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EXPERT REPORT OF BRUCE P. LANPHEAR, MD, MPH

I. EXPERT QUALIFICATIONS

I am a Professor in the Faculty of Health Sciences at Simon Fraser University in Vancouver, British Columbia. I have studied the impact of toxic chemicals, including lead, pesticides, and fluoride, on children's brain development for over 25 years. My research has been almost exclusively funded by federal agencies, including the Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention (CDC), the National Institute for Child Health and Human Development, the National Institute of Environmental Health Sciences, the National Heart, Lung and Blood Institute, Health Canada, and the Canadian Institute of Health Research.

My research has been published in leading medical and scientific journals, including the *Journal of the American Medical Association*, *New England Journal of Medicine*, *Lancet*, *Environmental Health Perspectives*, and *Pediatrics*, and it has been extensively relied upon by environmental and public health agencies, including the US EPA, the Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), and Health Canada. My international pooled analysis of blood lead and IQ deficits in children (Lanphear, 2005) was the critical study the EPA relied on to reduce the national air standard for lead, and it was a key study cited by Health Canada in revising their guidance on lead in water.

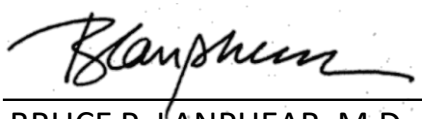
I have served on the editorial boards of several academic journals, including *Public Health Reports*, *PLoS Medicine* (a peer-reviewed medical journal published by the Public Library of Science), and *Environmental Health Perspectives* (a journal funded by the National Institutes of Environmental Health Sciences).

I have served on scientific committees on environmental health issues, including the Executive Council on Environmental Health for the American Academy of Pediatrics and various EPA scientific advisory boards. My work with the EPA included expert advisory member of the EPA's Science and Research Work Group of the Children's Health Protection Advisory Committee (1998-2001); EPA's Workshop on Assessing Environmental Exposures to Children (2000-2002); EPA's Clean Air Scientific Advisory Committee (2006-2008); EPA's Science Advisory Board for Evaluating Hazards of Partial Water Line Replacement (2011-2012); and EPA's Clean Air Scientific Advisory Committee (2021-present).

My research has earned awards, including the 2012 Research Integrity Award from the International Society for Environmental Epidemiology, the 2013 Public Policy and Advocacy Award from the Academic Pediatric Association, and the 2015 Research Award from the Academic Pediatric Association.

I am a Co-Principal Investigator of an ongoing National Institutes of Health-funded study to examine the impact of early-life fluoride exposures on intellectual abilities in a birth cohort in Canada known as the MIREC Study. I am also a co-investigator of an ongoing study funded by the Canadian Institutes of Health Research to examine the impact of early-life fluoride exposures on intellectual abilities in a 500-person cohort in the New Hampshire Birth Cohort Study.

A complete summary of my qualifications and list of my publications can be found in my attached Curriculum Vitae.



October 15, 2024

BRUCE P. LANPHEAR, M.D., M.P.H. DATE

II. ISSUES TO ADDRESS

1. What is the status of the scientific debate on the risks and benefits of community water fluoridation?

2. What was the state of scientific research on the issue in 2019? How was it different than today?

3. Were Dr. Dickson's public statements contrary to the accepted views of the medical profession at the time?

4. In reply to the expert opinion of Dr. Milne-Epp (05.16.2023), do you agree with her conclusion that "the information that Dr. Dickson is promoting is not supported by good quality evidence, and therefore is false"? Please explain.

5. In reply to the expert opinion of Dr. Sikora (04.25.2023), do you agree with his conclusion that "the advocacy observed does generally function contrary to current and widely accepted views of the profession, and against the intent and purpose of improving overall population health"?

To address these questions, I'll begin by reviewing the evolution of community water fluoridation. My focus is on whether – and when – evidence was sufficient to raise questions about the safety and effectiveness of community water fluoridation.

III. THE ORIGIN AND EVOLUTION OF COMMUNITY WATER FLUORIDATION

Community water fluoridation – the addition of fluoride to drinking water to prevent dental caries – was based on the discovery that children with fluorosis had a lower prevalence of dental caries. In the 1930s, H. Trendley Dean showed that 1

mg/L of fluoride in drinking water was the optimal concentration to protect against caries while causing minimal and barely discernable dental fluorosis (Zelko, 2019). Dean cautioned that further investigation was needed before fluoride was added to drinking water (Zelko, 2019). In 1944, the Editor of the Journal of the American Dental Association thought adding fluoride to water for caries prevention, "spectacularly attractive", but he also worried about adding a "highly toxic substance" to drinking water and said the "potentialities for harm far outweigh those for good" (Anthony, 1944).

Still, tooth decay was rampant from sugar consumption and observational studies conducted in the mid-1940s showed a striking reduction of dental caries in towns adding fluoride to their water supply (Zelko, 2019). In the 1950s, the era of "better living through chemistry", community water fluoridation offered an ostensibly simple solution to the caries epidemic, and the US Public Health Service promoted water fluoridation as both safe and effective in the fight against dental caries (Zelko, 2019).

In 1971, the National Institute for Dental Research launched the national caries prevention program with water fluoridation as the primary strategy to prevent dental caries (Kearns, 2015). Since then, rates of tooth decay plummeted in the United States and other countries that fluoridated their drinking water, but they *also* plummeted in countries without fluoridation (Neurath, 2005). The decline of dental caries may have been due to the use of fluoride toothpaste or strategies to reduce sugar intake but reducing sugar intake was not part of the caries prevention strategy in the United States (Kearns, 2015).

In 2000, the Greater Boston Physicians for Social Responsibility reviewed

evidence on toxic threats to children's development, including fluoride. They concluded that studies in both animals and human populations suggest that fluoride exposure – at levels experienced by a significant proportion of the population in fluoridated communities – may have adverse impacts on the developing brain (Schettler, 2000).

In 2006, the National Research Council (NRC) recommended that longitudinal studies of children be done on the psychological, behavioral, and social effects of fluoride in U.S. communities with water fluoride concentrations > 1 ppm (NRC, 2006). One NRC panel member said the report "should be a wake-up call" about the potential neurotoxicity of fluoride.

In a 2007 commentary, Cheng, Chalmers, and Sheldon – an epidemiologist, a physician, and a health service researcher in the United Kingdom – expressed surprised at the confidence with which water fluoridation is both promoted and opposed, given the poor quality of the evidence (Cheng, 2007). They noted that water fluoridation aims to reduce inequalities in oral health, but studies have not shown it is effective in reducing these disparities (Cheng, 2007). The authors also noted that the quality and quantity of available data were insufficient to rule out all but the most significant side effects, such as fluorosis (Cheng, 2007).

Prior to 2012, most studies of fluoride neurotoxicity were cross-sectional and had primarily been conducted in China or Iran; few studies had been conducted in North America. In a 2012 meta-analysis of studies published from 1989 to 2011, Anna Choi and her team found that children with higher fluoride exposure had significantly lower IQ scores (Choi, 2012). They reported 7-point lower IQ scores among children with higher fluoride exposure compared with children who had

lower exposure (Choi, 2012). The meta-analysis by Choi raised serious questions about the neurotoxicity of fluoride and should have been a wake-up call for the public health community and other proponents of community water fluoride to seriously evaluate the potential neurotoxicity of fluoride.

In 2015, the US Public Health Service lowered the recommended concentration of fluoride in drinking water, from a range of 0.7 – 1.2 mg/L to 0.7 mg/L, to reduce the risk of dental fluorosis while conserving its protective effect against dental caries (DHHS, 2015). In that same year, the National Toxicology Program (NTP), a federal interagency program established to study the health effects of chemicals, began a systematic review and meta-analysis to determine if fluoride is a developmental neurotoxicant.

In 2024, Mohamed Taher and his colleagues at the University of Ottawa conducted a comprehensive systematic review of fluoride toxicity (Taher, 2024). Although the authors noted some uncertainty in the causal evidence for fluoride reducing IQ scores in children, they concluded, "the cumulative body of evidence suggests a positive association of reduced IQ scores for children and fluoride exposures relevant to current North American drinking water levels" (Taher, 2024).

In 2024, a Cochrane systematic review report concluded that community water fluoridation led to non-statistically significant reductions of dental caries in primary teeth and permanent teeth (Iheozor-Ejiofor, 2024).

These studies and government reports indicate that the levels of fluoride producing adverse effects, such as fluorosis and neurotoxicity, has continued to evolve. The most recent and comprehensive reports raise serious questions about

the safety and effectiveness of community water fluoridation.

IV. DISCUSSION OF ISSUES PRESENTED

1. What is the status of the scientific debate on the risks and benefits of Community Water Fluoridation?

The status of the risk and benefits of community water fluoridation continues to evolve. As of this writing, fluoride remains a contentious and hotly debated topic. Yet – as noted above – questions about fluoride's safety and efficacy have been raised by prominent dentists, public health agencies, physicians, and scientists for many decades. Community water fluoridation was promoted based on historical evidence that was not as rigorously evaluated as it would be today.

In terms of the benefit of preventing dental caries, a 2024 Cochrane review concluded that, "Contemporary studies indicate that initiation of community water fluoridation may lead to a slightly greater reduction in dmft [*decayed, missing, and filled primary teeth*] and may lead to a slightly greater increase in the proportion of caries-free children, but with smaller effect sizes than pre-1975 studies." The authors of the Cochrane report estimated that community water fluoridation led to a 4 percent reduction in dental caries in primary teeth and a 3 percent reduction in dental caries of permanent teeth, but with low certainty (Iheozor-Ejiofor, 2024). The authors also concluded that there was insufficient evidence to determine the effect of cessation of community water fluoridation on caries (Iheozor-Ejiofor, 2024). The evidence supporting the effectiveness of contemporary community water fluoridation programs on dental caries is weak.

On the risk side of the equation, fluoride is considered safe by many health officials when consumed at recommended levels, but a growing body of evidence

has linked systemic fluoride exposure with detrimental effects on bone fractures (Riggs, 1990; NRC, 2006; Helte, 2021; Lindsay, 2023), thyroid function (Peckham, 2014; Iamandii, 2024; Hall, 2024), and brain function (Taher, 2024; NTP, 2024; NTP, in press).

This report will focus on research showing that fluoride is a risk factor for diminished intellectual abilities in children, as there have been significant developments over the past decade. I will briefly explore new evidence that community water fluoridation is associated with hypothyroidism and bone fractures.

2. What was the state of scientific research on the issue in 2019? How was it different than today?

The primary difference in the state of fluoride research in 2019 and today is that several new studies (Till, 2020; Cantorial, 2021; Goodman, 2022; Grandjean, 2023; Ibarluzea, 2022), two comprehensive, systematic reviews (Taher, 2024; NTP, 2024), and a meta-analysis on fluoride neurotoxicity (NTP in press) have been – or will soon be – published. New studies have also been published on the associations of fluoride exposure with bone fractures and hypothyroidism at levels found in fluoridated communities (Hilte, 2021; Lindsay, 2023; Hall, 2024). These newer studies and reports – which are consistent with studies published prior to 2020 – indicate that fluoride is a neurocognitive hazard. They also confirm that cognitive function is a more sensitive and consequential endpoint than fluorosis at levels of fluoride below 1.5 ppm (NTP, in press).

3. Were Dr. Dickson's public statements contrary to the accepted views of the medical profession at the time?

As noted by the College's experts, community water fluoridation is supported by the American Academy of Pediatrics, Health Canada, and the Canadian Dental Association (AAP, 2024; Health Canada, 2022; CDA, 2024]. Based on statements of the leading medical organizations in Canada and the United States, it is understandable to see how Dr. Dickson's public statements appeared to conflict with the accepted views of the mainstream medical and dental societies in Canada and the United States. For example, in 1999, the US Centers for Disease Control (CDC) declared water fluoridation one of the ten great public health achievements of the 20^{th} century, along with vaccination and tobacco control (CDC, 1999).

Yet the support of community water fluoridation by the medical and public health communities continues, despite emerging scientific evidence raising concerns about its effectiveness and safety. In 2019, for example, a spokesperson for the American Academy of Pediatrics Section on Oral Health, dismissed the Green et al study (Green, 2019), arguing that "one study did not refute the thousands of studies showing that fluoride was safe and effective". To be sure, more than one study had raised serious questions about the safety or effectiveness of systemic fluoride, but the American Academy of Pediatrics' statement indicates that community water fluoridation was not to be questioned, even in the face of new evidence and, as reviewed below, a federal court decision (AAP, 2024).

Rather than simply relying on broad public health statements about safety and efficacy, I have reviewed the scientific evidence behind the public statements of Dr. Dickson on the topic of community water fluoridation. Dr. Milne-Epp and Dr. Sikora

cite several statements from Dr. Dickson that cause them concern. My review of these statements follows:

A. WHEN PREGNANT MOTHERS OR WOMEN AND BABIES DRINK FLUORIDATED WATER, THEY GET A MUCH HIGHER DOSE OF TOXIC FLUORIDE, CAUSING DAMAGE TO THE BRAINS AND BODY SYSTEMS.

Infants and young children retain 80-90% of absorbed fluoride (Ekstrand, 1994) compared with 50% in healthy adults (Buzalaf, 2011). Infants drinking formula made with fluoridated water can have a 70-fold higher fluoride intake than exclusively breastfed infants; fluoride is found in only trace amounts in breastmilk (Ekstrand, 1981; EPA, 2010; Zohoori, 2018). Pound-for pound, formula-fed infants can have exposures 3 to 4-times higher than adults (NRC, 2006).

Young children are at increased risk for excess fluoride exposure because they often swallow toothpaste (Thornton-Evans, 2019; Tobias, 2024). Swallowing toothpaste is estimated to account for up to 80% of total dietary fluoride intake in young children, but it varies by child's age, frequency of brushing, and amount and type of toothpaste used (Petrovic, 2023). Nearly 40% of US children aged 3-6 years used more than the "pea-size" amount of toothpaste recommended by health authorities; 18% used a "full load" of toothpaste (Thornton-Evans, 2019).

Studies that have collected serial urine samples throughout pregnancy show increases in urinary fluoride concentrations towards the end of gestation (Malin, 2023; Till, 2018). In the MIREC cohort, for example, the 95th percentile urinary fluoride concentrations among pregnant women in fluoridated communities during the 3rd trimester was 2.4 mg/L, two-times higher than the respective 95th percentile urinary fluoride concentration among pregnant women in

non-fluoridated communities (Till, 2018). Reasons for this higher third trimester urinary fluoride concentrations are unclear, but they may reflect increased water ingestion and increased plasma volume. The American College of Obstetrics and Gynecology encourages pregnant women to drink 8 to 12 cups of water per day. Higher levels during third trimester of pregnancy may also reflect mobilization of fluoride from maternal bone (Opydo, 2007).

These studies indicate that pregnant mothers, infants, and young children are exposed to higher doses of fluoride than other groups. The potential effects of higher fluoride exposure are explored below.

B. CHILDREN, THE POOR, AND DISADVANTAGED ARE AFFECTED MUCH MORE BY HARMS AND SIDE EFFECTS OF FLUORIDATION

Water fluoridation has been promoted for low-income children who may not regularly brush their teeth or have access to a dentist. In a 2007 commentary on the University of York's meta-analysis, Cheng, Chalmers, and Sheldon noted that no studies had shown that water fluoridation reduced inequalities in dental health (Cheng, 2007). Similarly, the authors of the 2024 Cochrane Report concluded that insufficient evidence was available to determine whether water fluoridation reduces social disparities in dental caries (Iheozor-Ejiofor, 2024).

Over two-thirds of US children have dental fluorosis (Beltran-Aguilar, 2010; Weiner, 2018). To reduce the risk of dental fluorosis, the American Academy of Pediatrics and the American Dental Association recommend using fluoride-free water or water with low fluoride levels for reconstituting infant formula (Clark, 2020). Over 90% of mothers who feed their infants formula use tap water for formula preparation (Till, 2018; van Winkle 1995). Unfortunately, low-income

families who lived in fluoridated communities may not be able to afford a water filter or bottled water.

Studies published over the past two decades consistently found that fluoride is neurotoxic. Community water fluoridation poses an added burden for low-income children who are at higher risk for exposure to other neurotoxicants, like lead, and are less likely to be breastfed. People can filter their tap water to reduce their fluoride exposure, but low-income families may not be able to afford water filters or bottled water.

Collectively, these reports support Dr. Dickson's claims that children, the poor, and the disadvantaged, are affected much more by harms and side effects of community water fluoridation.

C. FLUORIDE DOES NOT WORK WHEN INGESTED

When community water fluoridation was first introduced, fluoride toothpaste was not available. Topical fluoride exposure, such as brushing with fluoride toothpaste, delivers fluoride to the interface between the tooth surface (enamel) and the oral fluids (Buzalaf, 2018). Daily use of fluoride toothpaste with ≥1,000 ppm is shown to be effective for caries prevention in children (Walsh, 2017). Over the past 25 years, scientists have found that fluoride's anti-caries effect is primarily topical, working at the tooth surface rather than being incorporated into mineralized structures during tooth formation (Featherstone, 2000; Buzalaf, 2011; Buzalaf, 2011). Thus, systemic fluoride provides no benefit to the developing fetus and infant before tooth eruption (Featherstone, 2000; Fejerskov, 1981).

Does community water fluoridation prevent dental caries? A 2024 Cochrane

review concluded that community water fluoridation may lead to a slightly greater increase in the proportion of caries-free children, but with smaller effect sizes than pre-1975 studies. The authors estimated that community water fluoridation after 1975 led to a 4 percent reduction in dental caries in primary teeth and a 3 percent reduction in dental caries of permanent teeth, but the effects were not statistically significant (Iheozor-Ejiofor, 2024).

D. FLUORIDE IS A PROVEN NEUROTOXICANT

Community water fluoridation has been practiced for over 75 years in the United States and Canada, but prospective cohort studies examining whether fluoride is neurotoxic to the developing brain were only conducted during the past decade. Six studies from four countries (Canada, Mexico, Spain, and Denmark) have examined the effect of gestational fluoride exposure on children's cognitive abilities; four were conducted in areas with optimal salt (Cantoral, 2021; Goodman, 2022) or water fluoridation (Green, 2019; Ibarluzea, 2022), one was conducted in an area with endemic fluorosis (Valdez Jimenez, 2017), and one was conducted in a non-fluoridated area (Grandjean, 2023). Five of the six studies included individual-level measures of urinary fluoride and one estimated fluoride intake from dietary intake. Three of the four prospective, low risk-of-bias birth cohort studies conducted in areas with levels similar to those in fluoridated communities found a significant inverse association between higher levels of gestational exposure to fluoride and lower child IQ (Cantoral, 2021; Goodman, 2022; Green, 2019); the Spanish study (Ibarluzea, 2022), did not find a significant inverse association.

The NTP systematic review found that fluoride was inversely associated with IQ or cognitive abilities in 18 of 19 high-quality studies (NTP, 2024). The NTP

systematic review concluded that fluoride is neurotoxicant hazard at levels above 1.5 mg/L. When the NTP released the systematic review to the federal court, they also indicated that their meta-analysis of fluoride and IQ scores was accepted by a scientific journal to be published in JAMA Pediatrics later in 2024. The NTP scientists wrote:

> *"The group-level meta-analysis of 59 studies (n = 20,932 children) used SMD as the effect measure and reported statistically significant inverse associations between fluoride exposure measures and children's IQ. There was also a significant dose response relationship between group-level fluoride exposure and IQ. In stratified dose-response meta-analyses of the low risk-of-bias studies, the direction of association remained consistent when group-level exposure was restricted to <4 mg/L, <2 mg/L, and <1.5 mg/L fluoride in drinking water and <4 mg/L, <2 mg/L, and <1.5 mg/L fluoride in urine. The regression slopes meta- analysis of 13 studies (n = 4,475 children) with individual-level measures of fluoride found a significant decrease in IQ of 1.63 points (95% CI: −2.33,−0.93; p-value <0.001) per 1-mg/L increase in urinary fluoride. In subgroup analyses of both group-level and individual level data, the direction of the association remained inverse when stratified by study quality (high versus low risk of bias), sex, age group, outcome assessment, study location, exposure timing, and exposure metric."*

Another significant development in the debate over whether fluoride is a neurotoxicant occurred on September 24th, 2024, when Judge Edward Chen of the United States District Court in the Northern District of California made the following

ruling in *Food & Water Watch, Inc, et al vs United States Environmental Protection Agency*:

> *The issue before this Court is whether the Plaintiffs have established by a preponderance of the evidence that the fluoridation of drinking water at levels typical in the United States poses an unreasonable risk of injury to health of the public within the meaning of Amended TSCA. For the reasons set forth below, the Court so finds. Specifically, the Court finds that fluoridation of water at 0.7 milligrams per liter ("mg/L") – the level presently considered "optimal" in the United States – poses an unreasonable risk of reduced IQ in children. It should be noted that this finding does not conclude with certainty that fluoridated water is injurious to public health; rather, as required by the Amended TSCA, the Court finds there is an unreasonable risk of such injury, a risk sufficient to require the EPA to engage with a regulatory response. This order does not dictate precisely what that response must be. Amended TSCA leaves that decision in the first instance to the EPA. One thing the EPA cannot do, however, in the face of this Court's finding, is to ignore that risk* (Chen, 2024).

Judge Chen continued:

> *"Specifically, the Court finds that fluoridation of water at 0.7 milligrams per liter ("mg/L") – the level presently considered "optimal" in the United States – poses an unreasonable risk of reduced IQ in children. Not only is there an insufficient margin between the hazard level and these exposure levels, for many, the exposure levels exceed the hazard level of 0.28 mg/L*." (Chen, 2024).

The American Dental Association (ADA) and the American Academy of Pediatrics (AAP) were not swayed by these developments and continue to support community water fluoridation. In 2024, the ADA wrote, *"The district court ruling against the Environmental Protection Agency provides no scientific basis for the ADA to change its endorsement of community water fluoridation as safe and beneficial to oral health."* (ADA, 2024). In a press release by the American Academy of Pediatrics (AAP): *"There is nothing about the current decision that changes my confidence in the safety of optimally fluoridated water in the U.S.," said Charlotte W. Lewis, M.D., M.P.H., FAAP, a member of the AAP Section on Oral Health. "Water fluoridation is a public health policy based on a solid foundation of evidence. When new research is published, health experts scrutinize it to make sure it meets high standards for public safety*."

The AAP further noted, "*The NTP report has important limitations. High fluoride exposure was defined as at least 1.5 milligrams per liter of water, which is double the concentration U.S. officials recommend in community water. The review also was not intended to demonstrate cause and effect*."

Judge Edward Chen noted that the levels of fluoride commonly found in fluoridated communities offer no margin of safety. A 10-fold safety factor is typically used by the US EPA to protect children and other vulnerable populations. Judge Chen also recognized that water fluoride concentration does not adequately capture the amount of water ingested or other sources of ingested fluoride (Till, 2018). In contrast, urinary fluoride is a biological measure of total fluoride exposure, including the dynamic interface between bone fluoride stores and plamsa fluoride. The distinction between water fluoride and urinary fluoride levels – which was not

appreciated or acknowledged by the AAP spokesperson – is important because regulatory and public health agencies must consider total fluoride intake when assessing risks.

The debate over the impact of fluoridation on brain development continues, but a growing body of evidence supports Dr. Dickson's claims that fluoride is a neurotoxicant – a poison – at levels found in communities with water fluoridation (NTP, 2024; NTP, in press). Nobody questions whether fluoride is a toxic at high levels (e.g., > 10 mg/L) (NRC, 2006), but new studies are finding effects of fluoride at ever lower levels of exposure.

The NTP's systematic review found that fluoride was inversely associated with cognitive abilities in 18 of 19 high-quality studies (NTP, 2024). The NTP systematic review concluded that fluoride is neurotoxicant hazard at levels above 1.5 mg/L, but two high-quality, prospective cohort studies have found that an increase in maternal urinary fluoride of 1 mg/L – which are typical for communities that fluoridate their water or salt – were associated with 3 to 5 IQ point decrements (Bashash, 2017; Green, 2019). By comparison, a blood lead level increase of 5 µg/dL is associated with a 3 to 5 IQ point decrement (Lanphear, 2005). So, the observed deficits associated with exposures to fluoride and lead that are typically found in communities today produce similar deficits.

In 2019, following the publication of a study of fluoride and IQ deficits in a prospective birth cohort study in Canada (Green, 2019), the Canadian Agency for Drugs and Technologies in Health (CADTH) was asked to conduct a rapid review of the study prior to a referendum on community water fluoridation in Calgary, Alberta. Unfortunately, the CADTH Rapid Response Report, which is often cited to

promote community water fluoridation, was superficial and lacked rigor. The CADTH report reviewed only one study (CADTH, 2019). In contrast, the NTP Report identified and reviewed 72 studies. The NTP scientists determined that in 18 of the 19 high-quality studies, fluoride exposure was inversely associated with cognitive abilities in children (NTP 2024). In contrast with the NTP Report, the CADTH report did not undergo peer-review by scientists or an independent scientific committee. Moreover, several errors were identified in the CADTH Rapid Response Report. For example, the CADTH Report erroneously reported that only 369 children were included in the primary sample, not 512 children. The CADTH Report said that testing for sex differences was conducted post-hoc and that the study failed to adjust for father's education or income. Neither of these statements are true.

E. FLUORIDE IS A PROVEN THYROID DISRUPTOR

Fluoride appears to be a thyroid suppressant. Fluoride was found to cause a reduction in the level of plasma protein-bound iodine and clinical improvement in hyperthyroidism (Galletti, 1958). At higher doses, Day et al found that fluoride increased the incidence of goiter (Day, 1972). This historical evidence raises worrisome questions about widespread exposure of pregnant women to fluoride because their infants depend entirely on the mother's thyroid hormones during the first and early second trimester of pregnancy, when the developing brain is sensitive to thyroid disruption. This concern is heightened by our findings in the MIREC cohort that iodine deficiency in pregnant women was associated with larger decrements in boys' performance IQ scores (Goodman, 2022). Iodine is essential for thyroid function, especially during early brain development.

In a Canadian birth cohort, pregnant women who were exposed to higher

concentrations of fluoride in their drinking water were at higher risk for primary hypothyroidism (Hall, 2024). For a 0.5 mg/L rise in water fluoride concentration, women who lived in the same residence for more than one year were 80% more likely to have primary hypothyroidism.

We also observed a statistically significant interaction between water fluoride concentration and maternal thyroid peroxidase antibody (TPOAb) status in predicting the risk of primary hypothyroidism. For a 0.5 mg/L rise in water fluoride concentration, women with normal levels of antibodies were nearly 3-times more likely to have primary hypothyroidism. Women with normal levels of antibodies who lived at the same residence for more than a year were nearly 4-times more likely to have primary hypothyroidism. In contrast, water fluoride concentration was not associated with primary hypothyroidism among women with elevated thyroid peroxidase antibody levels.

Iamandii and her team found that higher water fluoride concentrations, urinary fluoride concentrations, and serum fluoride concentrations were associated with higher thyroid stimulating hormone in children, with little evidence of a threshold (Iamandii, 2024).

Collectively, these studies support Dr. Dickson's claim that fluoride suppresses thyroid hormone and may increase the risk for hypothyroidism, but only two studies have examined the risk of fluoride exposure on hypothyroidism (Peckham, 2014; Hall, 2024).

F. EXCESS FLUORIDATION CAUSES FLUOROSIS AND AFFECTS BONE GROWTH

The concept of "optimal" fluoride concentration is more appropriately defined by the level that prevents dental fluorosis rather than the level that prevents dental caries (Buzalaf, 2018; Fejerskov, 1981). However, even at so-called "optimal" fluoride levels, studies have shown that a large fraction of the population will develop fluorosis and dental caries (Warren, 2009). This evidence raises concerns about the effectiveness of community water fluoridation and its contribution to fluorosis, especially for the developing fetus and infant.

Dental fluorosis is a developmental defect of tooth enamel due to excessive fluoride intake during the pre-eruptive period (Den Besten, 2011; Wong, 2011). High fluoride exposure before tooth eruption disrupts the formation of hydroxyapatite crystals and leads to hypomineralization of the enamel subsurface. As a result, the tooth enamel is discolored or mottled; mild fluorosis appears as thin white lines, moderate fluorosis coalesces into larger white areas, and severe fluorosis covers the entire surface, with or without the presence of brown discoloration and pitting. The severity of dental fluorosis primarily driven by the dose, frequency, and timing of fluoride exposure (Buzalaf, 2018).

The prevalence of dental fluorosis has steadily increased in the United States (Beltran-Aguilar, 2010; Neurath, 2019), indicating that excess fluoride exposure during tooth enamel formation has been occurring over the past few decades. The prevalence of mild, moderate, or severe fluorosis in American youth has increased from 30% in 2001-2002, to 60% in 2011 to 2012, and 69% in the 2015-2016 National Health and Nutrition Examination (NHANES) surveys (Beltran-Aguilar, 2010; Weiner,

2018). In 2015, the US Public Health Service lowered the recommended concentration of fluoride in drinking water, from a range of 0.7 – 1.2 mg/L to 0.7 mg/L, to reduce the risk of dental fluorosis (DHHS, 2015).

Fluoride is a risk factor for bone fractures (Riggs, 1990; NRC, 2006; Helte, 2021; Lindsay, 2023). In 2006, members of the National Research Committee concluded that fluoride could weaken the bone and increase the risk for fractures (NRC, 2006). In 2021, Helte and others found that Swedish women with the highest tercile of urinary fluoride concentrations were 50% more likely to have an incident hip fracture (HR=1.50, 95%CI=1.04, 2.17). Importantly, fluoride concentrations in the drinking water ranged from 0 to 1 mg/L, levels found in optimally fluoridated communities (Helte, 2021). The associations were stronger for women with consistent long-term drinking water exposure (Helte, 2021). Finally, in a national, cross-sectional survey, Lindsay found that children who lived in fluoridated counties were significantly more likely to have a forearm fracture, the most common fracture in children (Lindsay, 2023). While more studies are needed to confirm these associations at levels of fluoride found in fluoridated communities, the evidence supports the conclusion that fluoride is a risk factor for bone fractures.

G. IMPACT OF FLUORIDE ON KIDNEY HEALTH

Dr. Dickson cautioned that people with kidney disease should avoid fluoride. Many laboratory studies have found that fluoride is toxic to the kidney, but remarkably few studies have been done in humans at levels found in fluoridated communities (Dharmaratne, 2019). In 2007, Xiong and his team studied 210 children aged 10 to 12 years in the Henan Province of China. The fluoride in drinking water ranged from 0.76 mg/L to 5.69 mg/L. Xiong found that two urinary markers of

tubular epithelial cell injury were significantly higher in the groups with fluoride concentrations > 2 mg/L in their drinking water and urine (Xiong, 2007). Although consumption of optimal amounts of fluoride in drinking water does not appear to increase the risk of chronic kidney disease in humans, numerous studies have shown that people with impaired kidney function retain excess fluoride that may result in further damage to the kidneys (Dharmaratne, 2019). Thus, it is reasonable to advise people with kidney disease to avoid excess amounts of fluoride.

H. SUMMARY ON SCIENTIFIC EVIDENCE BEHIND COMMENTS ON SAFETY AND EFFICACY OF COMMUNITY WATER FLUORIDATION

Dr. Dickson was not the only physician or scientist questioning the safety and effectiveness of community water fluoridation. Numerous studies and reports published over the past 30 years have raised similar questions, even if they were typically ignored or dismissed by medical and dental societies and public health agencies in the United States and Canada.

In my opinion, Dr. Dickson's public statements raising questions about the effectiveness and risks of fluoride over the past 20 years were not contrary to *scientific evidence*. Dr. Dickson was an early adopter of emerging scientific evidence about the toxicity of fluoride and limited effectiveness in reducing dental caries from community water fluoridation. Early adopters of scientific evidence play a critical role in protecting people from hazards.

4. In reply to the expert opinion of Dr. Milne-Epp (05.16.2023), do you agree with her conclusion that "the information that Dr. Dickson is promoting is not supported by good quality evidence, and therefore is false"? Please explain.

I disagree with Dr. Milne-Epp. In my opinion, Dr. Dickson is promoting efforts to

reduce widespread exposure to a toxic chemical that increases the risk of cognitive deficits in children, does not appear to be effective at reducing dental caries when added to water, may be a thyroid suppressant, and adversely affects vulnerable populations. The quality of the evidence has evolved over the past two decades, but as reported by the National Toxicology Program, high quality studies – including several prospective, cohort studies – have consistently shown that fluoride is a risk factor for diminished IQ scores in children at levels found in fluoridated communities (NTP, 2024; NTP, in press).

Much of the information promoted by Dr. Dickson is supported by high-quality studies. As previously noted, for example, three of the four prospective, low risk-of-bias birth cohort studies conducted in optimally fluoridated areas found a significant inverse association between higher levels of gestational exposure to fluoride and lower child IQ (Cantoral, 2021; Bashash, 2017; Goodman, 2022; Green, 2019). Based on the NTP meta-analyses, the collective evidence provides consistent evidence that fluoride is a neurotoxicant, with no evidence of a threshold (NTP, in press).

5. In reply to the expert opinion of Dr. Sikora (04.25.2023), do you agree with his conclusion that "the advocacy observed does generally function contrary to current and widely accepted views of the profession, and against the intent/ purpose of improving overall population health"? Please explain.

Dr. Dickson's advocacy is not contrary to the intent or purpose of improving overall population health. If community water fluoridation provided definitive benefits with no risks, I would agree with Dr. Sikora. But, as noted above, experts have raised questions about the effectiveness of community water fluoridation (Iheozor-Ejiofor, 2024). Moreover, the collective evidence from prospective cohort

studies, two systematic reviews (Taher, 2024; NTP, 2024) and an upcoming meta-analysis (NTP, in press) supports the conclusion that fluoride exposure during early brain development diminishes the intellectual abilities in young children, including at "optimal" levels of fluoridated water for caries prevention. Finally, the AAP and CDC advise mothers to avoid using fluoridated water to mix infant formula, but mothers who live in fluoridated communities may not have any options other than to use fluoridated water.

Population-wide exposures to a toxic chemical that diminishes children's intellectual abilities will result in substantial increase in the number of people in a population who are challenged (i.e., have an IQ score < 70 points), reduce the number of people in a population who are gifted, and reduce the lifetime earnings for millions of people. Based on studies of low-level lead poisoning, each IQ point lost adds up to a $20,000 reduction in lifetime earnings (Lanphear, 2015). The lifetime costs of diminished IQ scores will overshadow the costs of dental caries, especially if contemporary community water fluoridation only "lead[s] to slightly less tooth decay in children's baby teeth" (Iheozor-Ejiozor, 2024).

Geoffrey Rose, a leading population health expert who wrote the book, *Strategy for Preventive Medicine*, cautioned that measures that were imposed on populations, such as community water fluoridation, require a higher level of scientific evidence and popular acceptability.

> *"The situation is basically different where individuals have no choice to reject a preventive measure. They can buy toothpaste with or without added fluoride, but if fluoride is added to the drinking water, they can hardly avoid imbibing it." Rose continued, "We should expect a higher level of scientific*

evidence and popular acceptability for measures such as [water fluoridation] which are imposed and not chosen by the recipients. (Geoffrey Rose, Strategy for Preventive Medicine, page 148).

Dr. Bob Dickson's advocacy – which questioned the safety and effectiveness of community water fluoridation – is consistent with Geoffrey Rose's views on population strategies.

V. CONCLUSION

Over the past two decades, a National Research Council expert panel recommended that the US Environmental Protection Agency lower the maximum contaminant level of fluoride to prevent fluorosis and bone fractures. The National Research Council also called for studies to examine the neurotoxicity and neurobehavioral effects of fluoride because the "consistency of results [from studies of populations exposed to fluoride at 2.5 to 4 mg/L in drinking water] appears significant enough to warrant additional research on the effects of fluoride on intelligence" (NRC, 2006). In 2015, the US Public Health Service recommended reducing the optimal level of fluoride in community water fluoride programs to reduce fluorosis (NRC, 2006; DHHS, 2015). Over the past 25 years, scientists have found that fluoride's anti-caries effect are primarily topical, working at the tooth surface rather than being incorporated into mineralized structures during tooth formation (Featherstone, 2000; Buzalaf, 2011; Buzalaf, 2011). Thus, systemic fluoride provides little benefit to the developing fetus and infant before tooth eruption (Featherstone, 2000; Fejerskov, 1981). During the same time, dozens of cross-sectional and prospective cohort studies have examined fluoride's potential neurotoxicity. The results of the NTP's systematic review and upcoming meta-

analyses – which thoroughly evaluated the neurotoxicity of fluoride – clearly indicate that yet another reassessment of the risk-benefit ratio of ingested fluoride is required, particularly for pregnant women and infants. Previous risk assessments were focused on dental fluorosis, but these meta-analyses indicate that cognitive function is a more consequential endpoint at levels of urinary fluoride below 1.5 ppm.

Collectively, these studies support Dr. Bob Dickson's claims that community water fluoridation is not effective at preventing dental caries, increases the risk for fluorosis for bone fractures, diminishes children's IQ scores, and may increase the risk for thyroid disruption, including hypothyroidism.

VI. REFERENCES

1. American Dental Association. Judge orders EPA to address impact of fluoride in drinking water. https://adanews.ada.org/ada- news/2024/september/judge-orders-epa-to-address-impacts-of-fluoride-in- drinking-water/
2. American Academy of Pediatrics. AAP, ADA stand by fluoride recommendations following court ruling. https://publications.aap.org/aapnews/news/30299/AAP-ADA-stand-by-fluoride-recommendations.
3. Anthony LP. The effect of fluorine on dental caries. J Am Dental Ass 1944:1360-1363.
4. Bashash M, Thomas D, Hu H, et al. Prenatal fluoride exposure and cognitive outcomes in children at 4 and 6-12 years of age in Mexico. Environ Health Perspect 2017;125:097017.
5. Beltran-Aguilar ED, Barker L, Dye BA. Prevalence and severity of dental fluorosis in the United States, 1999-2004. Data Brief 2010. National Center for Health Statistics, Centers for Disease Control and Prevention, Washington, D.C.
6. Buzalaf MAR; Pessan JP; Honorio HM; ten Cate JM. Mechanisms of Action of Fluoride for Caries Control. In *Fluoride and the Oral Environment*, ed M Buzalaf 2011; 22:97–114. Basel: Karger.
7. Buzalaf MAR, Whitford GM. Fluoride metabolism. *Monogr Oral Sci* 2011;22:20–36.
8. Buzalaf MAR. Review of Fluoride Intake and Appropriateness of Current Guidelines. *Adv Dent Res*. 2018;29:157–66.
9. CADTH. Community water fluoridation: a review of neurological and cognitive effects. 2019. CADTH rapid response report: summary with critical appraisal.

10. Canadian Dental Association. Position on Water Fluoridation. https://www.cda-adc.ca/en/about/position_statements/fluoride_water/
11. Cantoral A, Tellez-Rojo MM, Malin AJ, et al. Dietary fluoride intake during pregnancy and neurodevelopment in toddlers: a prospective study in the PROGRESS cohort. Neurotoxicology 2021;87:86-93.
12. Centers for Disease Control and Prevention. Achievements in Public Health, 1900-1999: Fluoridation of drinking water to prevent dental caries. MMWR 1999;48:933-940.
13. Chen E. https://www.cand.uscourts.gov/wp-content/uploads/2024/09/17- cv-2162-Food-_-Water-Watch-Inc.-et-al.-v.-EPA-et-al-Opinion.pdf.
14. Cheng KK, Chalmers I, Sheldon TA. Adding fluoride to water supplies. BMJ 2007;335:699-702.
15. Choi A, Sun G, Zhang Y, Grandjean P. Developmental fluoride neurotoxicity: a systematic review and meta-analysis. EHP 2012;120:1362-1368.
16. Clark MB, Keels MA, Slayton RL for the American Academy of Pediatrics Section of Oral Health. Fluoride use in caries prevention in the primary care setting. Pediatrics 2020;146:e2020034637.
17. Dharmaratne RW. Exploring the role of excess fluoride in chronic kidney disease: A review. Human Experimental Toxicology 2019;38:269-279.
18. Day TK, Powell-Jackson PR. Fluoride, water hardness, and endemic goitre. Lancet 1972;1(7761):1135-1138.
19. Den Besten P, Li W. Chronic fluoride toxicity; dental fluorosis. Monogr Oral Sci 2011;22:81-96.
20. Ekstrand, J., 1981. No evidence of transfer of fluoride from plasma to breast milk. BMJ 1981;283:761.

21. Ekstrand J, Ziegler EE, Nelson SE, Fomon SJ. Fluoride pharmacokinetics in infancy. Pediatric Research 1994;35:157–63.
22. Featherstone JDB. The science and practice of caries prevention. J Am Dent Assoc 2000;131:887-899.
23. Fejerskov O, Thylstrup A, Larsen MJ. Rational use of fluorides in caries prevention. A concept based on possible cariostatic mechanisms. *Acta Odontol Scand*. 1981;39:241–49.
24. Galletti P-M, Joyet G. Effect of fluorine on thyroidal iodine metabolism in hyperthyroidism. J Clin Endocrinol Metab 1958;18:1102-1110.
25. Goodman CV, Hall M, Green R, et al. Iodine status modifies the association between fluoride exposure in pregnancy and preschool boys' intelligence. Nutrients 2022;14:2920.
26. Goodman CV, Bashash M, Green R, et al. Domain-specific effects of prenatal fluoride exposure on child IQ at 4, 5, and 6-12 years in the ELEMENT cohort. Environ Res 2022;211:112993.
27. Grandjean P, Meddis, Nielsen F, et al. Dose dependence on prenatal fluoride exposure associations with cognitive performance at school age in three prospective studies. Eur J Public Health 2023;34:143-149.
28. Green R, Lanphear B, Hornung, R, Flora D, et al. Association brtween maternal fluoride exposure during pregnancy and IQ scores in offspring in Canada. JAMA Pediatrics 2019;173:940-948.
29. Hall M, Lanphear B, Chevrier J, et al. Fluoride exposure and hypothyroidism in a Canadian pregnancy cohort. Sci Tot Environ 2024;933:1731221.
30. Iamandii I, De Pasquale L, Giannone ME, et al. Does fluoride exposure affect thyroid function? A systematic review and dose-response analysis. Environ Res

2024;242:117759.

31. Health Canada. Fluoride and oral health. https://www.canada.ca/en/health-canada/services/healthy-living/your-health/environment/fluorides-human-health.html Accessed October 31, 2024.
32. Helte E, Vargas CD, Kippler M, et al. Fluoride in drinking water, diet, and urine in relation to bone mineral density and fracture incidence in postmenopausal women. Environ Health Perspect 2021;129: https://doi.org/10.1289/EHP7404
33. Ibarluzea J, Gallastegi M, Santa-Marina L, et al. Prenatal exposure to fluoride and neuropsychological development in early childhood. Environ Res 2022;207:112181.
34. Iheozor-Ejiozor Z, Walsh T, Lewis SR, et al. Water fluoridation for the prevention of dental caries. Cochrane Database of Systemic Reviews 2024 https://doi.org/10.1002/14651858.CD010856.pub3.
35. Kearns CE, Glantz SA, Schmidt LA. Sugar industry influence on the scientific agenda of the National Institute of Dental Research's 1971 National Caries Program: A Historical Analysis of Internal Documents. PLoS Medicine 2015;12:e1001798.
36. Lanphear BP. The impact of toxins on the developing brain. Ann Rev Public Health 2015;36:211-230.
37. Lindsay SE, Smith S, Yang S, Yoo J. 2023. Community Water Fluoridation and Rate of Pediatric Fractures. *JAAOS Global Research & Reviews*. 7(10):e22.00221.
38. Malin AJ, Hu H, Martínez-Mier EA, Eckel SP, Farzan SF, et al. Urinary fluoride levels and metal co-exposures among pregnant women in Los Angeles, California. *Environ Health*. 2023;22:74.

39. National Research Council (NRC), 2006. Fluoride in Drinking Water: A Scientific Review of EPA's Standards. National Academies Press, Washington, DC. doi: http://www.nap.edu.
40. National Toxicology Program. Monograph on the State of the Science Concerning Fluoride Exposure and Neurodevelopment and Cognition: A systematic review. Research Triangle Park, NC: National Toxicology Program. NTP Monograph 08. http://doi.org/10.22427/NTP-MGRAPH-8
41. Neurath C, Tooth trends for 12-year-olds in nonfluorinated and fluoridated countries. Fluoride 2005;38:324-325.
42. Neurath C, Limeback H, Osmunson B, et al. Dental fluorosis trends in US oral health surveys: 1986 to 2012. JDR Clin Trans Res 2019;4:298-308.
43. Opydo J, Borysewicz-Lewickaa M. 2007. Transplacental passage of fluoride in pregnant Polish women assessed on the basis of fluoride concentrations in maternal and cord blood plasma. Fluoride 2007;40:46–50.
44. Peckham S, Lowery D, Spencer A. Are fluoride levels in drinking water associated with hypothyroidism prevalence in England? A large observational study of GP practice data and fluoride levels in drinking water. J Epidemiol Community Health 2015;69:619-624.
45. Petrovic B, Kojiv S, Milic L, et al. Toothpaste ingestion – evaluating the problem and ensuring safety: systematic review and meta-analysis. Front Public Health 2023;11:1279915.
46. Podgorski J, Berg M. Global analysis and prediction of fluoride in groundwater. Nature Communication 2022;13:4232. doi.org/10/1038/s41467-022-31949-x.
47. Riggs BL, Hodgson SF, O'Fallon M, et al. Effect of fluoride treatment on the fracture rate in postmenopausal women with osteoporosis. NEJM

1990;322:802-809.

48. Sanders A, Grider WB, Maas W, Curiel JA, Slade GD. Association between water fluoridation and income-related dental caries of US children and adolescents. JAMA Pediatrics 2019;173:288-290.
49. Schettler T, Stein J, Reich F, Valenti M. In harm's way: Toxic threats to child development. Greater Boston Physicians for Social Responsibility. May 2000.
50. Taylor KW, Eftim SE, Sibrizzi CA, et al. Fluoride exposure and children's intelligence: A systematic review and meta-analysis. JAMA Pediatrics 2024 (in press).
51. Till, C., Green, R., Grundy, J., Hornung, R., Neufeld, R., Martinez-Mier, A., Ayotte, P., Muckle, G., Lanphear, B., Community water fluoridation and urinary fluoride concentrations in a national sample of pregnant women in Canada. Environ Health Perspect 2018;126; https://doi.org/10.1289/EHP3546.
52. Till C, Green R, Flora D, et al. Fluoride exposure from infant formula and child IQ in a Canadian birth cohort. Environ Int 2020;134:105315.
53. Tobias G, Khaimov A, Zini A, et al. Caries prevalence and water fluoridation in Israel; a cross-sectional study. Quintessence Int 2024;55:166-172.
54. Thornton-Evans G, Junger ML, Lin M, et al. Use of toothpaste and toothbrushing patterns among children and adolescents – United States, 2013-2016. MMWR 2019;68:87-87.
55. United States Environmental Protection Agency. 2010. Fluoride: relative source contribution analysis. *Health and Ecological Criteria Division, Office of Water.*
56. U.S. Department Health and Human Services Federal Panel on Community Water Fluoridation. U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries. Public

Health Rep 2015;130:318-331.

57. Valdez Jimenez J, Lopez Guzman, Cervantes Flores M, et al. In utero exposure to fluoride and cognitive development delay in infants. Neurotoxicology 2017;59:65-70.
58. Van Winkle S, Levy SM, Kiritsy MC, Heilman JR, Wefel JS, Marshall T. Water and formula fluoride concentrations: significance for infants fed formula. Pediatr Dent. 1995;17:305–310.
59. Walsh T, Worthington HV, Glenny A-M, et al. Fluoride toothpastes of different concentrations for preventing dental caries. Cochrane Database Syst Rev 2019;3:CD007868.
60. Warren JJ, Levy SM, Broffitt B, Cavanaugh JE, Kanellis MJ, Weber-Gasparoni K. Considerations on optimal fluoride intake using dental fluorosis and dental caries outcomes--a longitudinal study. J Public Health Dent 2009;69:111–15.
61. Wong MCM, Clarkson J, Glenny AM, et al. Cochrane Reviews on the benefits/risks of fluoride toothpastes. J Dent Res 2011;90:573-579.
62. Xiong X, Liu J, He W, et al. Dose-effect relationship between drinking water fluoride levels and damage to the liver and kidney functions in children. Environ Res 2007;103:112-116.
63. Zelko F. Optimizing nature: Invoking the “natural” in the struggle over water fluoridation. History of Science 2019;57:518-539.
64. Zohoori FV, Omid N, Sanderson RA, Valentine RA, Maguire A. Fluoride retention in infants living in fluoridated and non-fluoridated areas: effects of weaning. Br J Nutrit 2019;121:74-81 https://doi.org/10.1017/S0007114518003008.