distributed. Lower income and other health-disadvantaged populations experience poorer oral health and significant barriers to dental care. As a result, the removal of water fluoridation will be especially damaging for already health-disadvantaged populations and will worsen oral health inequities.

Recommendations

At municipal levels across the province:

1. Water fluoridation be continued in currently fluoridated regions, at levels consistent with Health Canada recommendations and Ontario Public Health Standards.
2. Communities that ceased water fluoridation should consider re-fluoridation.
3. Communities that have never been fluoridated should consider fluoridation, where they have capacity.

The provincial government has clearly recognized the importance of equitable access to dental care and good oral health. As part of the Poverty Reduction Strategy, the Ministry of Health and Long-Term Care launched Healthy Smiles Ontario and expanded the Children in Need of Treatment program to 14-17-year-olds.^{96,97,98} The Province's Chief Medical Officer of Health supports water fluoridation.⁹⁹ Removing fluoridation contradicts the intent of these policies. The provincial government has a critical role in promoting the value of water fluoridation and ensuring that municipalities across the province have the capacity to provide it.³

4. The province should consider providing financial assistance to municipalities to subsidize the cost of the purchase and installation of water fluoridation equipment, and, continual operating costs.

3 This issue was addressed by the Association of the Local Public Health Agencies in Resolution A00-11 - Community Water Supply Fluoridation (Mid-Season Resolution):

NOW THEREFORE BE IT RESOLVED that the Association of Local Public Health Agencies strongly and publicly state its support for the practice of community water fluoridation as a proven, cost-effective, safe and equitable public health intervention that significantly contributes to improving the overall health of the population. AND FURTHER THAT the Association of Local Public Health Agencies call for the Province of Ontario to provide support, including provincial legislation and funding to municipalities for the fluoridation of community drinking water.

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