



**SAFE WATER  
CALGARY**

**In Collaboration With**

**SCIENTISTS, RESEARCHERS, PHYSICIANS,  
TOXICOLOGISTS, AND DENTISTS ACROSS  
NORTH AMERICA, AUSTRALIA, IRELAND,  
AND THE UK**

**STATEMENT IN OPPOSITION  
TO ARTIFICIAL  
WATER FLUORIDATION**

**A Refutation of the CADTH Report  
on Community Water Fluoridation of 2019**

**ANALYSIS  
AND  
SCIENCE  
REVIEW –  
July 17,  
2019**

## ERRATA & IMPORTANT UPDATES

This page lists important updates, the errors and their corresponding corrections for the document titled *Statement in Opposition to Water Fluoridation – Calgary 2019 v3 (a)*. This document, *Statement in Opposition to Water Fluoridation – Calgary July 17 2019 (b)*, is the updated version.

| Important Addendum  |  |   |
|---|--|---|
| Appendix /p. 27 //  | <p><b>Addition of Appendix to highlight information from an upcoming Canadian study on Neurotoxicity.</b></p> <p>The abstract of this study titled <i>Fluoride Exposure during Fetal Development and Childhood IQ: The MIREC Study</i>, by Green et al., was presented by the authors at the Joint Annual Meeting of the International Society of Exposure Science and the International Society for Environmental Epidemiology (ISES-ISEE) held in Ottawa, Canada, las August 26-30, 2018.</p> <p>This study reinforces the findings in Bashash et al. 2017 study – Reference (<a href="#">11</a>) under Neurotoxicity section.</p> <p>See Appendix for the study abstract. The full and updated paper is expected to be published August 2019.</p> |   |
| Section / Page / Line / Footnote  | Original (a)   | Type of Update (b)  |
| SIGNED / pp. 3,4 //   |  | Addition of signatories   |
| HYPOTHYROIDISM / pp. 11, 12//   |  | Correction of minor text syntax for better clarity and addition of references.  |
| EFFECTIVENESS/ p. 17 /"Decay rates over time in Calgary and Edmonton" Graph / | Graph used on previous file had missing point markers on the image and it was missing its caption with description of graph data.  | The corrected version of the graph and its caption is included on this document.  |
| EFFECTIVENESS / p. 20 /"Tooth Decay Trends" Graph/                            | Previous graph presented data from 1965 to 2000 in reference to DMFT rates, and it is missing caption and reference of source.   | Replaced graph with its updated version "Development of DMT-12" which includes data up to year 2014, caption, and source reference. |

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### PERMITTED USES

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## EXECUTIVE SUMMARY ON ARTIFICIAL WATER FLUORIDATION

We at Safe Water Calgary submit this scientific report to the Calgary City Council, City of Calgary Community Services, the O'Brien Institute of Public Health (OIPH), and the city clerk for official record.

This statement is a summary providing documentation of the concerns voiced by Robert Dickson, MD; Hardy Limeback, PhD, DDS; and Paul Connett, PhD in their meetings with Dr. William Ghali and the OIPH in late May and early June 2019, as well as the scientific evidence and citations to critique the massive Canadian Agency for Drugs and Technologies in Health (CADTH) report "Community Water Fluoridation Programs: A Health Technology Assessment" (1) released earlier this year.

The CADTH report supports water fluoridation. We have reviewed major portions of this document. Unfortunately, it is deeply flawed. First and foremost, it has omitted numerous key, peer-reviewed scientific studies identifying the health risks of fluoride and fluoridated water. For the studies it does include, there are numerous statements that misrepresent scientific findings or have factual errors.

The Calgary City Council resolved that OIPH "**conduct an objective assessment of the evidence in the extant literature.**" We do not find that CADTH is objective. Its report is a review rather than original scientific literature and it does not provide a reliable or objective summary of the literature. Our detailed findings on specific portions of the CADTH report are provided in the attached submission.

Based on what we believe is a more objective assessment of the full extant literature, our findings can be summarized in four key areas:

- **Ethics:** Artificial fluoride added to public drinking water for the purpose of reducing cavities is a drug. Adding any drug to water is a direct violation of our citizen's right of informed consent. No other drug, in Canada or anywhere in the world, is allowed in drinking water.
- **Health risks:** There is significant scientific evidence that, among many other identified possible risks:
  - Fluoride is neurotoxic and fluoridation can cause brain damage, including lower IQs in children and higher rates of ADHD
  - Fluoride is an endocrine disruptor, and fluoridation can impair thyroid function.
  - An excess of fluoride causes dental fluorosis and fluoridation significantly contributes to mild, moderate and severe forms. Fluorosis is irreversible - many cases are cosmetically objectionable and may cause damage to the enamel.
  - At least 1% of the population (at least 15,000 people in the Calgary area) would have their health immediately put at risk due to chemical hypersensitivity to fluoride in the water
- **Effectiveness:** Fluoridation is minimally effective. It is generally acknowledged that fluoride's efficacy is mainly topical, not ingested.
- **Cost-effectiveness:** Fluoridation, when considering all factors including health risks, has no economic savings; indeed, it is an enormous cost to society.

**Based on the available scientific evidence, we urge CALGARY CITY COUNCIL and the OIPH to reject and oppose artificial water fluoridation.**

## Signed

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*Signed July 10, 2019*

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## ETHICS

CADTH argues that fluoridation **“can be ethically justified because its public health benefits are significant enough to override the concerns related to individual choice.”**

But artificial water fluoridation is unethical from several perspectives.

Health Canada (1) defines a drug as any substance used for **“the diagnosis, treatment, mitigation or prevention of a disease, disorder, abnormal physical state, or its symptoms, in human beings or animals.”** Fluoride added to water to prevent cavities, is, therefore, being used as a drug.

Fluoridation violates the rights of all people called for in the UNESCO Declaration on Bioethics and Human Rights (2) which says in Article 6, **“Any preventive, diagnostic and therapeutic medical intervention is only to be carried out with the prior, free and informed consent of the person concerned, based on adequate information.”**

If Calgary approves fluoridation, it is giving city councillors an authority over its citizens – to administer a drug - that not even their own personal physicians possess. Prescribing drugs is not a one-size-fits-all procedure. A doctor prescribes a drug based on an individual’s personal medical history, for a specific dose and a specific period of time. The doctor must also explain its potential benefits and harmful side effects. But it’s still up to the patient to decide to take the drug or not. Fluoridation violates all these safety protocols and our right of informed consent.

As Dr. Arvid Carlsson, 2000 Nobel Prize winner in physiology or medicine, stated, water fluoridation is **“obsolete”** and **“against all modern principles of pharmacology.”** (3)

Several European nations, including France, Germany, Belgium and the Netherlands, have cited the improper and/or unethical nature of adding any drug to drinking water as one reason they have banned fluoridation. (4)

No other drug is allowed to be put in public drinking water, in Canada, or anywhere in the world. There are no good reasons why fluoride should be the only exception.

Adding fluoride to drinking water because some people may get cavities makes no more sense than adding aspirin because some people have headaches or adding a statin drug because some people have high cholesterol. Virtually all drugs have harmful side effects that can result from higher doses and/or the age of exposure of those drinking it. With fluoridation, there is no control whatsoever over who ingests the drug and how much they drink, making it especially risky to vulnerable sub-populations like pregnant women, children and those who consume a lot of water such as diabetes and kidney patients, athletes and manual laborers.

Moreover, people are exposed to fluoride from numerous sources including food, pesticide residues, dental products (particularly toothpaste swallowed by young children), medications, and proximity to fluoride-emitting industries. All add to the toxic load.

CADTH's ethics claim is built on the premise that its benefits outweigh its risks. But this argument is totally unsupported by the scientific evidence. First, fluoridation's benefits are minimal, at best less than one cavity reduction per child in permanent teeth (see Effectiveness section for documentation), with no credible documentation that it significantly helps socioeconomically disadvantaged children or adults.

Second, the chemical used to fluoridate most water, fluorosilicic acid, is, according to water regulation agency NSF International (5), legally allowed to contain low levels of lead and arsenic. Health Canada cites arsenic as a carcinogen and lead as a neurotoxin that can lower IQ. The U.S. EPA has determined there are no safe levels of either. Drinking water may already naturally contain these contaminants, but it is clearly unethical to knowingly add them to drinking water.

Third, no one questions that ingested fluoride can be toxic. The only question that remains is how toxic it is at levels in fluoridated water. As shown in the Health Risk section, there is substantial evidence that it poses serious threats to our health. Even if fluoridation was two or three times as effective, it would not justify putting so many people's health at risk from so many conditions. Once fluoride is ingested, teeth, while very important, are relegated to only a minor role in the overall health picture.

Finally, fluoridation is also a social justice concern. Low income and minority populations are more susceptible to kidney disease and diabetes, both of which, according to the NRC Report (pp. 303, 260), can be exacerbated by ingested fluoride (6). They typically can't afford bottled unfluoridated water or expensive filters to avoid it, and are at higher risk of adverse effects, whether they realize it or not. This cannot be justified.



## HEALTH RISKS

As stated several times before the Calgary city council, the OIPH committee is relying heavily on the 2019 CADTH report. This review was favorable toward fluoridation.

From the start, this creates a bias. To provide balance concisely, this statement from Safe Water Calgary won't address each possible health risk. Instead, it will concentrate on just a few cited by CADTH and explore its biases and omissions in depth.

CADTH relied heavily upon Australia's National Health and Medical Research Council (NHMRC) 2016 [\(1\)](#) report which was an update of NHMRC's 2007 report [\(2\)](#). NHMRC is part of the Australian government and has endorsed fluoridation since 1958. It cannot be considered balanced and objective regarding health risks. The 2007 NHMRC report didn't review any animal or biochemical studies or clinical trials. It only examined studies in English. It had more pages reviewing teeth (106) than all other tissues and organs combined. There was less than one page each for neurotoxicity and the endocrine system. There were actually over three times as many citations from dental journals than non-dental journals.

The updated NHMRC report's study of health effects, covering October 2006 to October 2014, had similar limitations. It also excluded all animal and biochemical studies. It only compared water with fluoride compared to unfluoridated water, or water with fluoride at one level compared to water with fluoride at a different level. It excluded all studies measuring fluoride blood or urine levels, which are typically more relevant measurements of fluoride exposure than water concentrations.

**CADTH omitted the U.S. National Research Council's (NRC) 2006 report "Fluoride in Drinking Water" [\(3\)](#)**, considered the most comprehensive and authoritative review ever conducted on fluoride's toxicity. This 507-page volume took three years to complete and reviewed over 1100 human, animal and cellular studies from the previous 50 years. It was compiled by a well-balanced blue-ribbon committee of 12 leading North American scientists including fluoridation advocates, opponents and others who hadn't taken a position. Hardy Limeback, PhD, DDS, the only Canadian on the committee, is the former head of preventive dentistry at the University of Toronto and former president of the Canadian Association for Dental Research.

While the NRC committee wasn't charged with evaluating water fluoridation itself, its findings had multiple relevant applications. It also identified gaps in knowledge and called for more research on fluoride's connection to numerous harmful health conditions. This directly contradicted the certainty of U.S. government authorities since the 1950's that fluoridation had been demonstrated safe, which started the spread of fluoridation to Canada and other nations.

One more very important note must be added. Fluoridation supporters routinely dismiss studies measuring harm from water that has higher fluoride levels than recommended artificial fluoridation rates of 0.7 – 1.0 parts per million. But standard toxicological risk assessment practice, as noted in the reference book A Small Dose of Toxicology (p. 260) [\(4\)](#), always includes a margin of safety factor of at least 10 to account for human variability, protecting more vulnerable sub-populations at higher risk of harm than the average. For example, numerous studies have found fluoride's harm at 2 ppm. To protect everyone in a population, the level of fluoride must be reduced to less than 0.2 ppm.

This would, and should, effectively end artificial water fluoridation.

## NEUROTOXICITY

CADTH concluded that **“Overall, there was limited evidence for no association between water fluoridation at the current Canadian levels and IQ or cognitive function.”**

The ambiguous wording of this statement alone provides little reassurance that fluoridation is not neurotoxic to the fetus and children. More importantly, it ignores numerous high quality studies – human, animal and cellular - that have repeatedly demonstrated fluoride’s neurotoxicity, including at levels of exposure caused by water fluoridation in Canada.

CADTH, NHMRC and other fluoridation advocates commonly cite one study, Broadbent et al. 2015 (1), to support their claim that fluoridation doesn’t lower IQs in children. Broadbent, a dentist and fluoridation advocate, found no difference in the IQs of children and adults who spent their first 3 to 5 years of life in fluoridated vs. non-fluoridated areas of Dunedin, New Zealand. NHMRC/CADTH rates the study “High,” the only neurotoxicology study cited to achieve this designation.

But this rating is completely unjustified because it fails to account for several major weaknesses (Grandjean/Choi 2015 (2) and Osmunson et al. 2016 (3)).

- The study’s small sample size of non-water-fluoridated subjects (only 99 compared to 891 water-fluoridated subjects) means it statistically has low ability to detect any differences in IQ.
- Even more importantly, 139 subjects took fluoride tablets (he doesn’t say which). Since fluoride tablets are only recommended for children living without water fluoridation, it’s likely a high percentage of the 99 living in the non-fluoridated areas took them. A 1996 New Zealand study, Guha-Chowdhury et al., (4) found that children taking fluoride tablets in areas without fluoridation had as much or even more total fluoride intake as those in fluoridated areas not taking fluoride tablets. The confounding factor of the fluoride tablets renders the study, and its results, virtually meaningless.
- As Broadbent himself acknowledged, studies have shown the average IQ of rural dwellers in New Zealand is lower to begin with than that of those who dwell in urban areas, possibly because fewer education opportunities may be available outside major cities. Nearly all of the non-water-fluoridated subjects lived outside the city.
- Even though Broadbent is critical of other studies that don’t account for several possible confounding factors, his study only controlled for four such factors and failed to account for the neurotoxins lead and manganese, both of which may have been elevated in the main non-fluoridated town.

CADTH also misrepresented the findings of at least one neurotoxicity study, Choi et al. 2014 (5), which found a statistically significant correlation between dental fluorosis, a biomarker of excess fluoride ingestion, and impaired cognitive function. The authors concluded that the study **“supports the notion that fluoride in drinking water may produce developmental neurotoxicity.”**

But CADTH said **“Beta coefficient showed no significant correlation between water fluoridation and cognitive function measurements”** and **“There were no statistically significant differences between fluoride levels for any subtests of cognitive function measurements.”**

CADTH's wording is technically true because it referred to results for water fluoridation levels, but ignores the more important results for fluorosis, which is a better indicator of early childhood exposures. CADTH's description of the study results thereby gives the opposite conclusion as the study's authors. This is misrepresentation at its worst.

CADTH's most striking bias is its omission of numerous strong, qualifying studies that showed significant neurotoxicity, including several conducted by Canadian researchers:

The 2006 NRC review (p. 222) stated unequivocally that **"It is apparent that fluorides have the ability to interfere with the functions of the brain"** and that, based on their review of five studies all showing that increased fluoride levels correlated with lowered IQs, the consistency of results were **"significant enough to warrant additional research on the effects of fluoride on intelligence."**

Xiang et al. 2003 (6): The strongest evidence NRC cited (p. 205) was this study that measured urinary fluoride levels, considered a more accurate indicator than water fluoride levels. Xiang found that every one part per million increase in urine fluoride levels lowered IQs by 5 points for both boys and girls. This dose-response relationship is much stronger than simply comparing two villages. Possible confounding factors such as lead, arsenic, parental education levels, SES levels, etc. were accounted for, and it was concluded that the difference in fluoride levels could be attributed to drinking water.

Since the 2006 NRC review, over 100 animal and over 50 human epidemiology studies have been identified (7) that overwhelmingly confirm neurotoxicity and lowered IQs. Several of the studies in animals and humans have specifically found that fetal exposure causes neurotoxic harm including lowered IQ, so exposure to pregnant women is at least as much a concern as exposure to children. The findings have been remarkably consistent with only a handful not finding an effect, Broadbent being one of them. The most important studies since the NRC 2006 report are:

Choi et al. 2012 (8): This Harvard-based meta-analysis found that children ingesting higher levels of fluoride tested an average 7 IQ points lower in 26 out of 27 studies. Most had higher fluoride concentrations than in Canadian fluoridated water, but many had total exposures to fluoride no more than what millions of Canadians receive. One co-author, Phillippe Grandjean, MD, PhD, is a consultant to the Danish National Board of Health, co-editor of Environmental Health, and author of over 500 scientific papers. One of the most highly respected research scientists on environmental toxins in the world, he concluded **"Fluoride seems to fit in with lead, mercury, and other poisons that cause chemical brain drain."** (9)

Malin/Till 2015 (10): The authors, psychologists Christine Till and Ashley Malin at Toronto's York University, found that U.S. states with a higher portion of artificially fluoridated water had a higher prevalence of ADHD. This finding was consistent across six different years examined, starting in 1992. The trend held up even after controlling for socioeconomic status, which can affect ADHD rates.

Bashash et al. 2017 (11): This international longitudinal study, one of the most robust ever done, followed a cohort of women in Mexico. It was funded by the U.S. National Institutes of Health and led by researchers at the University of Toronto. Reinforcing the 2003 Xiang study, it found that every one part per million in fluoride in pregnant women's urine was associated with a reduction of their children's IQ by an average 5-6 points.

Petition to the EPA 2017 (12): Several organizations and individuals filed a petition to the EPA to end artificial water fluoridation, based mainly on its neurotoxicity. The petition's massive documentation included that fluoride caused harm in 112 out of 115 animal studies and lowered IQ in 57 out of 61 studies, nearly all of which were statistically significant, and some at exposure levels commonly reached in fluoridated parts of Canada and the U.S. EPA denied the petition, leading to a lawsuit that will be tried in U.S. federal court in late 2019 or early 2020.

Till et al. 2018 (13): This study found that among 1,566 pregnant women in Canada, fluoride levels in urine were almost two times higher for women who lived in regions where the drinking water was artificially fluoridated compared to pregnant women in regions with non-fluoridated water. Its findings directly supported the seriousness of the 2017 Bashash study. The range of urine fluoride levels in women in fluoridated parts of Canada were virtually the same as those in the women in the Bashash study.

This same group has a paper in press that found a 4-6 point drop for every 1 mg/L increase in water fluoridation concentration. This suggests that fluoridated water in Canada at 0.7 mg/L could cause an average loss of 3-4 IQ points.

Bashash et al. 2018 (14): This study, also led by University of Toronto researchers, using the same cohort of women and children in Mexico, found that higher levels of fluoride exposure during pregnancy were associated with global measures of ADHD and more symptoms of inattention in their children, adding further evidence to the findings of the Malin/Till 2015 study in the U.S.



## HYPOTHYROIDISM

Hypothyroidism (low thyroid function) causes much harm, including fatigue, memory problems, obesity, muscle and joint pain, depression and miscarriages and low birth rate for pregnant women. Its prevalence is very high - according to the Thyroid Foundation of Canada (1), 1 in 50 Canadians, and is 4 to 7 times more common in women. Drugs used to treat hypothyroidism are some of the most-prescribed medicines in the country.

In pregnant women, both clinical and subclinical (non-symptomatic) hypothyroidism may also lead to reduced IQ's in their children, and many cases go undiagnosed. Figures calculated from the 2006 NRC report (Klein et al, p. 263) show that a 140-pound pregnant woman with iodine deficiency would only have to drink 0.9 liters per day of fluoridated (0.7 ppm) water to be at increased risk of impaired thyroid function.

Numerous human, animal and epidemiological studies have found fluoride decreases thyroid function. In the 1940's and 1950's, fluoride was used as a treatment for *hyperthyroidism* (over-active thyroid).

Based on studies done from 1960 to 2005, the NRC report conclusively determined fluoride was an endocrine disruptor and **"The chief endocrine effects of fluoride . . . include decreased thyroid function."** (p. 8)

But even though scientific data linking fluoride ingestion with hypothyroidism is extensive, CADTH's summary on the subject was inconclusive: **"Overall, there was insufficient evidence for an association between water fluoridation at the current Canadian levels and thyroid function."** Unfortunately, CADTH's errors and omissions, which led to this statement, were especially glaring for this subject.

First and foremost, it omitted the major 2018 study Malin et al. (2) representing 6.9 million Canadians that found moderate to severely iodine-deficient adults (nearly 18% of the population) with higher fluoride levels had a greater risk of hypothyroidism. The study's lead scientist, Ashley Malin, is a researcher at the Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai in New York City.

She said **"I have grave concerns about the health effects of fluoride exposure . . . And not just from my study but the other studies that have come out in recent years . . . We're talking about potentially [more than] a million people at risk of an underactive thyroid due to fluoride exposure."** (Environmental Health News - Oct. 10, 2018 (3))

It also omitted a systematic review of 10 studies, Chaitnaya et al. 2018 (4), that **"suggests a positive correlation between excess fluoride and hypothyroidism"** and another 2018 study, Kumar et al. (5), that determined a **"Positive correlation exists between (dental) fluorosis and thyroid functional activity."**

CADTH also falsely reported the findings of two studies and made an incorrect statement on another:

For the 2018 Kheradpisheh et al. study (6), CADTH said **"Multivariable logistic regression analysis revealed no relationship between drinking water fluoride and hypothyroidism."** The author, however,

came to the opposite conclusion: **“The value of TSH hormone (greater impairment of thyroid function) increased by increasing water fluoride concentration”** and **“To help our thyroid function, we must consider limiting fluoride exposure and adding iodine to our diet.”**

For the 2014 Singh et al. study (7), CADTH said **“There was no significant difference in any of the thyroid function tests between groups.”** The authors’ conclusion tells a different story: **“The chronic over exposure of fluoride in drinking water causes growth disturbances particularly evident in adolescence and they result in thyroid dysfunction as studied by various authors . . . The results of this study question the validity of the fluoridation of drinking water, milk, fruit juices, and salt by public health authorities . . .”**

For the 2015 Peckham study (8), CADTH said **“only data from West Midlands (fluoridated) and Greater Manchester (non-fluoridated) of England were selected, instead of from the whole country.”** This is incorrect. The study had two models, one comparing West Midlands and Greater Manchester, and one that covered all of England. The study examined data from nearly every medical practice in the country. Peckham said **“Hypothyroidism is a major health concern and . . . fluoride exposure should be considered as a contributing factor. The findings of the study raise particular concerns about the validity of community fluoridation as a safe public health measure.”**

The established link between higher fluoride levels and increased hypothyroidism is highly significant in its own right. *But when the connection between hypothyroidism in pregnant women and lower IQ’s in their children is factored in, it becomes doubly important.*



## DENTAL FLUOROSIS

Dental fluorosis is damaged tooth enamel, a visible sign of overexposure and toxicity, caused by an excess of swallowed fluoride by children up to 8 years of age. It comes from fluoridated water, food and drinks processed with it (including infant formula), food grown with fluoride pesticides, swallowed fluoridated toothpaste, fluoride tablets and other sources.

“Very mild” or “mild” fluorosis produces white streaks or mottling on up to 50% of the tooth surface. “Moderate” covers 50% to 100% of the entire surface with a white chalky appearance and/or yellow or brown staining. “Severe”, in addition to discoloration, can pit or crumble tooth enamel. Moderate and severe levels can actually increase cavity rates. All degrees of fluorosis are permanent.

CADTH concluded, **“There was a significantly higher risk of developing dental fluorosis in high fluoridated areas compared with in low fluoridated areas. The additional studies identified from the updated literature search also found that the prevalence of dental fluorosis and its severity increased with increased water fluoride levels.”**

NRC determined that severe fluorosis is both an adverse health effect and adversely harms appearance, and that some people would also find moderate fluorosis on front teeth cosmetically objectionable. NRC also estimated that fluoridated water at 1.0 ppm contributed 41% - 83% of all fluoride ingestion, depending upon the age group. At 0.7 ppm, the level of many fluoridated cities now, it may be slightly less, and other sources could be increased. But even so, NRC concluded, **“water will still be the most significant source of exposure.”** (pp. 60-68)

Fluoridation proponents often claim that fluoridation only causes very mild or mild fluorosis, not moderate or severe. While it’s accurate that fluoridation alone is unlikely to cause moderate or severe levels, there is no doubt it’s a major contributing factor to both prevalence and all levels of severity.

The U.S. has a much higher rate of fluoridation than Canada at 74%, and consequently, a much more serious fluorosis problem. As fluoridation rates have continued to increase in the U.S. over recent decades, overall fluorosis prevalence and severity in 12-15 year-olds has grown significantly worse.

| Year      | Prevalence | Percent Moderate/Severe |
|-----------|------------|-------------------------|
| 1986-1987 | 21.8%      | 1.2%                    |
| 1999-2004 | 41.1%      | 3.7%                    |
| 2011-2012 | 64.8%      | 30.4%                   |

Two recent studies, both using highly respected NHANES statistics, have chronicled this trend. The figures above are from Neurath et al. 2019 ([1](#)) and similar increases for 16-17 year-olds were cited by Wiener et al.. 2018 ([2](#)). The U.S. CDC recently released a highly unusual paper ([3](#)) questioning its own NHANES figures on the sharp increase in moderate/severe in the 2011-2012 study period, which is under review. However, there can be no question that:

1. Fluorosis is a serious problem in the U.S.
2. Water fluoridation is a major contributor to this problem.
3. If Canada increases fluoridation, its fluorosis prevalence and severity rates will also increase.

Although one survey in Canada reported very low rates of moderate and severe fluorosis, others have found rates at least as high as the 1999-2004 data in the U.S. Also, most surveys in Canada greatly underestimate the severity because they only count the top front teeth. Neurath et al. 2019 (4) found that this method results in a halving of the rates of mild, moderate and severe fluorosis.

Fluorosis on the front teeth can cause significant embarrassment and anxiety over an individual's appearance, lowering self-esteem. Although fluorosis is permanent, it can be treated professionally, but at a very high cost. According to the U.S. Consumer Guide to Dentistry (5), lower-cost treatments cost between (US dollars) \$250 to \$1,500 per tooth and may only last 5-7 years. Porcelain veneers cost between \$925 to \$2,500 per tooth and may only last 10-15 years. Treatments are often not covered by insurance.

The Cochrane Collaboration (6) estimated that for a fluoride level of 0.7 ppm, the percentage of participants with fluorosis of aesthetic concern was approximately 12%.

Several published Canadian studies, none reported by CADTH, have shown that substantial percentages of people view fluorosis as aesthetically objectionable:

| Study                        | Fluoridated Communities | Percent of Population Perceiving Fluorosis as Aesthetically Objectionable |
|------------------------------|-------------------------|---|
| Clark/Berkowitz (1997) (7)   | British Columbia cities | Up to 4%  |
| Brothwel/Limeback (1999) (8) | Ontario cities          | 19%   |
| Leake (2002) (9)             | Toronto                 | 14%   |
| Ito (2007) (10)              | Brampton                | 9%  |

## CHEMICAL SENSITIVITIES/IMMUNE AND INFLAMMATORY RESPONSES

CADTH addressed chemical sensitivities in a very limited way, covering only gastric discomfort, musculoskeletal pain and headaches. It only cited two studies for each of the three health problems. All six of the studies found that fluoride levels in water 1.5 ppm or greater increased the prevalence of the harmful effects. But CADTH determined that their quality was low and provided insufficient evidence for an association between any of them and fluoridation in Canada. CADTH, however, did not include any of the scientific studies cited below.

In one way, fluoride in artificially fluoridated water is no different than other drugs, chemicals, or various foods, such as peanuts or shell fish. There is a subset of the population that will have adverse reactions upon swallowing them. In some cases, even being exposed topically, such as in fluoridated toothpaste or mouthwash, will produce harmful effects.

There are biological differences between allergic reactions and intolerance, but many of the symptoms are the same. For the purposes of this discussion, the crux of the matter is any adverse reaction, regardless of its category.

These adverse reactions can appear as a variety of symptoms, including nausea, vomiting, abdominal pain, fatigue, headaches, itching, rashes, eczema, mouth ulcers, vision problems, numbness, muscular weakness, spinal pain and others.

George Waldbott, MD was a pioneering allergy specialist and vice president of the American College of Allergists. His textbook, Health Effects of Environmental Pollutants, was a standard in universities in the United States and abroad. He also published the first medical report on cigarette smoking causing emphysema in 1953. In all, he wrote several books and over 200 scientific articles. His work on fluoride is cited more than 30 times in PubMed and a very brief summary is available. [\(1\)](#)

In his clinical practice in Michigan in the 1950's, Waldbott noticed that dozens of his patients suffering from the symptoms noted above were immediately relieved when they stopped drinking fluoridated water. He then ran blinded tests on many of them in which the patients were given water without knowing if it was fluoridated or not. The symptoms recurred only if they were given fluoridated water.

Another study, a 12-year project in New Jersey completed in 1961 by Reuben Feltman and George Kosel [\(2\)](#), had the same results. Working with pregnant women and their children, they concluded **“One percent of our cases reacted adversely to the fluoride. It was definitely established that the fluoride and not the binder was the causative agent . . . (the harmful dermatologic, gastrointestinal and neurological symptoms) have all occurred with the use of fluoride and disappeared upon the use of placebo tablets, only to recur when the fluoride tablet was, unknowingly to the patient, given again.”**

Finally, in a double-blind clinical study in the Netherlands, Grimbergen 1974 [\(3\)](#), subjects suffering gastrointestinal problems, migraine-like headaches, joint pains and several other harmful conditions drinking fluoridated water also had their symptoms disappear when they switched to unfluoridated water. The Grimbergen study, based upon the work of Dr. Hans Moolenburgh and his team of 12

physicians and supporting scientists, played a significant role in the Netherlands' decision to ban fluoridation in 1976.

Since these studies, the research has continued to accelerate showing fluoride's harmful effects. Below are just three recent examples, with direct quotes from the studies' authors:

Gutowska et al. 2015 (4), **"It is well known that exposure to fluorides lead to an increased ROS production and enhances the inflammatory reactions."** (ROS stands for reactive oxygen species, more commonly known as oxidative stress, which can cause significant damage to cell structures.)

Follin-Arbelet et al. 2016 (5), **". . . the association between inflammatory bowel disease (IBD) and oral hygiene has been noticed before . . . exposure to fluoride seems indirectly associated with higher incidence of IBD. Fluoride toxicology and epidemiology documents frequent unspecific chronic gastrointestinal symptoms and intestinal inflammation."**

Ma et al. 2017 (6) **"The results showed that inorganic arsenic and/or fluoride induced significant increase in endothelial cell apoptosis (cell death) and inflammation . . ."**

In contrast to CADTH, the 2006 NRC report cited the work of Waldbott, Grimbergen and Feltman/Kosel and called for more research on fluoride's effects at differing fluoridated water levels. However, there already was enough scientific evidence for the authors to assert **"There is no question that fluoride can affect the cells involved in providing immune responses."** (p. 295)

There is solid scientific evidence that artificially fluoridated water will adversely affect 1% of Calgary's population. At least 15,000 people can be expected to suffer harmful reactions from chemical sensitivities alone.

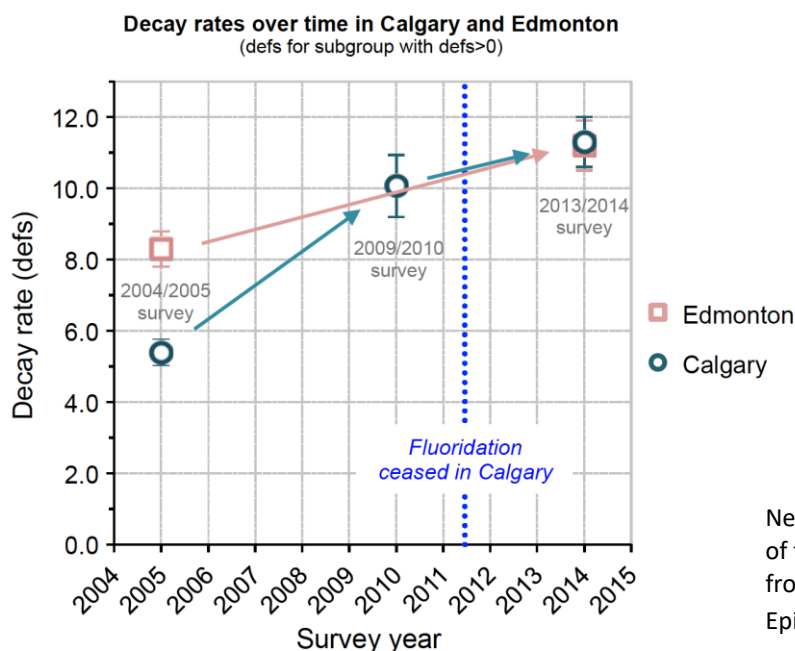
## EFFECTIVENESS

According to CADTH, there was consistent evidence showing an association between fluoridation and reducing cavity rates in both primary and permanent teeth. There was insufficient evidence from studies on changes in cavity rates after a city had stopped fluoridating and no firm conclusions could be drawn.

One such study, McLaren et al. 2016 (1) has particular relevance to Calgary, which ended fluoridation in 2011, and Edmonton, which continued fluoridation, as a comparison. The study concluded **“findings observed for primary teeth were consistent with an adverse effect of fluoridation cessation on children's tooth decay”** and was publicized widely in the media. Fluoridation supporters used the study as a scientific justification for why Calgary and other cities should be fluoridated.

However, upon closer inspection cited in a subsequent study, Neurath et al. 2017 (2), critical data omitted by McLaren actually supported the conclusion that stopping fluoridation in Calgary had no effect on cavity rates.

McLaren's study only used data from two dental surveys in Calgary and Edmonton, one in 2004/2005, many years before Calgary stopped fluoridating in 2011, and the other from about 3 years after cessation. However, the study omitted a survey in Calgary from 2009/2010, just 1.5 years before cessation. When the cavity rate for primary teeth from this omitted survey is combined with the data used by McLaren, it is clear that decay had been increasing in Calgary at virtually the same rate before cessation as after cessation:



Neurath C, Beck JS, Limeback H, et al. Limitations of fluoridation effectiveness studies: Lessons from Alberta, Canada. Community Dent Oral Epidemiol. 2017;00:1–7

**FIGURE 2** Dental decay rates for subgroup of those children with at least one defs (defs>0). Data for 2004/2005 and 2013/2014 from CDOE paper. Data for 2009/2010 from IJEH paper, but converted from deft to defs using conversion method described in text. Error bars indicate 95% CIs.



Edmonton, which had remained fluoridated, also experienced an increase in decay over the study period. Therefore, instead of providing evidence that stopping fluoridation caused an increase in decay, the full data show that when each city was fluoridated decay was increasing despite fluoridation. Factors other than fluoridation status must have been the cause of the increases in both cities. Moreover, the McLaren study did not control for confounding factors in either city that are commonly measured: socio-economic status, diet, ethnicity, dental care, dental hygiene practices and many others, a major weakness.

The media extensively publicized McLaren's original study. But it widely ignored the peer-reviewed Neurath et al. study, published in the same journal as McLaren's study, that documented that fluoridation cessation had virtually no effect on Calgary's cavity rates.

As CADTH reported, a number of studies have shown decreased cavity rates in fluoridated water areas. They have typically been expressed by percentage, but almost always omit actual number of cavities. When these figures are reported, fluoridation's minimal effectiveness becomes clearer.

Hardy Limeback, PhD, DDS, former head of preventive dentistry at the University of Toronto and former president of the Canadian Association for Dental Research, prepared the analysis below, as excerpted from his textbook, Comprehensive Preventive Dentistry.

| <b>Summary of Studies on Fluoridation</b>  |                |                           |                                |   |
|--|----------------|---------------------------|--------------------------------|---|
| Excerpted from Hardy Limeback, PhD, DDS 2012 textbook "Comprehensive Preventive Dentistry" |                |                           |                                |   |
| <b>Study Author</b>  | <b>Country</b> | <b>Number of Subjects</b> | <b>Age of Subjects (years)</b> | <b>Surfaces Saved with optimum fluoridation</b> |
| Heller et al. 1997   | US             | 18,755                    | 12                             | 0.5*  |
| Brunelle and Carlos 1990   | US             | 16,498                    | 12                             | 0.5*  |
| Angelillo et al. 1990  | Italy          | 643                       | 12                             | 0.6   |
| Selwitz et al. 1998  | US             | 495                       | 8-16                           | 1.2   |
| Ismail 1991  | Canada         | 219                       | 10-12                          | 0.7   |
| Clark 1991   | Canada         | 1131                      | 6-14                           | 0.8   |
| Slade et al. 1995  | Australia      | 9,690 vs. 10,195          | 5-15                           | 0.2   |
| Jackson et al. 1995  | US             | 243                       | 7-14                           | 1.2*  |
| Kumar et al. 1998  | US             | 1,493                     | 7-14                           | -0.2  |
| Armfield and Spencer 2004  | Australia      | 5129                      | 4-9                            | 1.5   |
|  |                | 4803                      | 10-15                          | NS  |
| Komarek et al. 2005  | Belgium        | 4468                      | 7-12                           | NS  |
| Spencer et al. 2008  | Australia      | 8183 (SA)                 | 5-15                           | NS  |
| Nyvad et al. 2009  | Lithuania      | 300                       | 12-15                          | NS  |
| Ekstrand 2010  | Denmark        | 191 municipalities        | 15                             | 1.0-2.0   |
| Armfield 2010  | Australia      | 128,990                   | 5-15                           | 0.5   |

\*Difference was statistically significant.



The Cochrane Collaboration (3) is considered the gold standard of evaluating effectiveness. Its 2015 analysis found a 26% DMFT (decayed, missing, filled permanent teeth) reduction in fluoridated areas. The U.S. CDC (4) cites a similar 25% reduction. Cochrane also cited **“insufficient evidence”** that **“fluoridation results in a change of disparities in caries levels across socio-economic status.”**

According to the 2007-2009 Canadian Health Measures Study, the latest figures available, the average DMFT rate for Canadian 6-19 year-olds is 3 cavities. When the percentage decreases for studies showing effectiveness above are applied, most come out to less than one cavity per child difference.

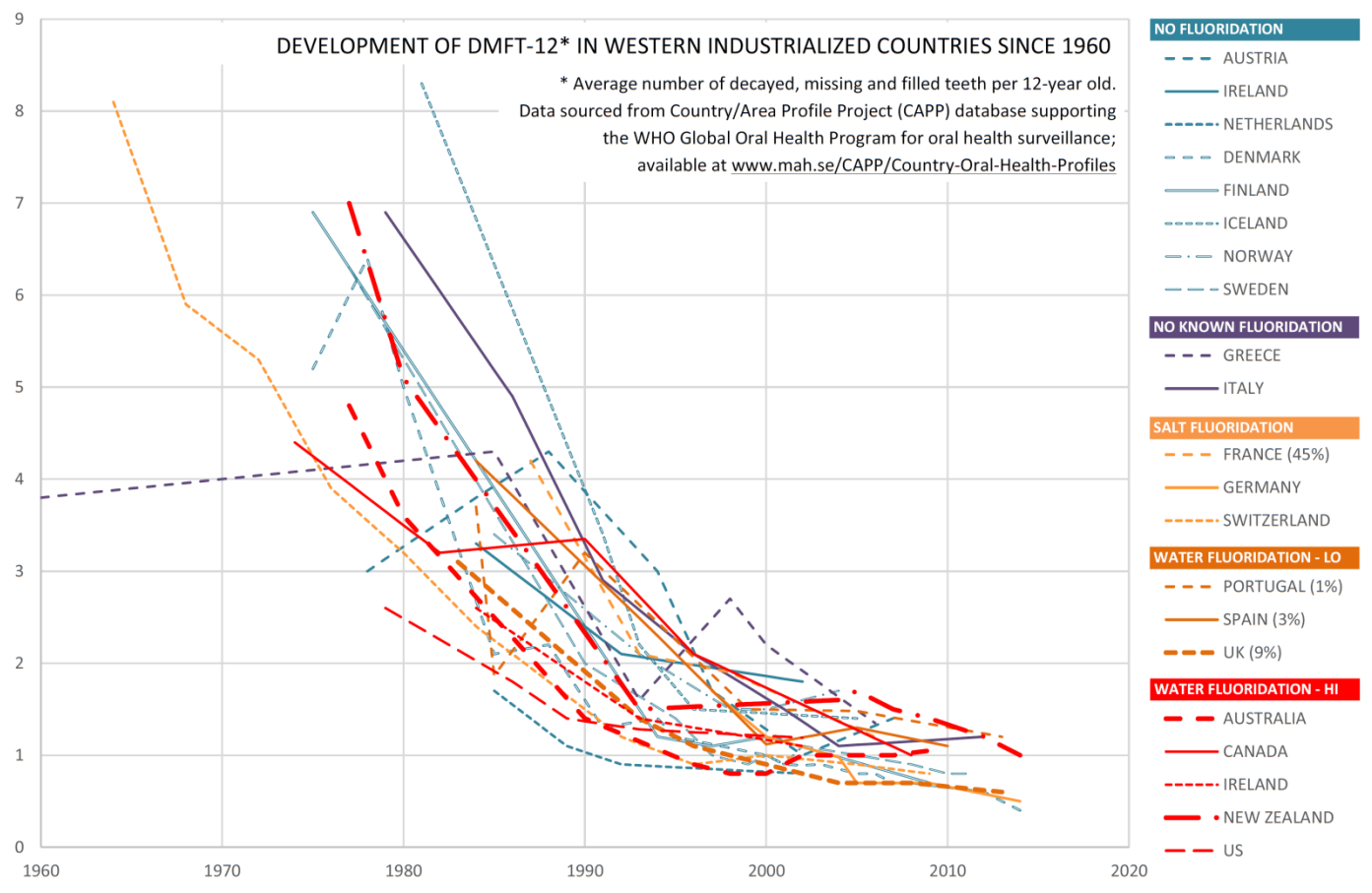
The Iowa Fluoride Study (IFS), funded by the U.S. National Institutes of Health, is the most comprehensive, ongoing research project in the U.S. - the only study in the U.S. or Canada measuring all sources of fluoride ingestion. CADTH, however, did not include any studies from IFS.

The most recent relevant study from IFS, Curtis et al. 2018 (5) found no significant correlation between ingested fluoride and cavity reduction, further validating a 2009 study from IFS, Warren et al. (6) that stated: **“Achieving a caries-free status may have relatively little to do with fluoride intake (emphasis in the original) . . . recommending an ‘optimal’ fluoride intake is problematic.”**

For adults, the strongest studies, Slade et al. 2013 (7), Slade et al. 2018 (8) and Do et al. 2017 (9), all found that fluoridation at most resulted in a one cavity reduction over a 40-year period. Cochrane stated, **““We did not identify any evidence . . . to determine the effectiveness of water fluoridation for preventing caries in adults.”**

Indeed, there is a consensus, including the CDC, NRC, Cochrane Collaboration, Iowa Fluoride Study and others that fluoride’s effectiveness is mainly topical (10), not from ingestion. There is little robust scientific evidence that swallowing fluoride provides any benefit over and above more appropriate topical applications.

Finally, World Health Organization data (11) shows cavity rates in children (age 12) have dropped as much in nations that don’t fluoridate (darker solid lines) as in nations that do (red/yellow dotted lines). Obviously, many individual and nationwide factors affect cavity rates, including diet, personal dental habits, socioeconomic status and professional dental care. Still, the WHO data is consistent with independent studies showing minimal effectiveness of fluoridation.



**Development of DMFT-12 1960 – 2014. Percentages in parenthesis show the part of population covered by fluoridation measures, where reported by [Cheng et al. \(2007\)](#).**

Source: Affidavit of Michael Lusk, affirmed on 27 April 2017, filed in *Lusk v. Tong and Commonwealth Ombudsman*, Federal Circuit Court of Australia, Sydney Registry, File No.1354/2017.

## COST EFFECTIVENESS

CADTH determined that fluoridating the water was significantly cost effective: **“For a large urban municipality, the budget impact of CWF introduction compared with CWF non-implementation was found to generate net savings of more than \$525 million over twenty years.”**

CADTH’s analysis identified three main costs associated with not fluoridating water - increased dental bills, loss of productivity for time spent at the dentist’s office, and transportation costs to and from treatment. The only costs considered for fluoridating water were construction of fluoridation facilities and ongoing operation and maintenance.

It cited five reviews, all of which found that fluoridation was cost effective. It omitted the Ko/Thiessen 2015 analysis (1) which found no cost savings from fluoridation, rebutting the 2001 Griffin et al. study (2) which CADTH cited.

Moreover, the selection of studies used to compute the cost savings are highly questionable and we believe far too high. CADTH appears to have relied mainly on one study, Arrow 2015 (3), while omitting others cited in CADTH showing much less effectiveness, such as Lee/Han 2015 (4) and Broffit et al. 2013 (5). If anything, Slade 2013 (6), Do 2017 (7) and Slade 2018 (8) show at most one tooth saved from dental decay after 40 years of fluoridation. So, although this statement uses CADTH’s \$525 million figure in the bottom line analysis for comparison purposes (adjusted to \$1.2 billion for Calgary’s population), it is not a figure we are in agreement with.

CADTH’s conclusions on fluoridation’s cost-effectiveness are invalid from several other perspectives.

A major flaw of the entire report is that it ignores the huge health costs of fluoridation. Indeed, none of the five reviews that CADTH cited included these costs. Examining just two harms out of many, dental fluorosis and loss of IQ, puts this in proper perspective.

The losses from fluoridation from neurotoxicity alone are enormous.

As stated in the Neurotoxicity statement, the 2017 Bashash et al. study (9), funded by the U.S. National Institute of Health and led by the University of Toronto, found that every one part per million in fluoride in pregnant women’s urine was associated with a reduction of their children’s IQ by an average 5-6 points. This was reinforced by a 2018 study, Till et al. (10) that determined that fluoride levels in urine in Canadian pregnant women were almost twice as high for those who lived in regions where the water was artificially fluoridated.

A review by Bellinger (11) found that roughly \$18,000 (USD) in lifetime earnings is lost for every 1 point reduction in IQ. This equates to approximately \$23,000 CD at current exchange rates. (All figures below in Canadian dollars)

Estimates for Calgary’s population vary. For these benefit and cost estimates, 1.5 million (figuring population growth from the 2016 Census – Statistics Canada, the same source as CADTH) will be used. This Census is also the source for other figures.

CADTH based its conclusions on an urban population of 675,429. Calgary's 1.5 million population is 2.22 times this number. Therefore, its estimated benefits of net financial gains, \$525 million x 2.22 = approximately \$1.2 billion.

Assuming a conservative estimate of 1 IQ point loss per person in fluoridated Calgary (individuals vary – many would have no IQ loss, others could lose many IQ points), for an estimated working lifetime of 45 years, this equates ( $\$23,000 \div 45$ ) to an approximate \$500 earnings loss per year, or \$10,000 loss per person for the 20 year period that CADTH used.

Calgary's working population can be approximated from ages 20 to 64. The Census total of that age group can be estimated at 960,000 people. Multiplying by the \$10,000 loss of income per person, this comes to a total loss just from IQ reduction of approximately \$9.6 billion.

For dental fluorosis, Hardy Limeback, PhD, DDS, former head of preventive dentistry at the University of Toronto and former president of the Canadian Association for Dental Research, prepared the analysis below on the treatment costs if Calgary fluoridates.

## The cost of treating dental fluorosis if Calgary re-instates fluoridation

1. In 40 yrs., 650,000 children under age 6 will be exposed to fluoridated water
2. 1 in 10 (65,000) will end up with objectionable dental fluorosis
3. If half (32,500) get microabrasion and or bleaching, this will cost \$32.5 - \$50 million
4. If 40% (26,000) get bleaching/microabrasion PLUS some cosmetic fillings, this will cost up to \$75 million
5. If the remaining 10% elect to have porcelain veneers the cost is up to \$130 million

**Total cost to treat dental fluorosis = \$255 million**

6. If one tooth is saved from dental decay/person after 40 years and it costs \$175 to repair, then the dental cost savings is 1.5 M X \$175 = \$263 Million

Sources:

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Dr. Limeback's figures are calculated over 40 years. To be consistent with CADTH's time horizon, the cost of treating fluorosis over 20 years would be half as much, approximately \$128 million.

Finally, one CADTH assumption was “**All of those who lived in a municipality with CWF are assumed to drink fluoridated water.**” But this doesn’t reflect the reality of Canadian water drinking habits. According to the latest (2017) figures from Statistics Canada ([12](#)), 20% of Canadians drink primarily bottled water and 8% drink a combination of tap and bottled. Since nearly all bottled water is unfluoridated, the presumed savings of fewer cavities from drinking fluoridated water would be reduced by at least 20%, approximately \$233 million.

**The bottom line over a 20-year period if Calgary is fluoridated:**  
**(Estimated figures rounded for simplicity)**

**GAINS**

CADTH’s estimated net benefit in reduced cavities \$1.2 billion\*

**LOSSES**

|   |                     |
|---|---------------------|
| Estimated loss from IQ decline                      | 9.6 billion         |
| Estimated loss from dental fluorosis treatments     | 128 million         |
| <u>Lowered estimate from bottled water drinking</u> | <u>233 million</u>  |
| <b>TOTAL LOSSES:</b>                                | <b>\$10 billion</b> |

**NET LOSS from fluoridation**

**\$8.8 billion**

**\*Safe Water Calgary believes this figure is very high.**

The estimated financial losses from fluoridating Calgary, \$8.8 billion, are staggering. These figures don’t include the massive medical costs of fluoridation-linked hypothyroidism and chemical sensitivity, nor other diseases linked to fluoride not covered by this statement, such as diabetes, musculoskeletal and kidney disease.

Another financial burden of fluoridation CADTH didn’t consider is the cost of avoidance. Many people will not drink fluoridated water, a significant number because of health risks. They will be forced to buy expensive filters or bottled water. Low income families will not be able to afford these alternatives, making this a major social justice issue. They will not have a choice.

CADTH said that its budget impact analysis encompassed “**a broad societal perspective.**” It is obvious that it did not.



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**DISCLAIMER**

*This document is made for informational purposes only, and it should not be used as a substitute for medical advice. Safe Water Calgary is not responsible for any errors or omissions within the referenced materials.*



## APPENDIX

### Fluoride Exposure during Fetal Development and Childhood IQ: The MIREC Study

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#### Abstract

**Background:** The potential neurotoxicity of early life exposure to fluoride, which has sparked controversy about community water fluoridation, is poorly understood. Objective: To test the association between fluoride exposure during fetal development and childhood IQ in a Canadian sample of 510 mother-child pairs enrolled in the Maternal-Infant Research on Environmental Chemicals (MIREC) birth cohort; 38% received "optimal" levels of community fluoridated water.

**Methods:** We measured three maternal urinary fluoride (MUF) concentrations during pregnancy, averaged them and adjusted them for specific gravity. Children's cognitive abilities were assessed using the Wechsler Primary and Preschool Scale of Intelligence-III at 3-4 years of age. We used multiple linear regression analyses to examine covariate-adjusted associations between MUF and IQ, and to test for interaction with child's sex. We retained the following covariates based on theoretical and statistical relevance: city, quality of child's home environment, maternal education, and race.

**Results:** Average MUF concentrations for all women were 0.51 mg/L (+/-0.36; range=0.06-2.44); MUF concentrations were lower in women supplied with non-fluoridated water (0.40 mg/L +/-0.27) than women supplied with fluoridated water (0.69 mg/L +/-0.41). MUF levels were inversely associated with Full Scale IQ in males (B=-4.51, 95% CI: -8.39, -0.63, p=0.02), but not in females (B=2.43, p=0.33). Among males, higher MUF levels were associated with a significantly larger reduction in Performance IQ (B=-4.63, p=0.04) than Verbal IQ (B=-2.85, p=0.14). Sensitivity analyses using MUF adjusted for creatinine and controlling for other known neurotoxins (i.e., lead, mercury and arsenic) did not substantially change the results.

**Conclusion:** An increase of 1mg/L of MUF during prenatal development was associated with a decrease of Full Scale IQ by 4.5 points in young boys.<sup>329</sup>