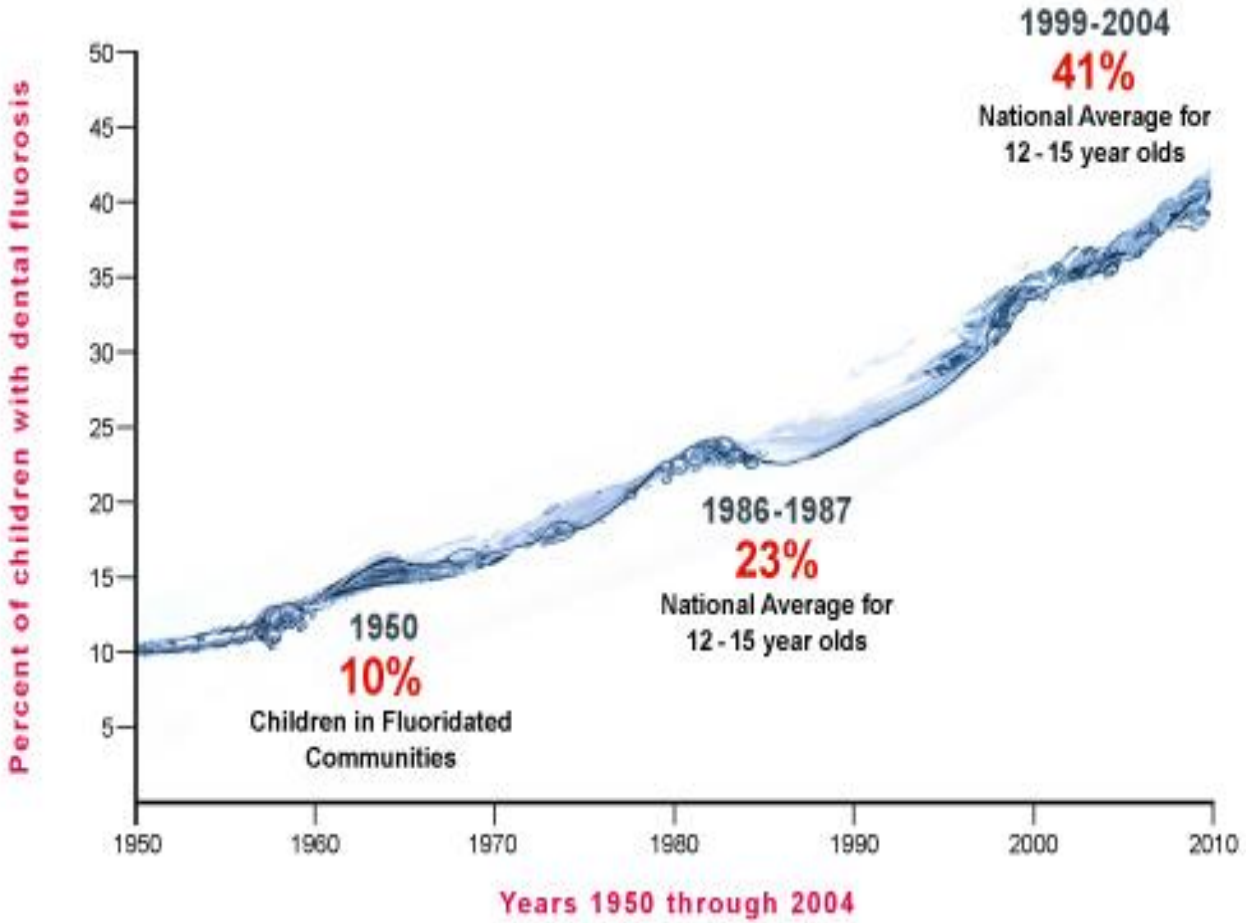
Dental Fluorosis

- **Excess fluoride in children known to result in dental fluorosis**
- **Condition in which the teeth enamel becomes irreversibly damaged and permanently discolored, displaying a white or brown mottling pattern and forming brittle teeth that break and stain easily**
- **Can range from mild to severe**
- **Considered the first sign of fluoride toxicity**

Photos from David Kennedy and are used with permission from victims of dental fluorosis


Dental Fluorosis

Dental Fluorosis Rates in the United States: 1950 through 2004



- Beltran ED, et al. (2010). *Prevalence and Severity of Dental Fluorosis in the United States, 1999 - 2004.* NCHS Data Brief No. 53. Figure 3.
- National Research Council. (1993). *Health Effects of Ingested Fluoride.* National Academy Press, Washington DC. p. 4-5.

Prenatal fluoride exposure and attention deficit hyperactivity disorder (ADHD) symptoms in children at 6-12 years of age in Mexico City

Bashash et al., 2018:

- Found that pregnant mothers with higher levels of fluoride had increased ADHD rates in their children.

- The effects of fluoride persisted even after adjusting for numerous potentially confounding factors, including lead, smoking, alcohol, socio-economic status and birth weight.

Why should we care about fluoride?

- Loss in IQ at population level = huge economic cost in society
- No evidence that the dental benefits of CWF outweigh the potential for harm for the fetus and infants.
- These risks are preventable.

What Does the Precautionary Principle Mean for Evidence-Based Dentistry?

Journal of Evidence Based Dental Practice 2006

Joel Tickner, ScD,a Melissa Coffin, BA,b From the Department of Community Health and Sustainability (a) and Lowell Center for Sustainable Production (b), University of Massachusetts Lowell, Lowell, MA

"Some issues that make fluoridation ripe for applying a precautionary approach include the following:"

- "Also, there is increasing evidence that fluoride provides its protective benefits through topical exposures, rather than by ingestion. 43"
- "Broader consideration about hazards and cumulative exposures."
- "What does the whole of the evidence tell us about fluoride exposures, hazards, and risks?"

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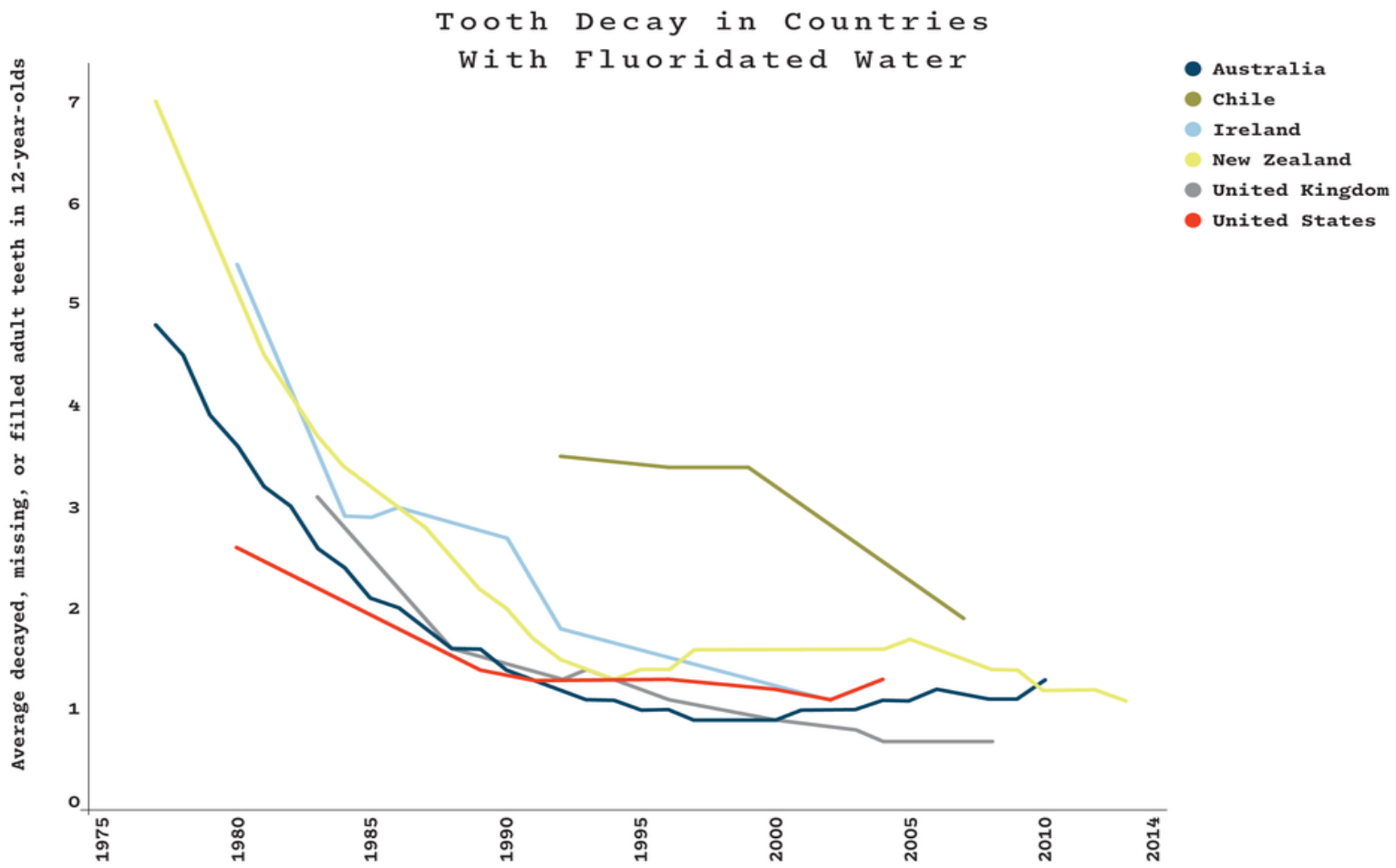
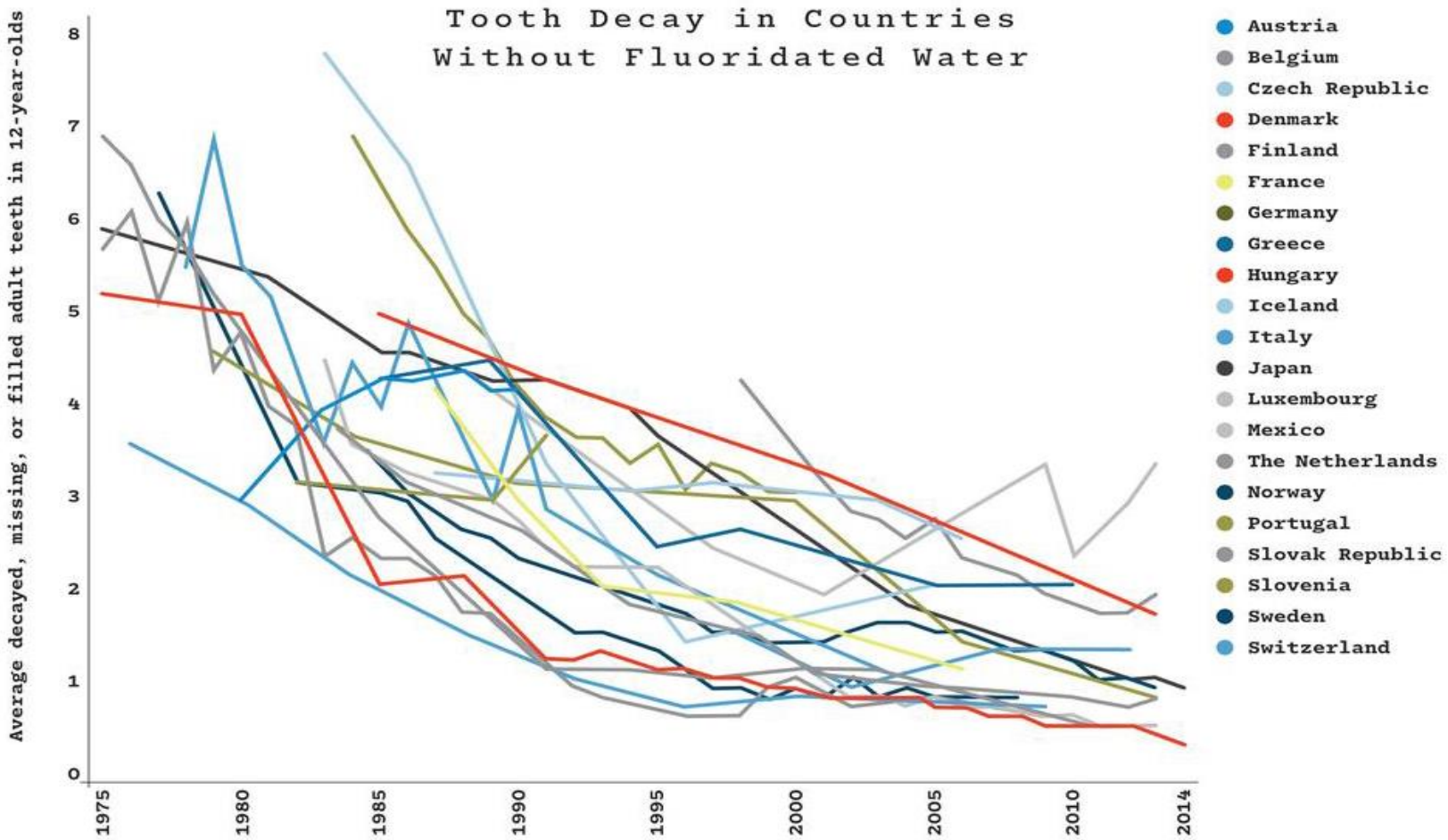
- “Further, studies have shown that the incidence of cavities has fallen throughout the western industrialized world regardless of fluoride use. 38-40”



Adapted from *Harvard Public Health* Magazine



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What Does the Precautionary Principle Mean for Evidence-Based Dentistry?

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Some issues that make fluoridation ripe for applying a precautionary approach include the following:

“In the face of uncertain evidence

it is important to act in a

manner that protects public health.”

Why is there so much resistance?

Pediatric RESEARCH

www.nature.com/pr

PERSPECTIVE

Controversy: The evolving science of fluoride: when new evidence doesn't conform with existing beliefs

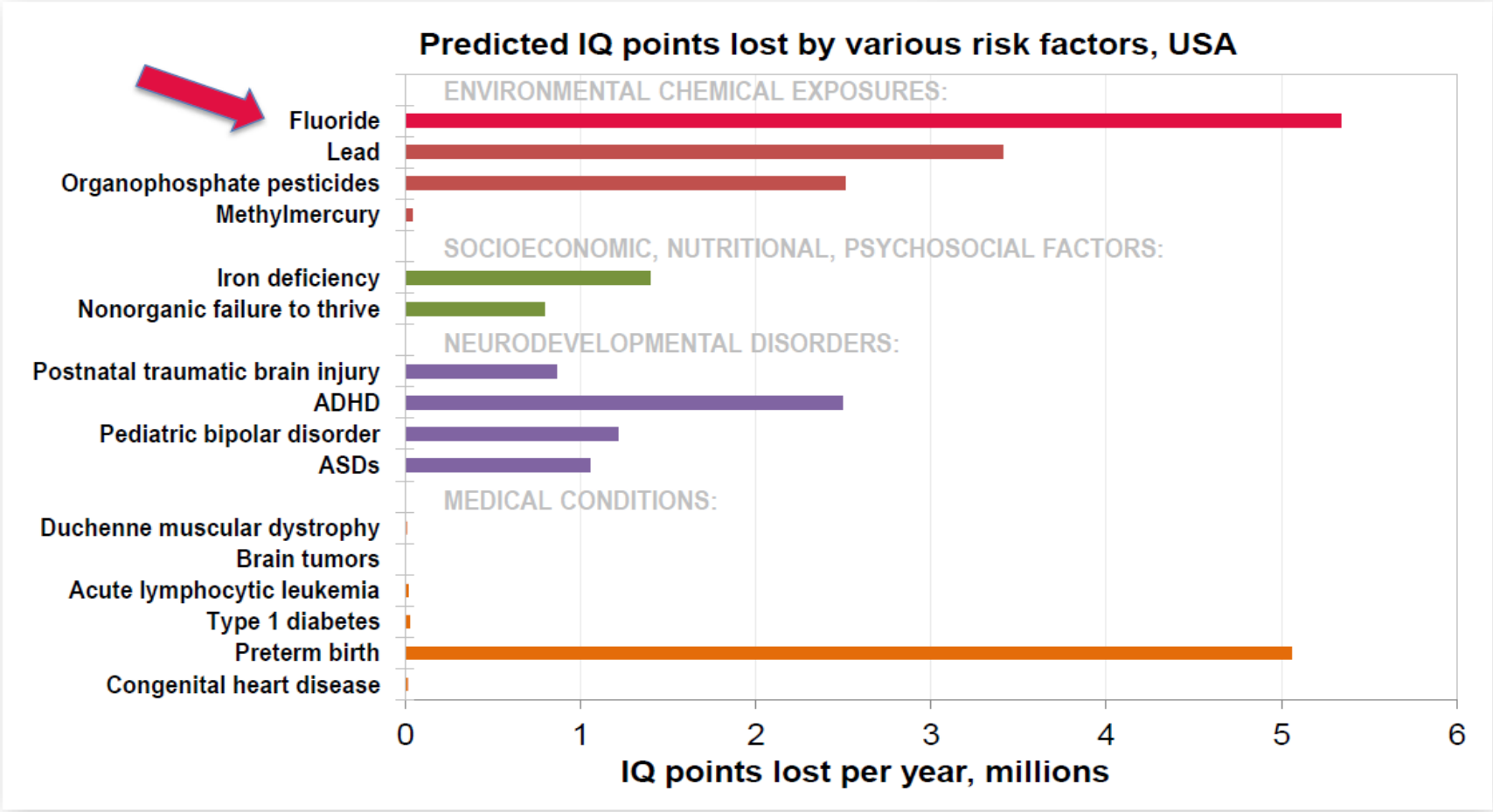
Christine Till[1] and Rivka Green[1]

Over the past 75 years, health authorities have declared that community water fluoridation—a practice that reaches over 400 million worldwide—is safe. Yet, studies conducted in North America examining the safety of fluoride exposure in pregnancy were nonexistent. When a Canadian study reported that higher fluoride exposure in pregnant women was associated with lower IQ scores in young children, critics attacked the methodology of the study and discounted the significance of the results. Health authorities continued to conclude that fluoride is unequivocally safe, despite four well-conducted studies over the last 3 years consistently linking fluoride exposure in pregnancy with adverse neurodevelopmental effects in offspring. We describe the challenges of conducting fluoride research and the overt cognitive biases we have witnessed in the polarized fluoride debate. The tendency to ignore new evidence that does not conform to widespread beliefs impedes the response to early warnings about fluoride as a potential developmental neurotoxin. Evolving evidence should inspire scientists and health authorities to re-evaluate claims about the safety of fluoride, especially for the fetus and infant for whom there is no benefit.

Conclusion

- We now have new evidence about fluoride neurotoxicity.
- We would be guilty of an unpardonable arrogance to conclude that we need more evidence before we act, especially when safe alternatives are available .

How does fluoride compare against other risk factors?



All risk factors except fluoride based on Bellinger 2012, Table 2.

Slide courtesy of Neurath, 2020

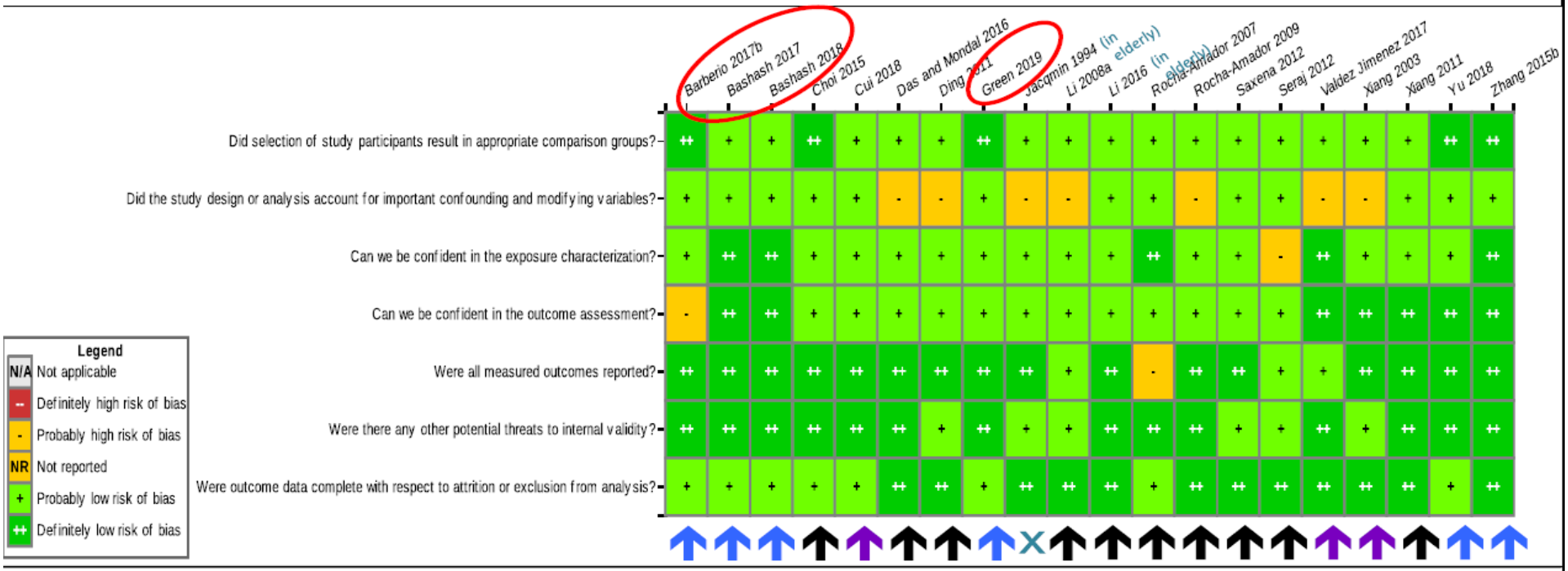
IMPLICATIONS OF FLUORIDE NEUROTOXICITY

Implications of 3-5 IQ points:

Shift of 5 IQ points

Courtesy of Little Things Matter, Lanphear

20 of the studies were considered high quality (low Risk of Bias)



All studies except one found significant adverse effects

↑ = Study found adverse effects at exposure levels of **0.7 mg/L** water F or equivalent

↑ = Study found adverse effects at exposure levels **below 1.5 mg/L** water F or equivalent

↑ = Study found adverse effects at exposure levels **above 1.5 mg/L** water F or equivalent

X= did not find statistically significant adverse effect

Figure courtesy of Neurath, 2020

August 19, 2019

JAMA Pediatrics | Original Investigation

Association Between Maternal Fluoride Exposure During Pregnancy and IQ Scores in Offspring in Canada

Rivka Green, MA; Bruce Lanphear, MD; Richard Hornung, PhD; David Flora, PhD; E. Angeles Martinez-Mier, DDS; Raichel Neufeld, BA; Pierre Ayotte, PhD; Gina Muckle, PhD; Christine Till, PhD

Editorial and Editor's Note
Supplemental content

IMPORTANCE The potential neurotoxicity associated with exposure to fluoride, which has generated controversy about community water fluoridation, remains unclear.

OBJECTIVE To examine the association between fluoride exposure during pregnancy and IQ scores in a prospective birth cohort.

DESIGN, SETTING, AND PARTICIPANTS This prospective, multicenter birth cohort study used information from the Maternal-Infant Research on Environmental Chemicals cohort. Children were born between 2008 and 2012; 41% lived in communities supplied with fluoridated municipal water. The study sample included 601 mother-child pairs recruited from 6 major cities in Canada; children were between ages 3 and 4 years at testing. Data were analyzed between March 2017 and January 2019.

EXPOSURES Maternal urinary fluoride (MUF_{SG}), adjusted for specific gravity and averaged across 3 trimesters available for 512 pregnant women, as well as self-reported maternal daily fluoride intake from water and beverage consumption available for 400 pregnant women.

EDITORIAL

Is Fluoride Potentially Neurotoxic?

David C. Bellinger, PhD, MSc

Environmental epidemiology is a field replete with controversies, but the intensity of the debate inspired by the fluoridation of municipal water supplies to reduce dental ca perhaps unrivaled. G ments, as well as ind als, differ in their a ments of water fluori as public policy. The U ters for Disease Contr Prevention consider water fluoridation to be one measured. Because individuals were classified into exposure groups based solely on community of residence, some mis-

Editor's Note
Related article

Editor's Note

Decision to Publish Study on Maternal Fluoride Exposure During Pregnancy

Dimitri A. Christakis, MD, MPH

This decision to publish this article was not easy.[1] Given the nature of the findings and their potential implications, we subjected it to additional scrutiny for its methods and the presentation of its findings. The mission of the journal is to ensure that child health is optimized by bringing the best available evidence to the fore. Publishing it serves as tool JAMA Pediatrics is committed to disseminating the best science based entirely on the rigor of the methods and the soundness of the hypotheses tested, regardless of how contentious the results may be. That said, scientific inquiry is an iterative process. It is rare that a single study provides definitive evidence. This study is neither the first, nor will it be the last, to test the association between prenatal fluoride exposure and cognitive development. We hope that purveyors and consumers of these findings are mindful of that as the implications of this study are debated in the public arena.

Editorial

"So when I first saw this title, my initial inclination was **'What the hell?'**"
- Dr. Christakis

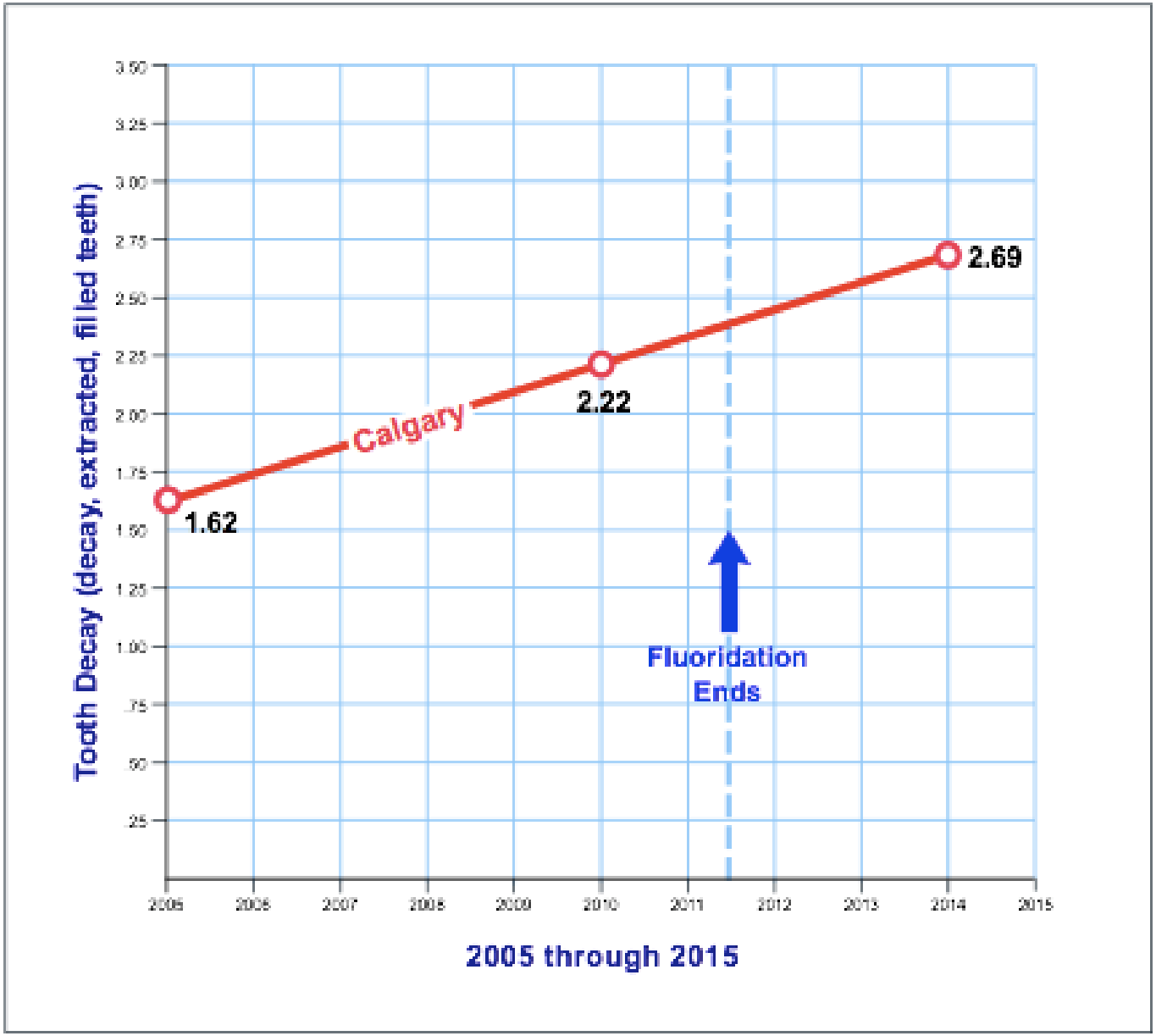
"The effect size is really quite large.... The results are really startling."
- Dr. Rivara

Conclusion:
Fetal development is a critical period of concern for neurotoxicity.

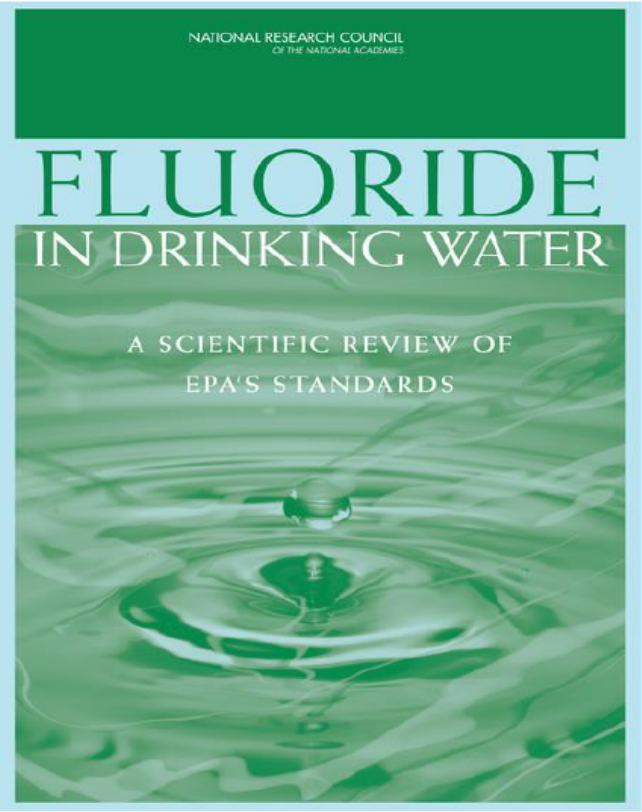
- There are 3 well-conducted prospective birth cohort studies: Bashash et al. 2017; Valdez-Jiménez et al. 2017; Green et al. 2019

- All report adverse effects of fetal exposure to fluoride *vs*. no prenatal studies showing safety

Calgary, Canada

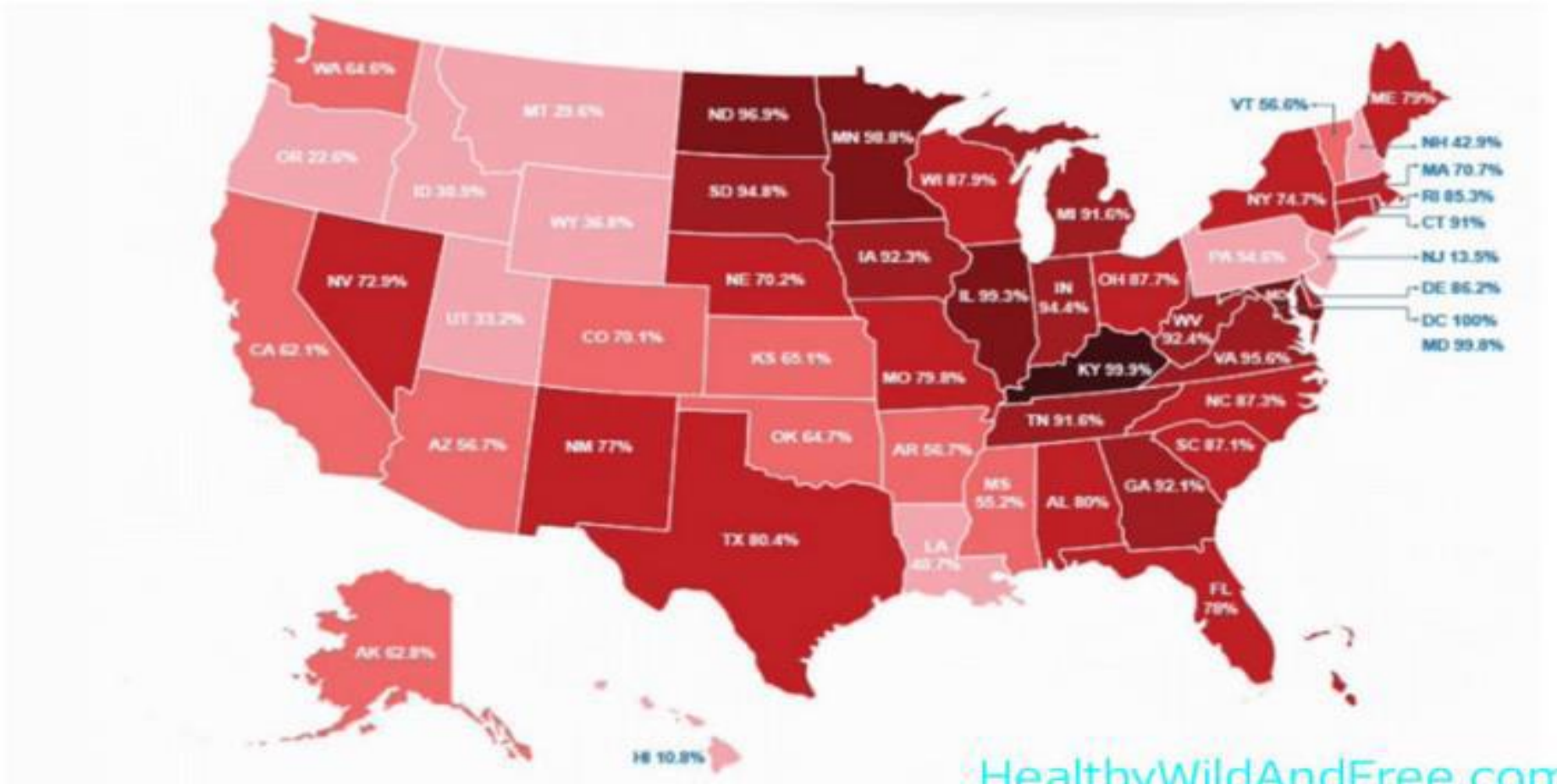


Evidence for Adverse Health Effects of Fluoride Reviewed by NRC (2006)



- **Dental fluorosis***
- **Bone fractures & skeletal fluorosis***
- Reproductive and developmental effects
- Lowering of IQ
- Endocrine disruption
- GI, renal, hepatic and immune system effects
- Carcinogenicity

*Committee concluded that lifetime exposure to Fl at drinking water concentrations of 4 mg/L or higher is likely to contribute to these effects



International Journal of
Environmental Research and Public Health

MDPI

Review

A Meta-Analysis of Stressors from the Total Environment Associated with Children's General Cognitive Ability

Frances M. Nilsen [1,*], Jazmin D.C. Ruiz [1,2] and Nicolle S. Tulve [1]

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2 Honeywell International, Buffalo, NY 14210, U
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Received: 10 June 2020; Accepted: 20 July 2020; Pu

Fluoride was observed to have the **greatest increase** in impacting cognitive ability (OR = 1.40, p <.05) relative to the other toxic elements that were examined (Hg, Pb, As, Cd).