

# **Water Fluoridation: A Reckless Medical Practice**

Paul Connett, PhD

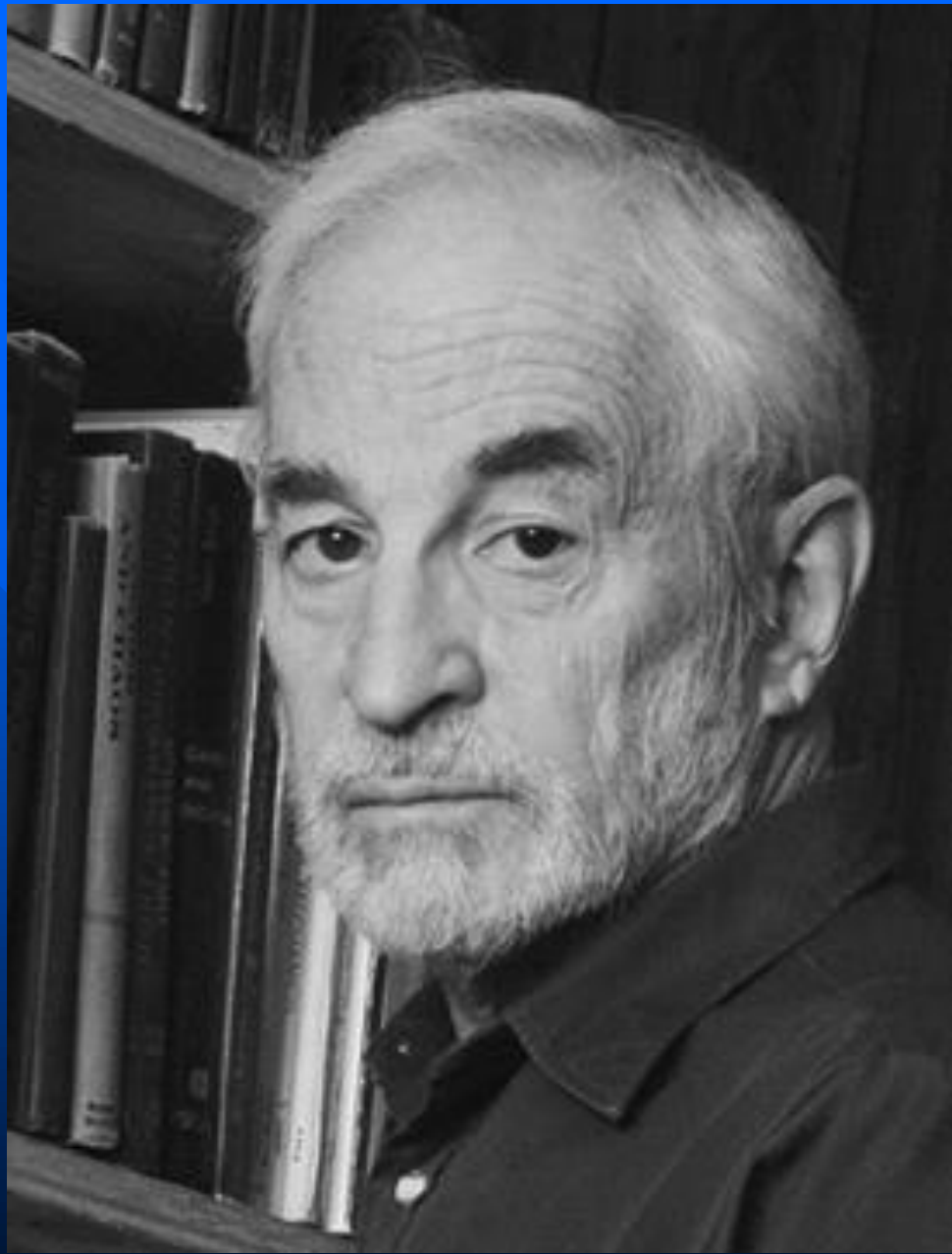
Director, Fluoride Action Network

Fluoride**ALERT**.org

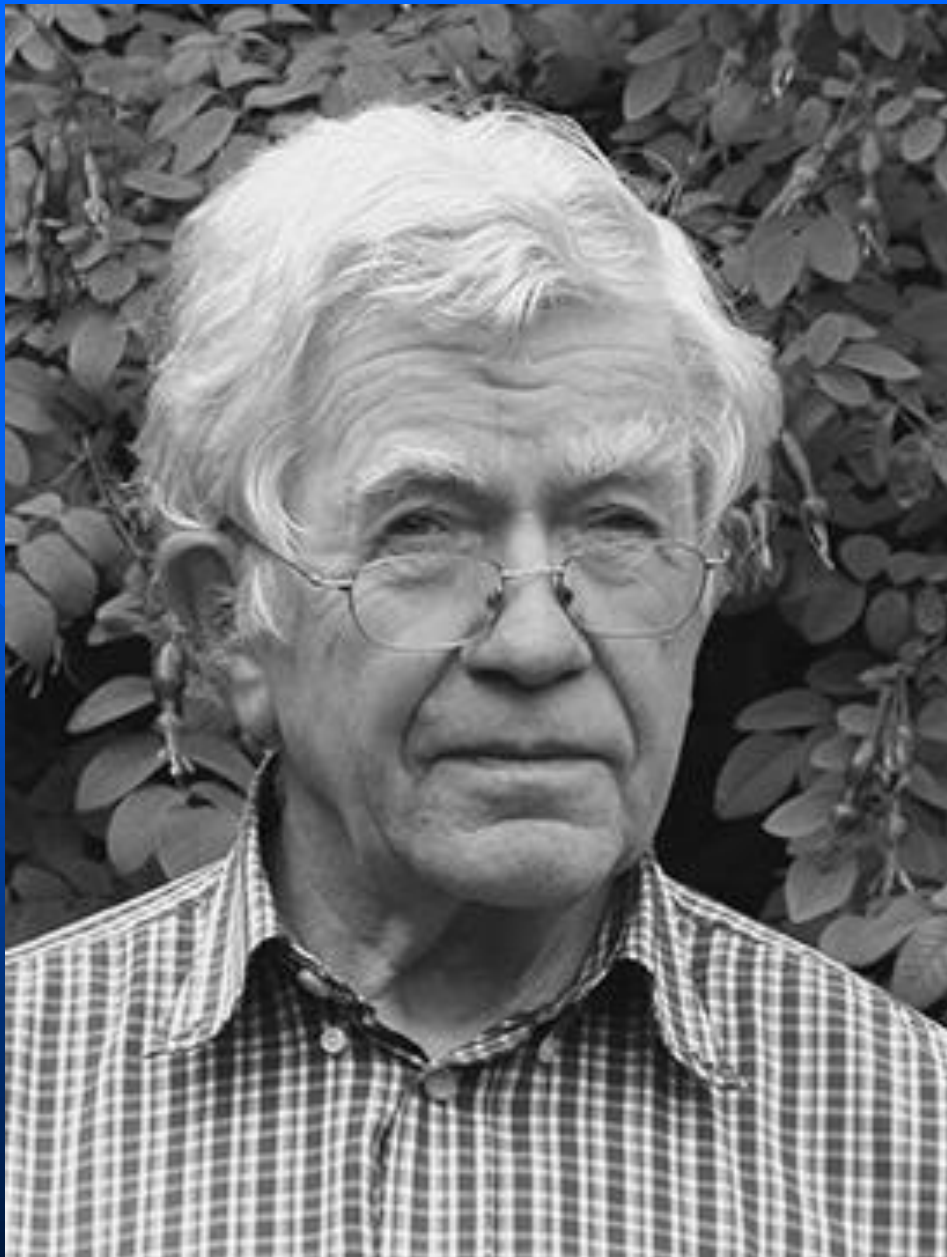
**Calgary, May 30, 2019**

# Personal introduction

- I am a retired professor of chemistry, who specialized in environmental chemistry and toxicology.
- I have spent the last 23 years (since 1996) researching fluoride's toxicity and the water fluoridation debate.
- I have presented the arguments against fluoridation in the book *The Case Against Fluoride* which I co-authored.



**James Beck, MD, PhD, retired professor of Physics from Calgary**



**HS Micklem, D Phil (Oxon), retired professor of Biology from Edinburgh**





.....  
A New Look  
at the Scientific  
Evidence  
.....

# THE CASE AGAINST Fluoride

How Hazardous Waste  
Ended Up in Our Drinking Water  
*and* the Bad Science and  
Powerful Politics  
That Keep It There

PAUL CONNETT, PhD

JAMES BECK, MD, PhD | H. S. MICKLEM, DPhil

Book published  
by Chelsea Green

October, 2010

Contains  
80 pages  
of references  
to the  
Scientific  
literature

# The key arguments against water fluoridation

# Key arguments against fluoridation

1. It is a bad medical practice. **You cannot control the dose and who the fluoride goes to.**

**Please note the difference between concentration and dose.** Engineers can control the concentration at the water works in mg/liter, but they cannot control the dose (mg/day) people get because that depends on how many liters of water they drink and how much fluoride they get from other sources.

**Please also note the difference between dose and dosage.**

**For a given dose in mg/day the toxic effect depends upon bodyweight**

**Dose = mg/day**

**Dosage = mg/kg bodyweight/ day**

# Toxicity depends on

- **Bodyweight.**
- **For a given dose**, toxicity (toxic effect) is
- worse for a **child** than an **adult**;
- worse for an **infant** than a **child** and
- worse for a **fetus** than an **infant**.

# Toxicity: Using Dosage

- So if the toxic dose (for a given end point) for a 70 Kg adult was
- **10 mg/day** The toxic dosage =  $10/70$  mg/kg/day
- The toxic dose for a 35 kg child would be
- $10/70 \times 35 =$  **5 mg/day**
- The toxic dose for a 3.5 kg infant would be
- $10/70 \times 7 =$  **0.5 mg/day**
- The toxic dose for a 0.1 kg fetus would be
- $10/70 \times 0.1 =$  **0.014 mg/day**



# Key arguments against fluoridation

- **2. It violates the individual's right to informed consent to medical treatment.**

# Key arguments against fluoridation

- **3). Fluoride is very toxic.** It interferes with many biochemical processes.

# Major biochemical concerns

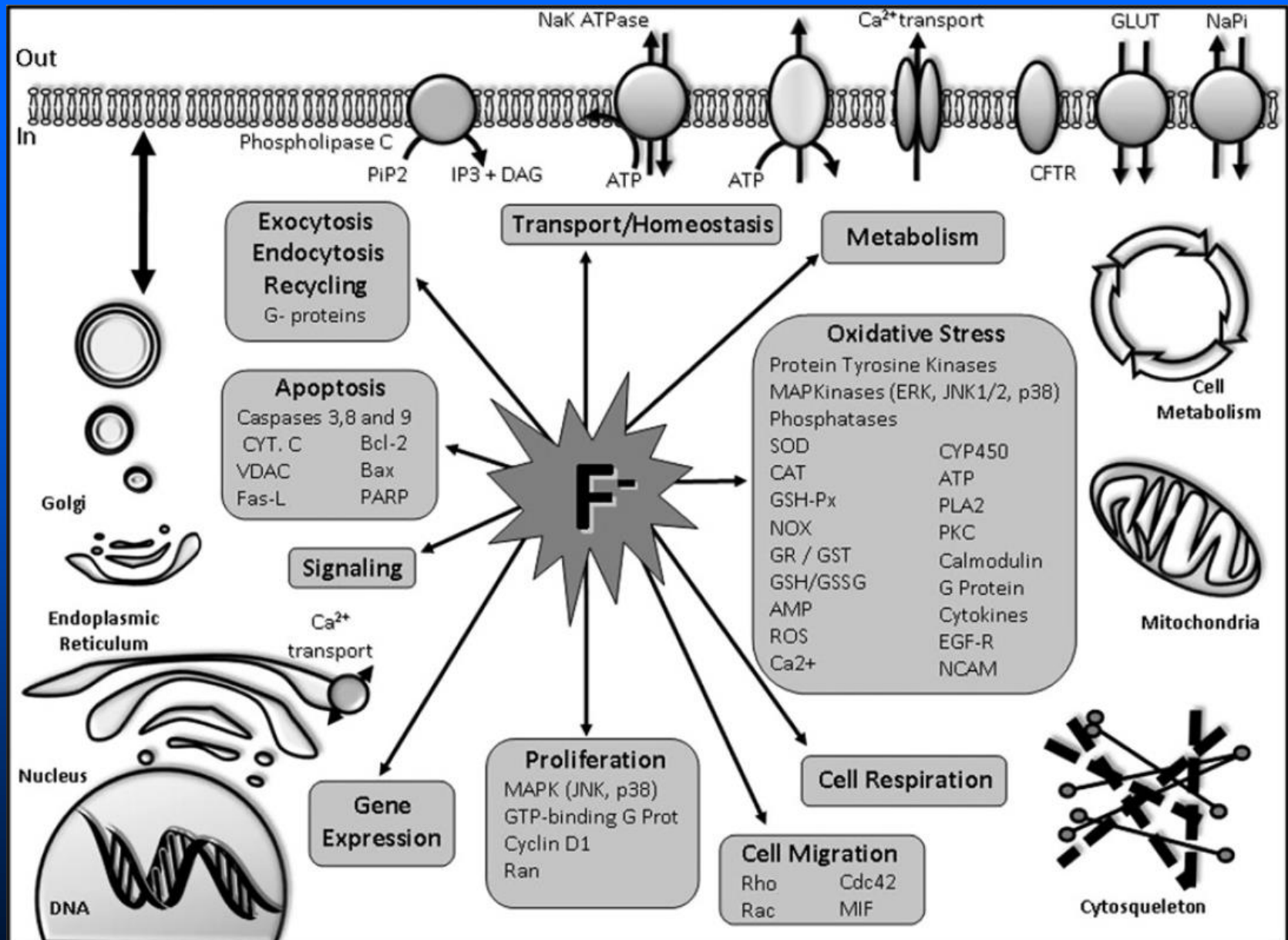
- 1) Fluoride inhibits many ENZYMES
- 2) Fluoride switches on G-PROTEINS
- 3) Fluoride up regulates and down regulates many GENES
- 4) Fluoride forms a strong hydrogen bond
- 5) Fluoride complexes with every metal ion except the group I metals (Na, K, Rb etc)

**Fluoride interferes with human  
biochemistry at very low levels.**

See **Barbier et al, (2010).**

**Molecular mechanisms of  
fluoride toxicity. *Chem. Biol.  
Interact. 188(2):319-333.***

# Fluoride's effects on human cells



Barbier O, Arreola-Mendoza L, Del Razo LM.

Molecular mechanisms of fluoride toxicity. Chem Biol Interact. 2010 Nov 5; 188(2):319-33

# Key arguments against fluoridation

**4) Nature has developed ways of defending living things from fluoride**



# Nature protects living things from fluoride

For some lower level organisms like bacteria, fungi etc. high levels of fluoride switch on genes which produce “Fluoride Exporting proteins” (FEX-proteins) Breaker, 2012.



RETURN TO ISSUE | < PREV **ARTICLE** NEXT >

# ***CsFEX*, a Fluoride Export Protein Gene from *Camellia sinensis*, Alleviates Fluoride Toxicity in Transgenic *Escherichia coli* and *Arabidopsis thaliana***

Jiaojiao Zhu, Anqi Xing, Zichen Wu, Jing Tao, Yuanchun Ma, Bo Wen, Xujun Zhu, Wanping Fang and Yuhua Wang\*

✓ **Cite This:** *J. Agric. Food Chem.* 2019, 67, 21, 5997-6006

Publication Date: May 6, 2019 ▾

<https://doi.org/10.1021/acs.jafc.9b00509>

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# Nature protects living things from fluoride

In mammals the kidneys excrete about 50% of the fluoride ingested each day

Remainder of fluoride rapidly sequestered in the hard tissues (calcifying tissues).

The breast filters out fluoride

# Key arguments against fluoridation

**4. Mothers' milk protects the baby from fluoride.** A bottle-fed baby in a fluoridated community gets about 200 times more fluoride than a breast-fed baby.

**The level of fluoride in Mothers' milk  
is 0.004 ppm (NRC, 2006, p.40)**



**The level of fluoride in Mothers' milk  
is 0.004 ppm (NRC, 2006, p.40)**



**In effect, mothers' milk protects  
the infant from fluoride exposure**



# Water fluoridation removes that protection when babies are bottle-fed



Range of F in USA, 0.7 – 1.2 ppm  
= 175 - 300 x level in mothers' milk

**Unfortunately**

**Nature does not protect the fetus from fluoride – it easily passes through the placental membrane**

# Key arguments against fluoridation

## 5. **Fluoride is not an essential nutrient.**

There is not one biochemical process in the human body that needs fluoride to function properly.

## 6. **Tooth decay is not caused by lack of**

***ingested fluoride*** but by poor diet (especially too much sugar), poor dental hygiene and lack of early intervention.

7. Even the main proponents of fluoridation agree that any benefit is largely **topical** not systemic (CDC, 1999).

CDC, MMWR, 48(41); 933-940,  
Oct 22, 1999

- “...laboratory and epidemiologic research suggest that fluoride prevents dental caries **predominantly** after eruption of the tooth into the mouth, and its actions primarily are topical...”

# Key arguments against fluoridation

8. **There have been no RCTs** (Randomized clinical trials) that swallowing fluoride lowers tooth decay. RCTs are the gold standard for demonstrating the effectiveness of drugs or medical interventions.

However, there have been 70 RCTs which demonstrate that fluoride toothpaste lowers tooth decay. (**In other words it works TOPICALLY**)

# Key arguments against fluoridation

**9. American kids are being grossly over-exposed to fluoride.** As illustrated by the dramatic increase in the prevalence in dental fluorosis.



# Dental fluorosis

- When fluoridation began in 1945 promoters expected that 10% of children would be impacted with dental fluorosis in the “very mild” category. Dental fluorosis is discoloration and mottling of the enamel.

Impacts up to 25% of tooth surface



**Very Mild Dental Fluorosis**

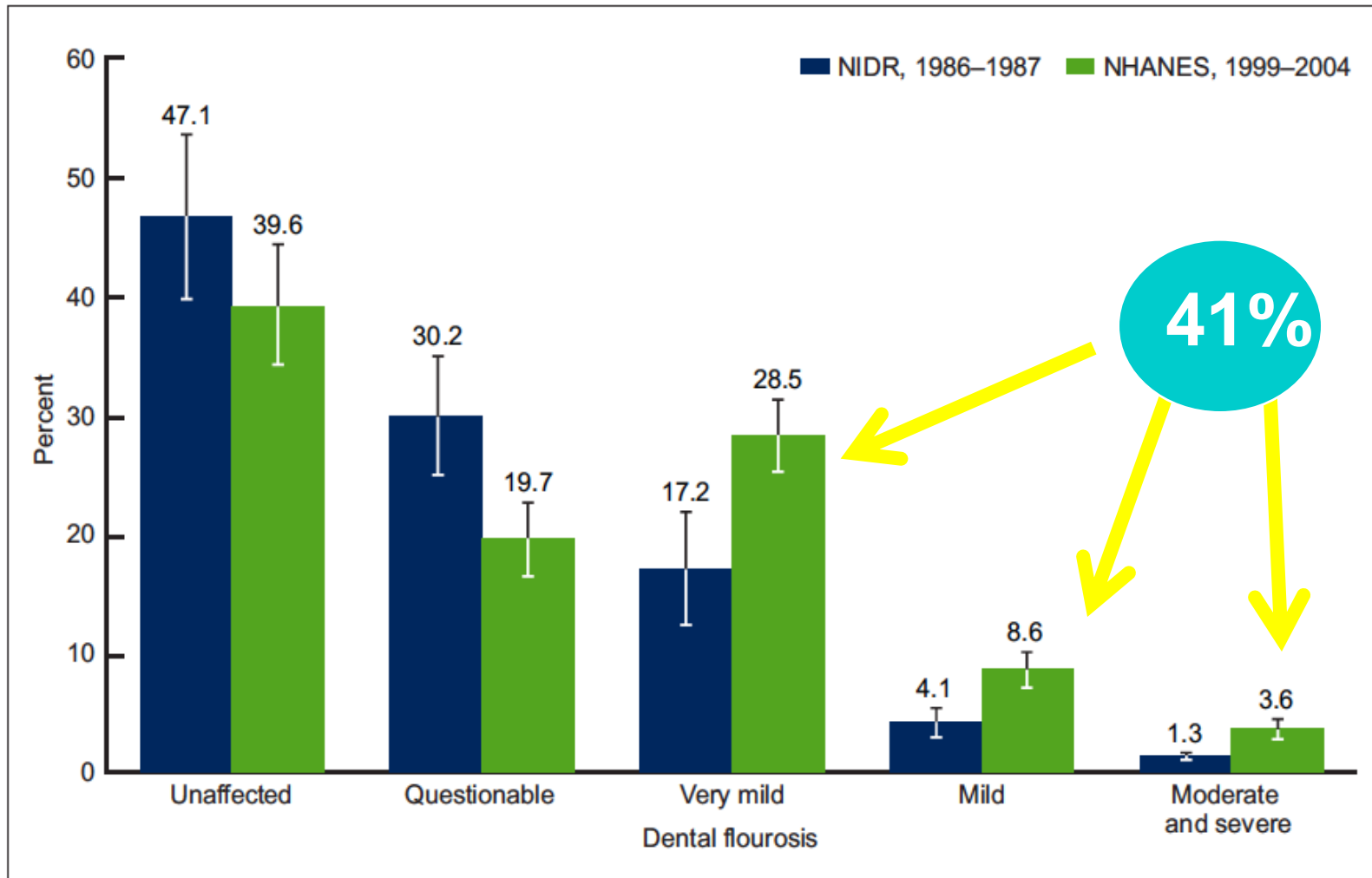
Impacts up to 50% of tooth surface



**Mild Dental Fluorosis**

# CDC, 2010

Figure 3. Change in dental fluorosis prevalence among children aged 12–15 participating in two national surveys: United States, 1986–1987 and 1999–2004



NOTES: Dental fluorosis is defined as having very mild, mild, moderate, or severe forms and is based on Dean's Fluorosis Index. Percentages do not sum to 100 due to rounding. Error bars represent 95% confidence intervals.

SOURCES: CDC/NCHS, National Health and Nutrition Examination Survey, 1999–2004 and National Institute of Dental Research, National Survey of Oral Health in U.S. School Children, 1986–1987.

# Dental fluorosis increasing dramatically

- 1945 expected prevalence = 10 % (very mild)
- 1986-87 prevalence = 23% (NIDR)
- 2001-04 prevalence = 41 % (NHANES)
- 2011-12 prevalence = 65 % (NHANES -  
This has been questioned by CDC)

Vol. 3 • Issue X

*Dental Fluorosis Trends in United States Oral Health Surveys: 1986-2012*

ORIGINAL REPORT: EPIDEMIOLOGICAL RESEARCH

## **Dental Fluorosis Trends in United States Oral Health Surveys: 1986-2012**

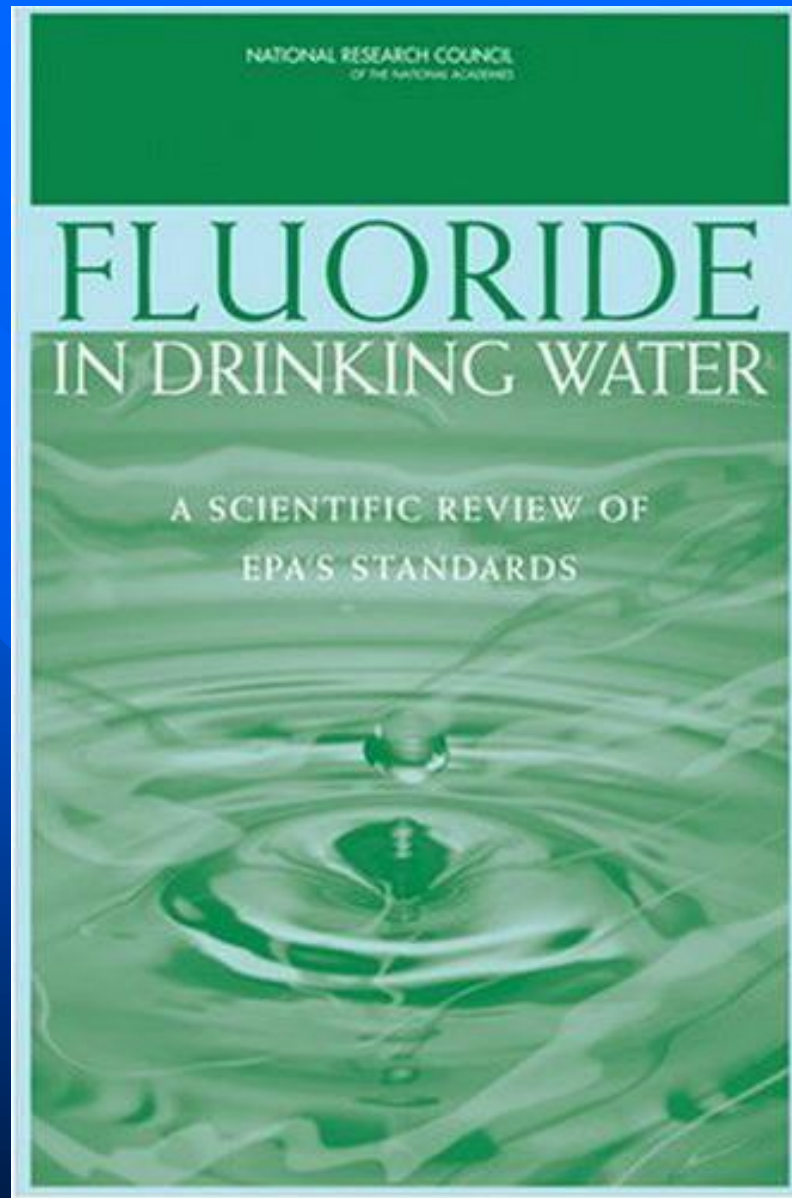
C. Neurath<sup>1</sup>, H. Limeback<sup>2</sup>, B. Osmunson<sup>3</sup>, M. Connett<sup>4</sup>, V. Kanter<sup>5</sup>, C. R. Wells<sup>6</sup>

# Key arguments against fluoridation

**10. Fluoride can damage other tissues in the body at high doses** including the bone, brain, thyroid gland and kidney – and it may do so in fluoridated communities when you consider the **total exposure** levels from all sources of fluoride and the stage of life when exposure occurs.

Harmful effects have been  
carefully documented in a 507-  
page (1100 references) report by  
the  
**US National Research Council**  
published in 2006.





National Research Council (2006)

# Key arguments against fluoridation

**11. We should not be exposing vulnerable subsets of the population to fluoride,**  
which include

- a) The fetus
- b) Bottle-fed babies
- c) people with poor kidney function
- d) people with borderline or low iodine intake (fluoride makes thyroid function worse for these people, Malin, 2018)
- e) people with above average water intake

# Key arguments against fluoridation

**12. We should not be adding a known neurotoxic (brain-damaging) substance to the public drinking water.**

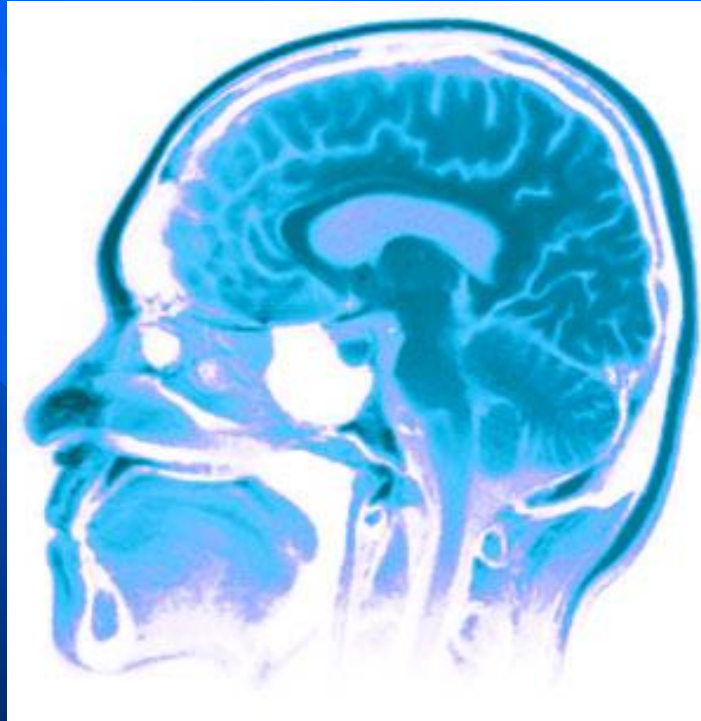
As of January, 2019

**Over 50 (out of 60) human studies** link fluoride exposure to lowered IQ in children *at doses of fluoride close to or within the range of doses children are exposed to in fluoridated communities*

# Brief History of Fluoride-IQ studies

- **1996:** The first two Chinese studies published in English
- **2006:** The U.S. National Research Council reviewed 5 of the IQ studies

*National Research Council (2006):*  
**Fluoride & the Brain**



“it is apparent that fluorides have the ability to interfere with the functions of the brain.”



# Brief History of Fluoride-IQ studies

- Between 2006 and 2008, 18 more IQ studies were published, including studies translated from Chinese.
- In 2008 FAN held a joint conference with the ISFR in Mississauga and reviewed these studies. Results presented at press conference in Toronto.



# Brief History of Fluoride-IQ studies

- In 2010, we published *The Case Against Fluoride* and referenced 23 studies.
- In 2011, Health Canada reviewed the safety of fluoridation and only examined 5 IQ studies even though I presented them with references to 18 other studies (after the draft report).

## In 2012

A team from Harvard, including Philippe Grandjean, published a meta-analysis of 27 IQ studies (Choi et al., 2012).

These included 25 studies from China and 2 from Iran.

# Harvard Meta-analysis of IQ studies

## Review

### Developmental Fluoride Neurotoxicity: A Systematic Review and Meta-Analysis

Anna L. Choi,<sup>1</sup> Guifan Sun,<sup>2</sup> Ying Zhang,<sup>3</sup> and Philippe Grandjean<sup>1,4</sup>

<sup>1</sup>Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts, USA; <sup>2</sup>School of Public Health, China Medical University, Shenyang, China; <sup>3</sup>School of Stomatology, China Medical University, Shenyang, China; <sup>4</sup>Institute of Public Health, University of Southern Denmark, Odense, Denmark

**BACKGROUND:** Although fluoride may cause neurotoxicity in animal models and acute fluoride poisoning causes neurotoxicity in adults, very little is known of its effects on children's neurodevelopment.

**OBJECTIVE:** We performed a systematic review and meta-analysis of published studies to investigate the effects of increased fluoride exposure and delayed neurobehavioral development.

**METHODS:** We searched the MEDLINE, EMBASE, Water Resources Abstracts, and TOXNET databases through 2011 for eligible studies. We also searched the China National Knowledge Infrastructure (CNKI) database, because many studies on fluoride neurotoxicity have been published in Chinese journals only. In total, we identified 27 eligible epidemiological studies with high and reference exposures, end points of IQ scores, or related cognitive function measures with means and variances for the two exposure groups. Using random-effects models, we estimated the standardized mean difference between exposed and reference groups across all studies. We conducted sensitivity analyses restricted to studies using the same outcome assessment and having drinking-

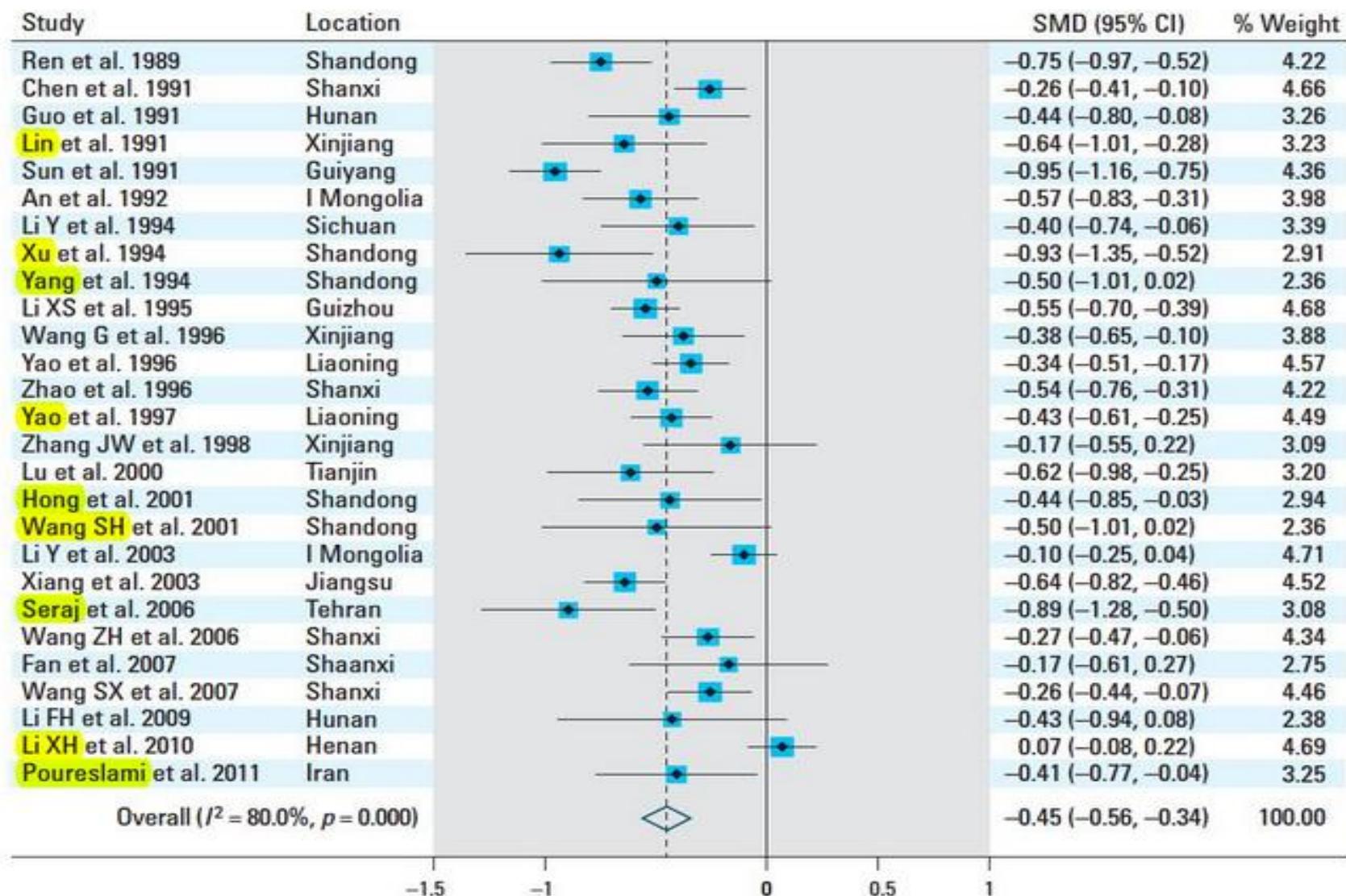
Registry 2003). Fluoride exposure to the developing brain, which is much more susceptible to injury caused by toxicants than is the mature brain, may possibly lead to permanent damage (Grandjean and Landrigan 2006). In response to the recommendation of the NRC (2006), the U.S. Department of Health and Human Services (DHHS) and the U.S. EPA recently announced that DHHS is proposing to change the recommended level of fluoride in drinking water to 0.7 mg/L from the currently recommended range of 0.7–1.2 mg/L, and the U.S. EPA is reviewing the maximum amount of

Environmental Health Perspectives,  
2012 Oct;120(10):1362-8.

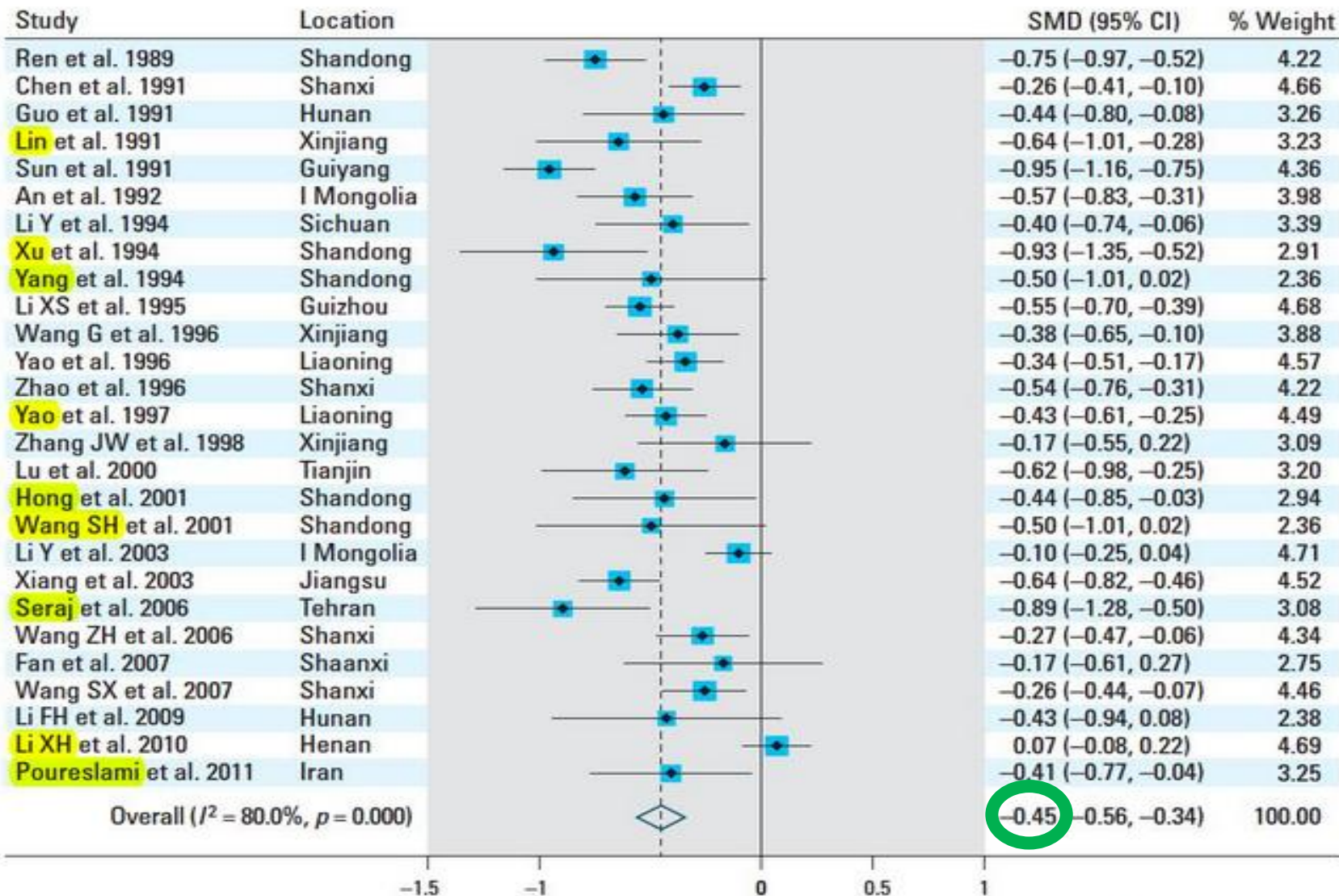
# Harvard meta-analysis of 27 studies

- The Harvard team acknowledged that there were weaknesses in many of the studies
- However, they stressed that the results were remarkably consistent
- In ***26 of the 27 studies*** average IQ in the “high fluoride” village was lower than the “low fluoride village
- Average lowering was **7 IQ points**



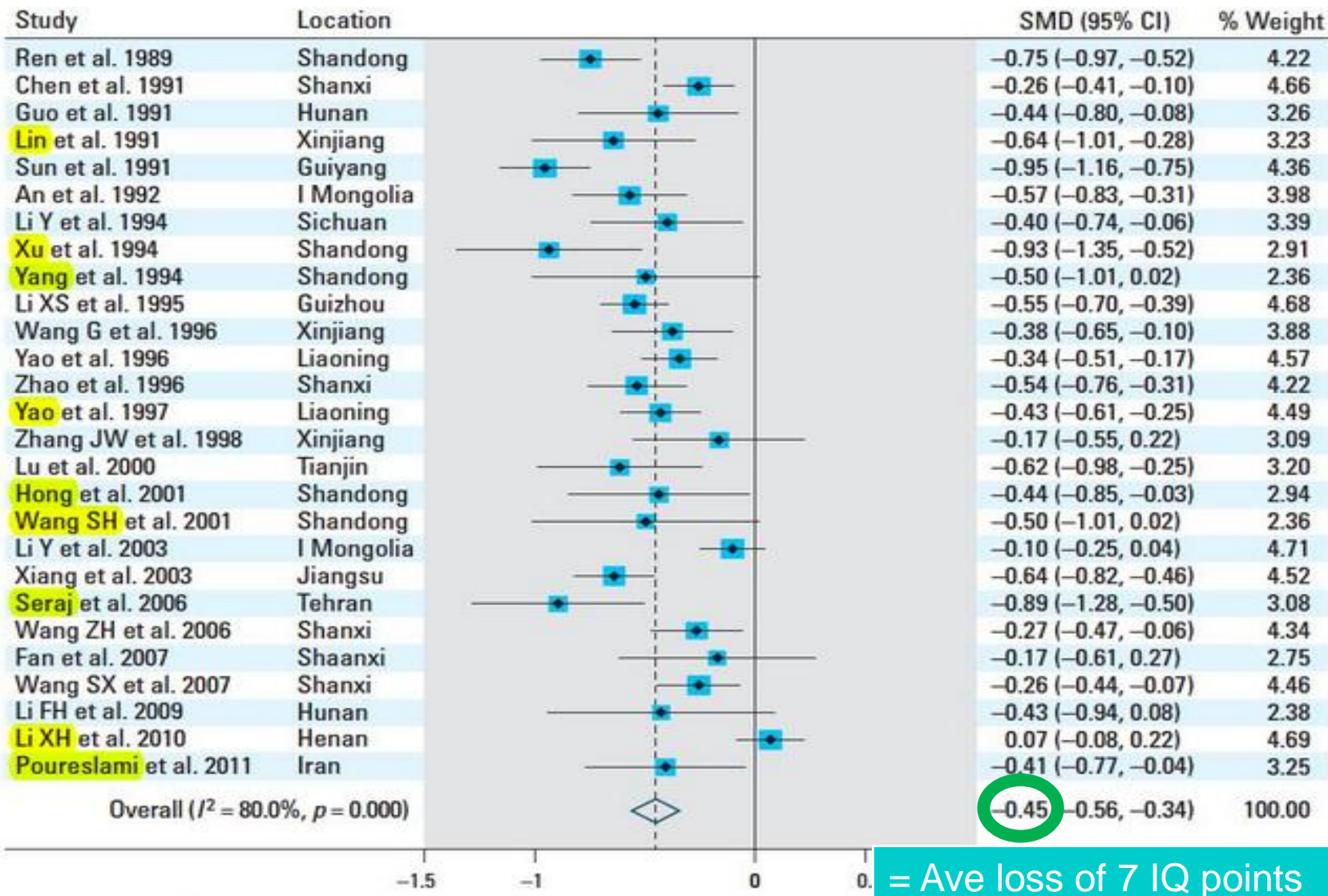


**Figure 2.** Random-effect standardized weighted mean difference (SMD) estimates and 95% CIs of child's intelligence score associated with high exposure to fluoride. SMs for individual studies are shown as solid diamonds (◆), and the pooled SMD is shown as an open diamond (◇). Horizontal lines represent 95% CIs for the study-specific SMDs.



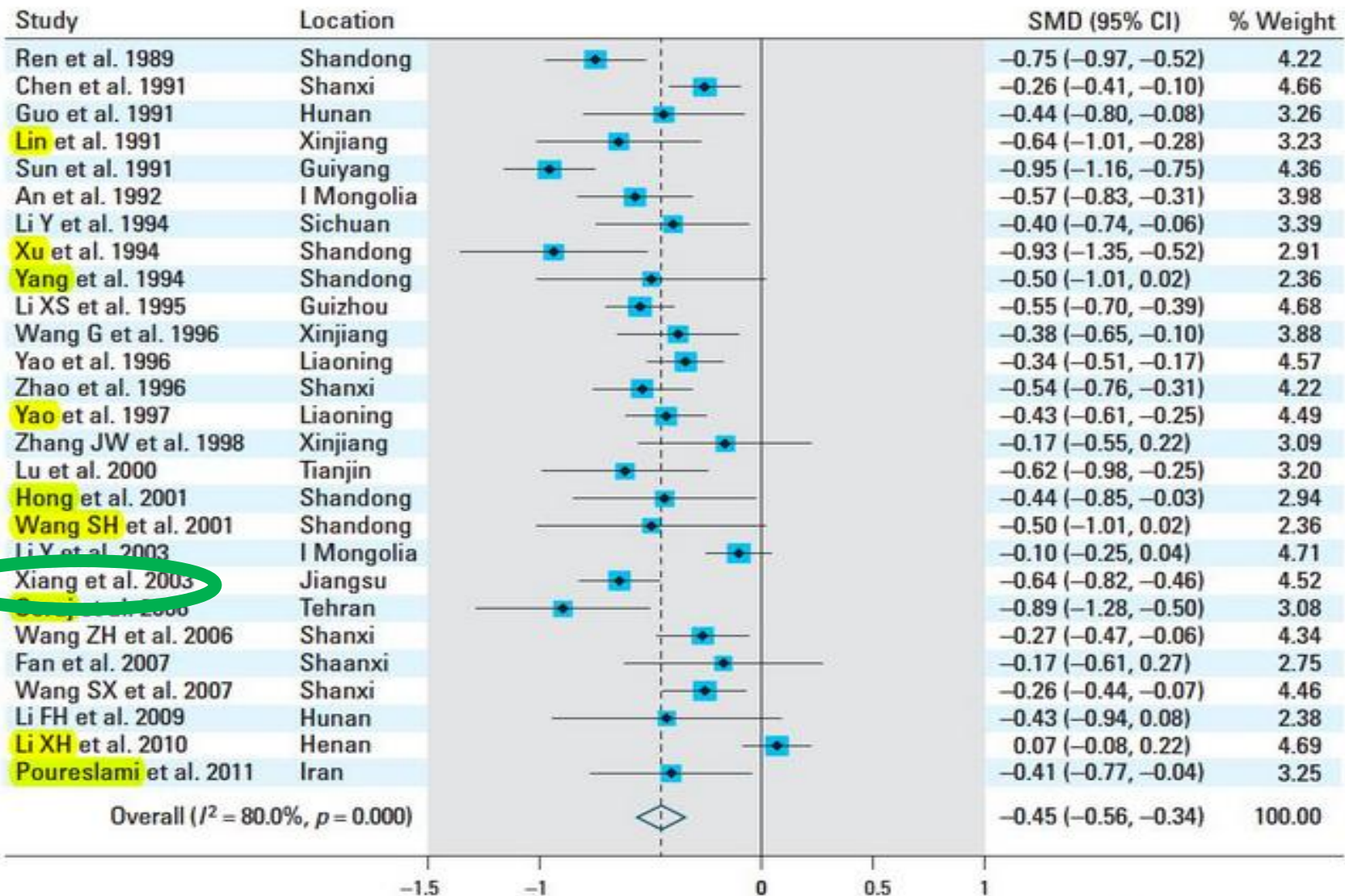
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Quanyong Xiang, Paul Connett, Chris Neurath and Bill Hirzy  
outside the EPA Headquarters in Washington, DC Sept 8, 2014

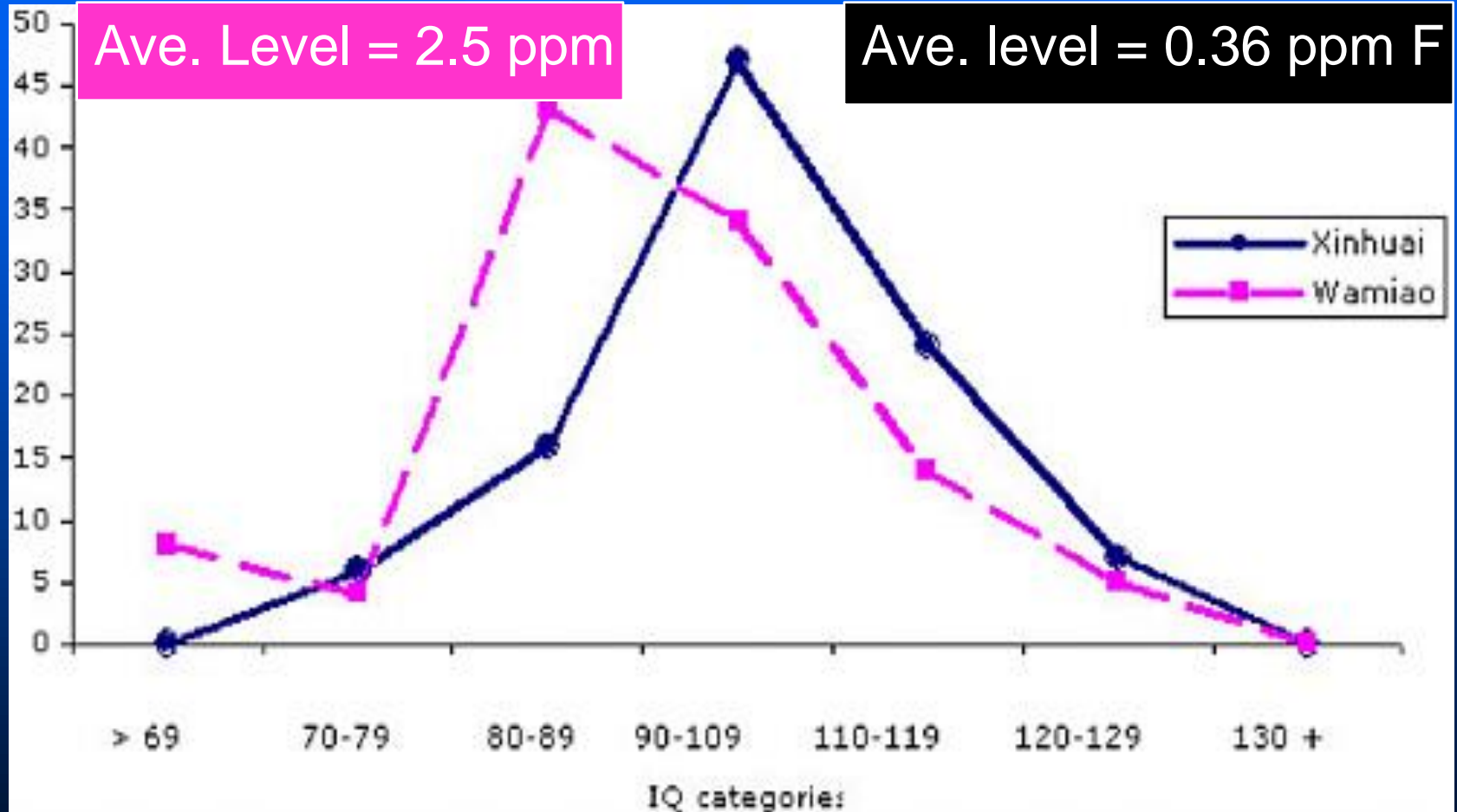


# Xiang et al. (2003 a,b)

- Compared IQ of children in two villages:
- Low Fluoride Village Average F in well water = **0.36 ppm** (Range = 0.18 -0.76 ppm)
- High Fluoride Village Average F in well water = **2.5 ppm** (Range 0.57 – 4.5 ppm)
- **Controlled for lead exposure** and **iodine intake**, and retrospectively for **arsenic**
- Found a drop of 5-10 IQ points across the whole age range between the two villages

# Xiang et al. (2003 a,b)

**MALES**



**Table 8.** Level of fluoride in drinking water and children's IQs

Village	F in drinking water (mg/L)		IQ and rate of retardation			
	Group	No. sample	Water F level (Mean±SD)	No. children	IQ (Mean±SD)	Rate of IQ<80 (%)
Xinhuai	F	290	0.36±0.15	290	100.41±13.21	6.55
Wamiao	A	9	0.75±0.14	9	99.56±14.13	0.00
	B	42	1.53±0.27	42	95.21±12.22*	9.52
	C	111	2.46±0.30	111	92.19±12.98 <sup>†</sup>	14.41*
	D	52	3.28±0.25	52	89.88±11.98 <sup>†</sup>	21.15 <sup>†</sup>
	E	8	4.16±0.22	8	78.38±12.68 <sup>†</sup>	37.50 <sup>†</sup>

\* $p < 0.05$ . <sup>†</sup> $p < 0.01$  compared with group F.

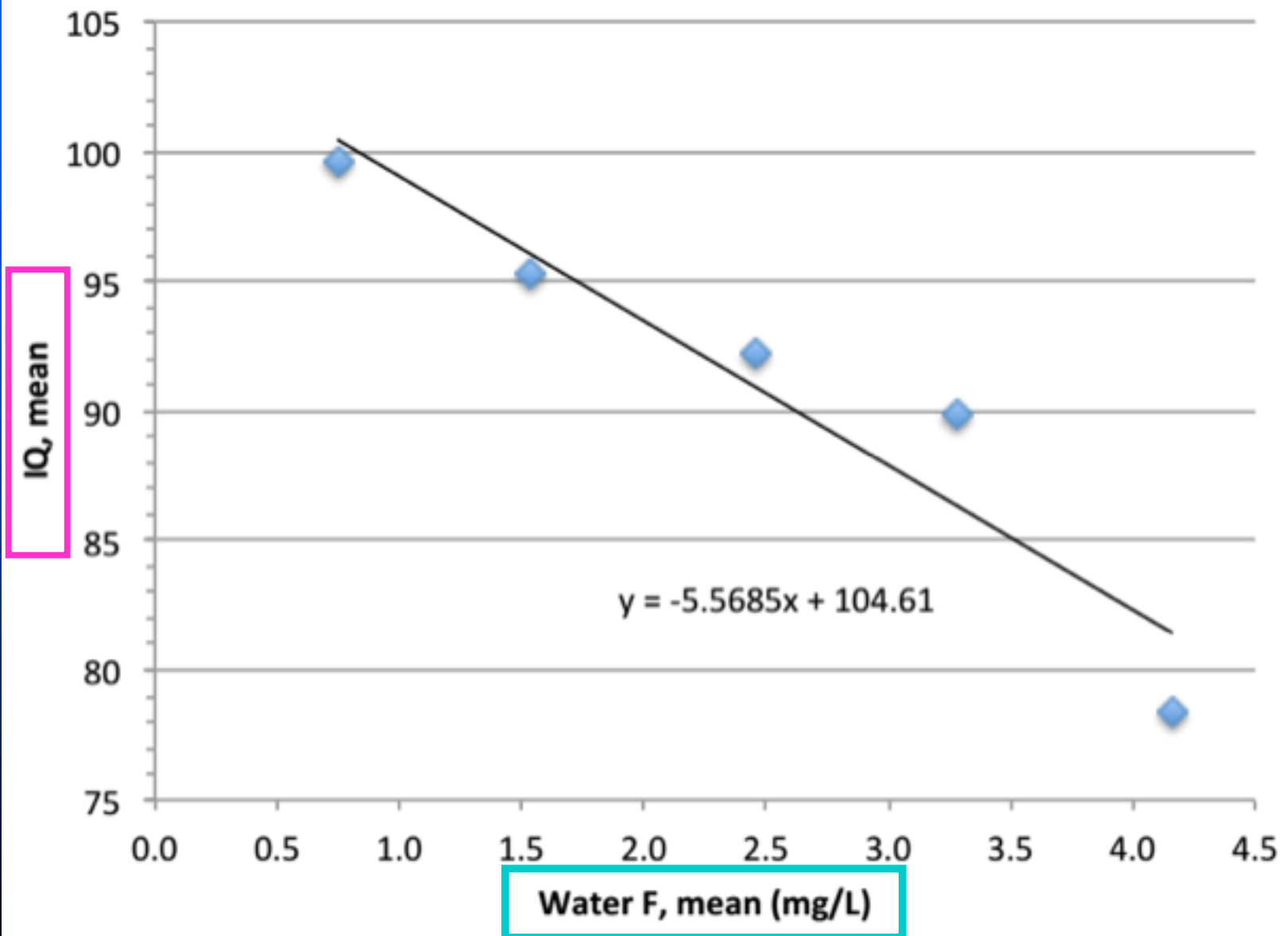
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## IQ vs Water F

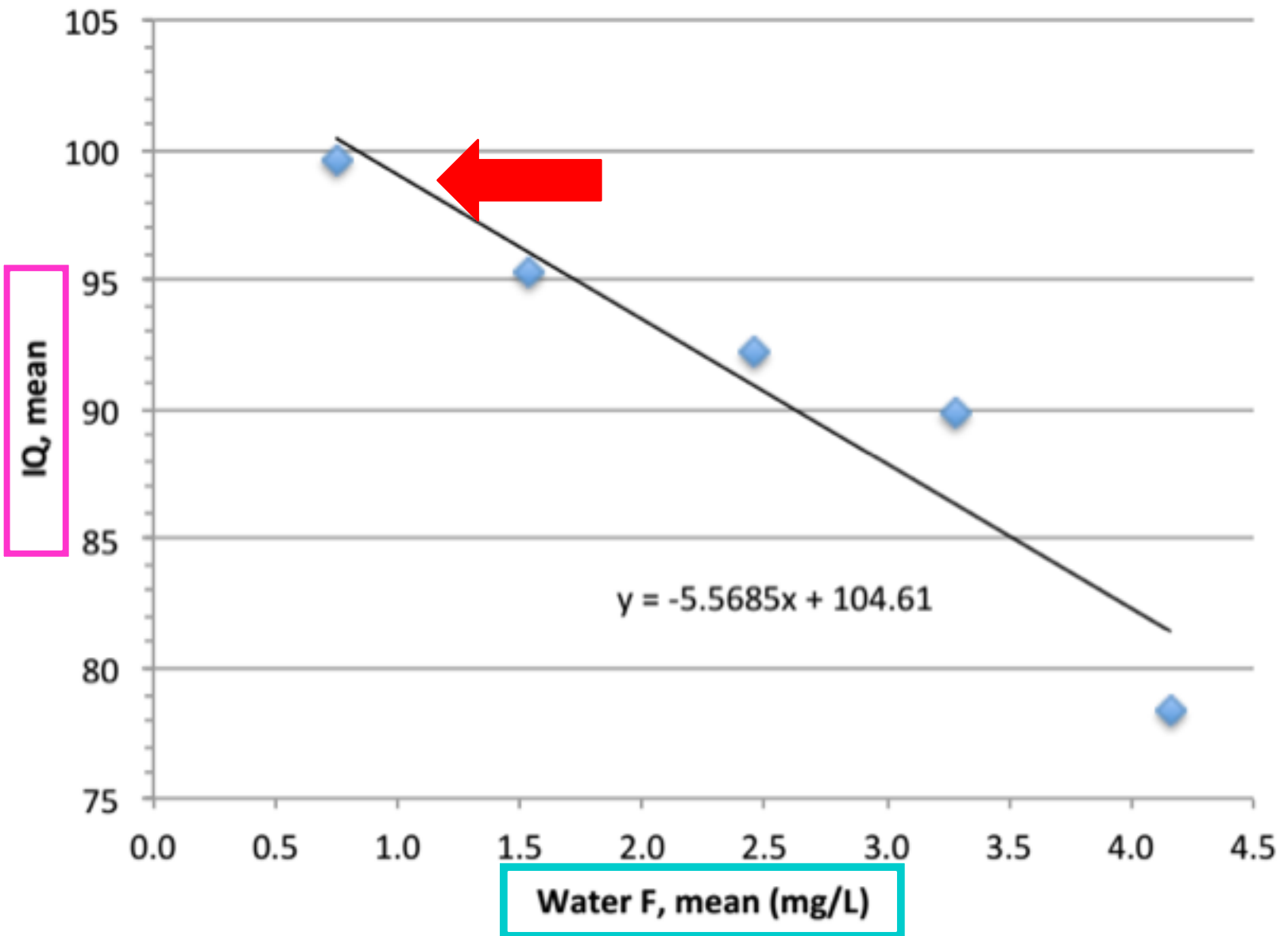
(for "high F" village Waimao, grouped by water F category)



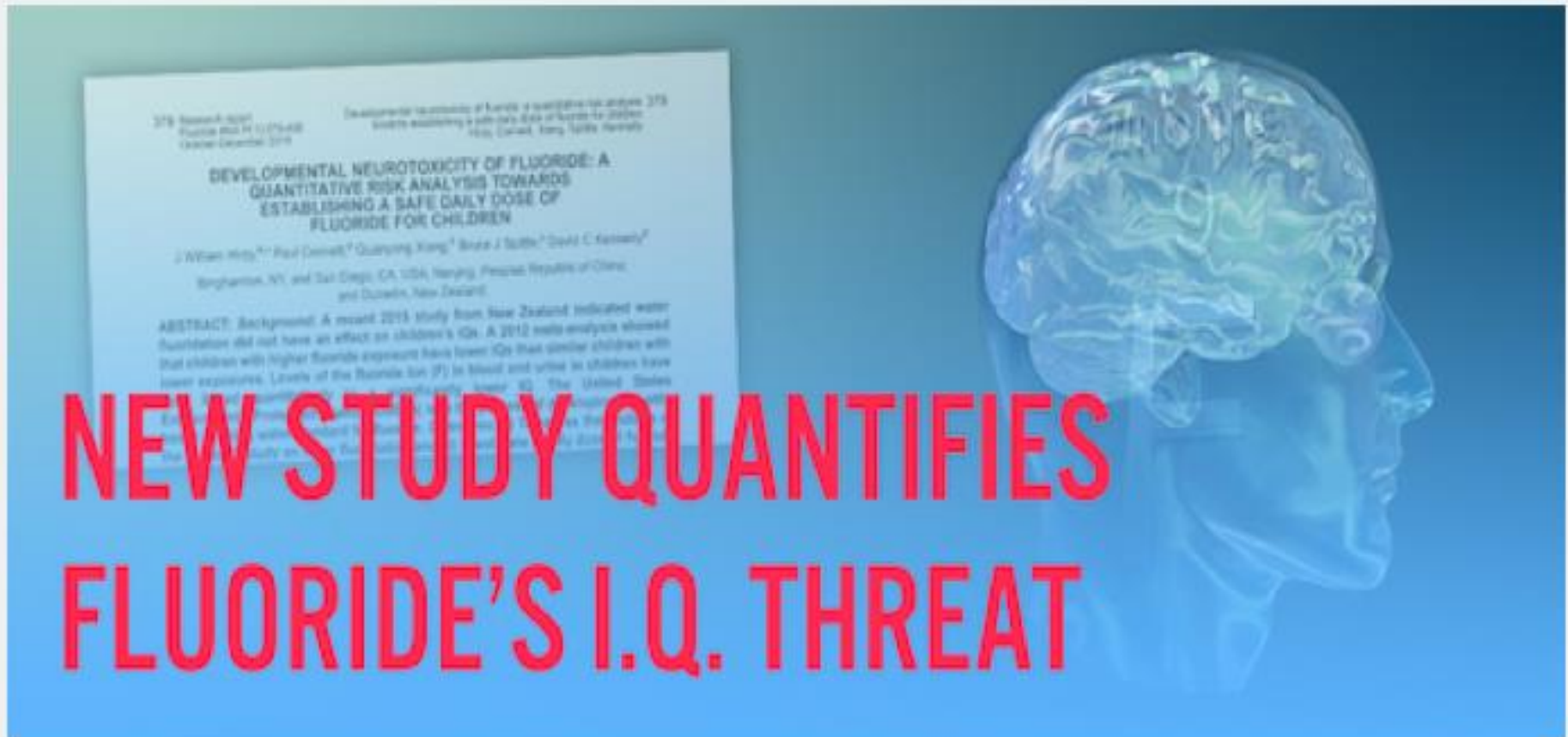


# IQ vs Water F

(for "high F" village Waimao, grouped by water F category)



# NEW STUDY QUANTIFIES FLUORIDE'S POTENTIAL TO LOWER IQ IN CHILDREN



379 Research report  
Fluoride 49(4 Pt 1):379-400  
October-December 2016

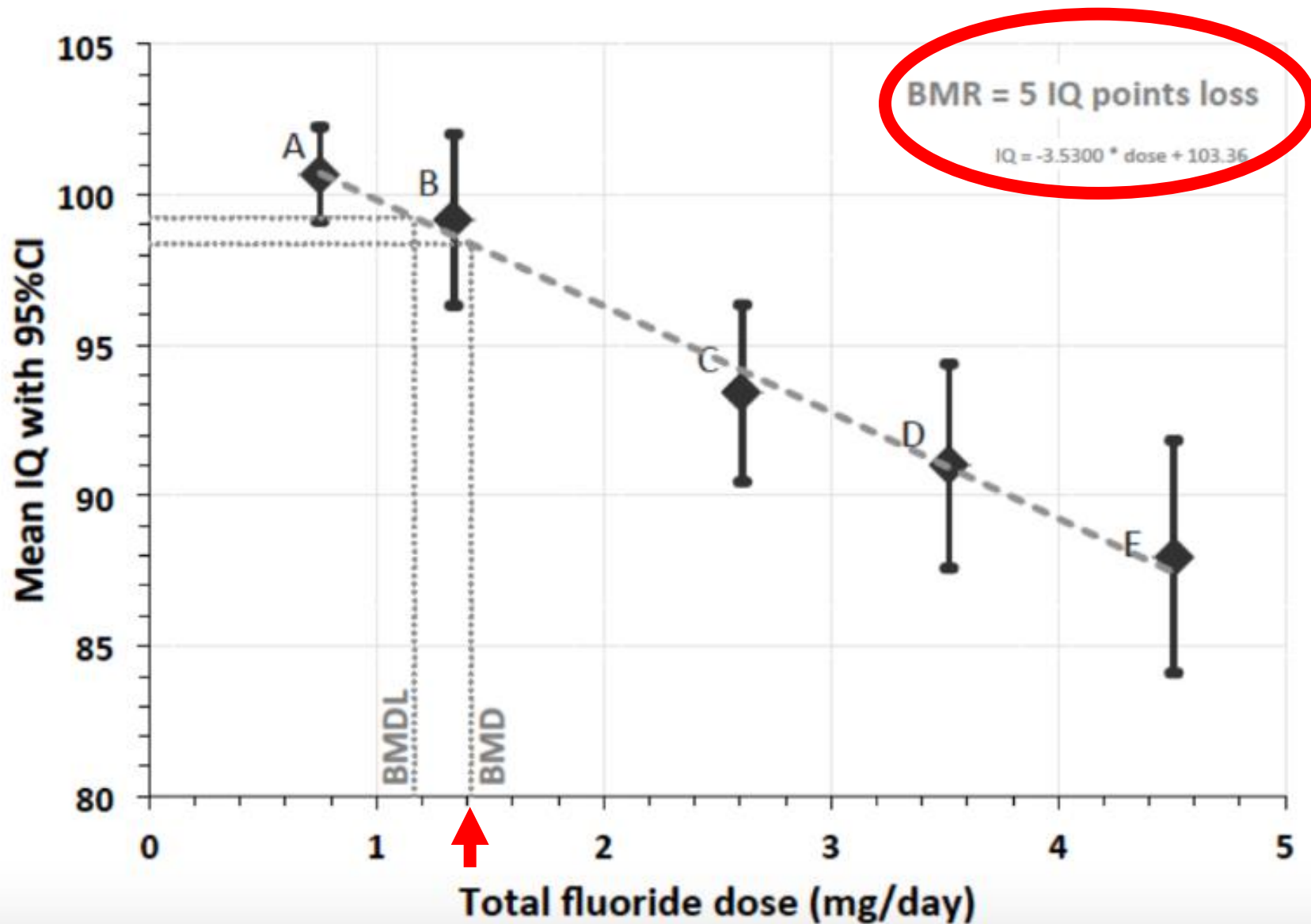
Developmental neurotoxicity of fluoride: a quantitative risk analysis 379  
towards establishing a safe daily dose of fluoride for children  
Hirzy, Connett, Xiang, Spittle, Kennedy

**DEVELOPMENTAL NEUROTOXICITY OF FLUORIDE: A  
QUANTITATIVE RISK ANALYSIS TOWARDS  
ESTABLISHING A SAFE DAILY DOSE OF  
FLUORIDE FOR CHILDREN**

J William Hirzy,<sup>a,\*</sup> Paul Connett,<sup>a</sup> Quanyong Xiang,<sup>b</sup> Bruce J Spittle,<sup>c</sup> David C Kennedy<sup>d</sup>

Binghamton, NY, and San Diego, CA, USA; Nanjing, Peoples Republic of China;  
and Dunedin, New Zealand;

**FIGURE 9: BMD for Loss of 5 IQ Points from Fluoride**  
(Linear Model, BMR = 5 IQ Points)



A dose of 1.4 mg/day  
lowers IQ in Xiang  
study by 5 IQ points  
(Hirzy et al., 2016)

# Brief History of Fluoride-IQ studies

- On Sept 19, 2017, the **Bashash et al., 2017 study** was published. This is the most important Fluoride-IQ study published to date.



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# FLUORIDE EXPOSURE IN UTERO LINKED TO LOWER IQ IN KIDS, NEW STUDY SAYS



# The Bashash et al., 2017 study



*Environ Health Perspect*; DOI:10.1289/EHP655

## Prenatal Fluoride Exposure and Cognitive Outcomes in Children at 4 and 6–12 Years of Age in Mexico

Morteza Bashash,<sup>1</sup> Deena Thomas,<sup>2</sup> Howard Hu,<sup>1</sup> E. Angeles Martinez-Mier,<sup>3</sup> Brisa N. Sanchez,<sup>2</sup> Niladri Basu,<sup>4</sup> Karen E. Peterson,<sup>2,5,6</sup> Adrienne S. Ettinger,<sup>2</sup> Robert Wright,<sup>7</sup> Zhenzhen Zhang,<sup>2</sup> Yun Liu,<sup>2</sup> Lourdes Schnaas,<sup>8</sup> Adriana Mercado-García,<sup>9</sup> Martha María Téllez-Rojo,<sup>9</sup> and Mauricio Hernández-Avila<sup>9</sup>

## The Bashash et al., 2017 study

- This was a 12-year multi-million dollar study – funded by EPA, NIH and NIEHS.
- Authors came from many prestigious institutions (e.g. Universities of Toronto, McGill, Harvard, Indiana, Michigan, Mount Sinai and more)

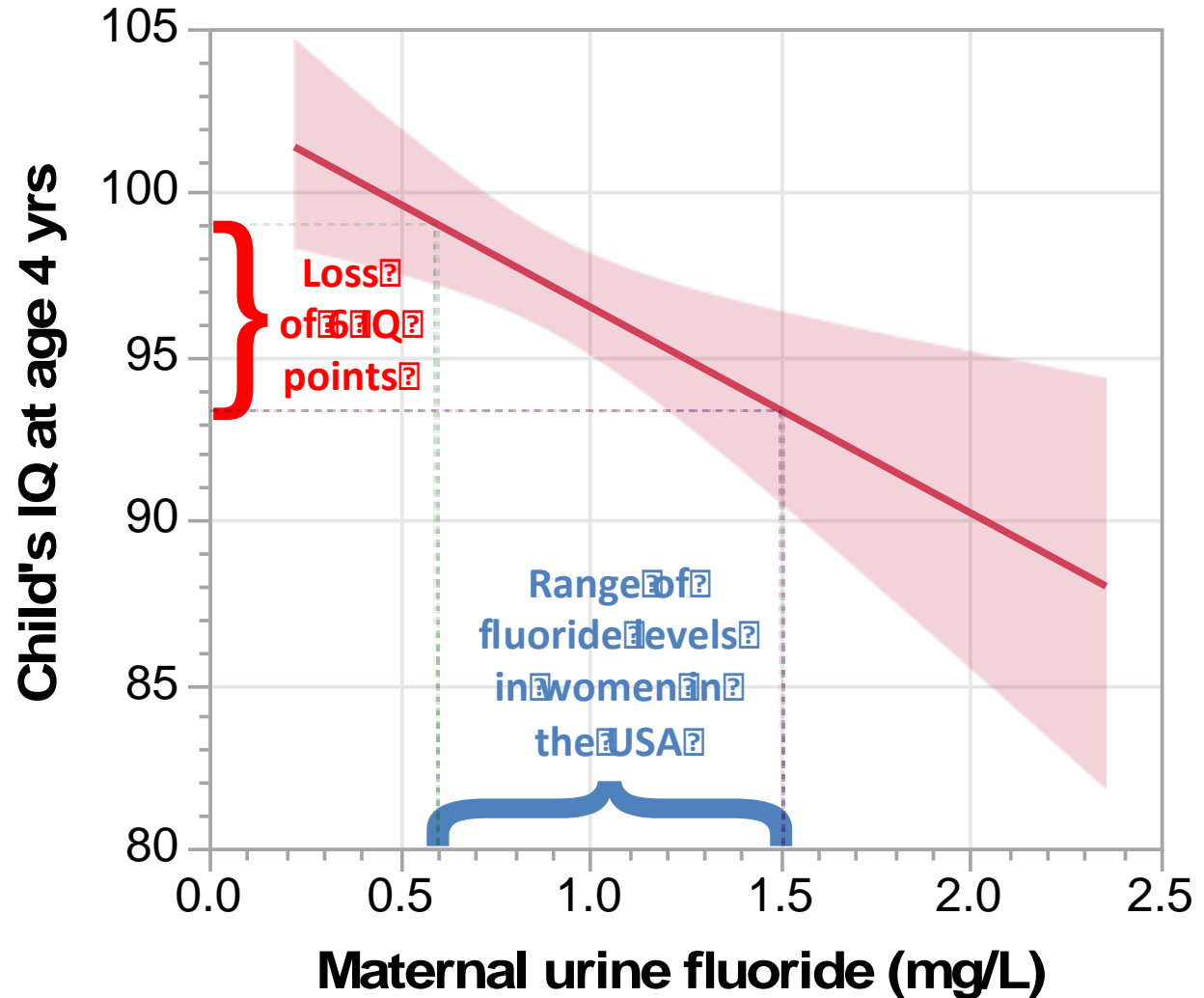
## The study

- Examined approximately 300 mother-offspring pairs.
- Both exposure and outcomes were determined on an **individual** basis.
- The mothers' exposure to fluoride during pregnancy was determined via analysis of their urine (**a measure of total fluoride exposure regardless of source**).

# The study results

- The IQ of the women's children was measured at age 4 and again at 6-12 years
- For every 1 mg/L increase in the mother's urine F level the children lost an average of **5-6 IQ points**, a very large effect.

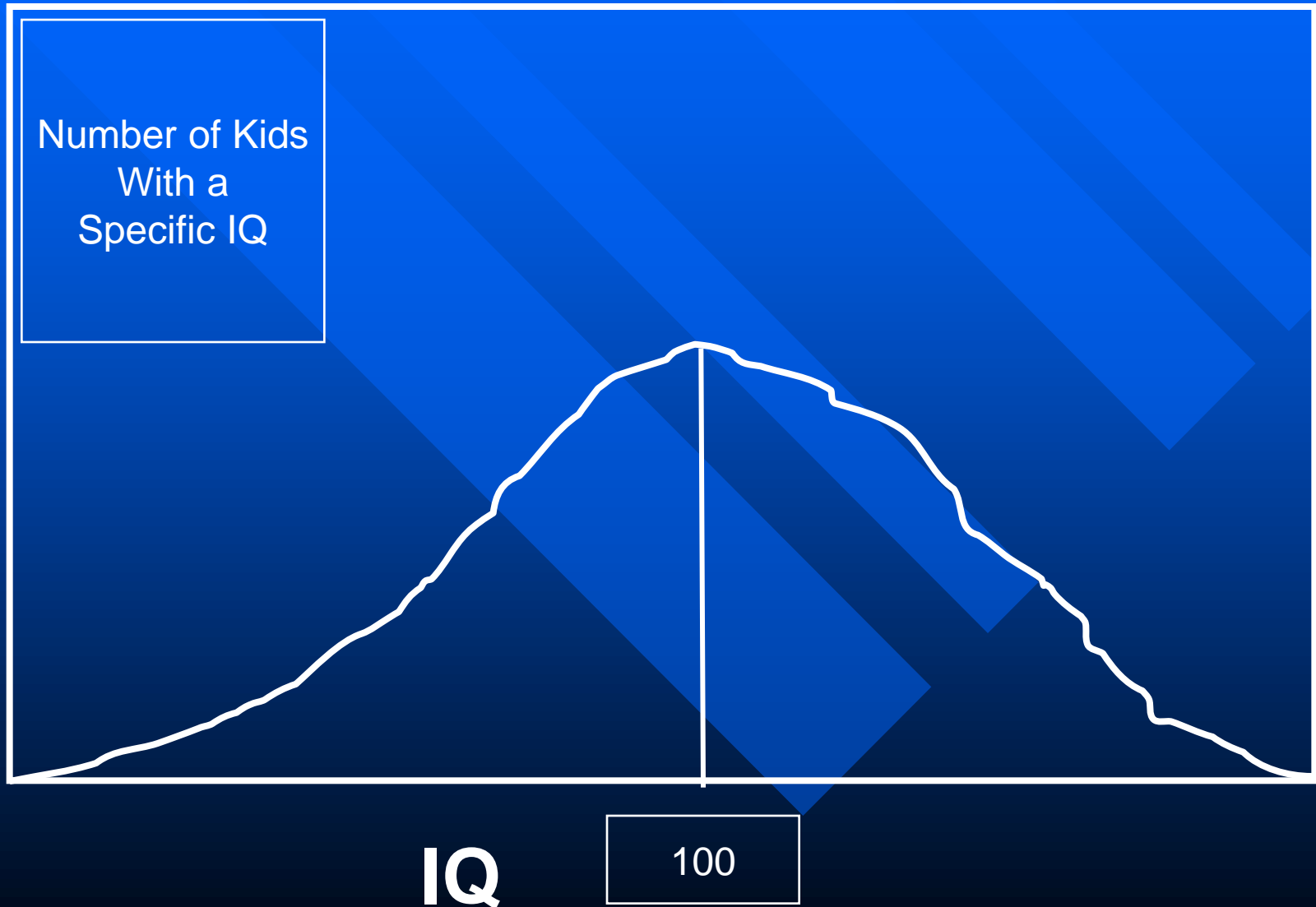
# Relationship between fluoride and IQ found in new study (Bashash et al. 2017)



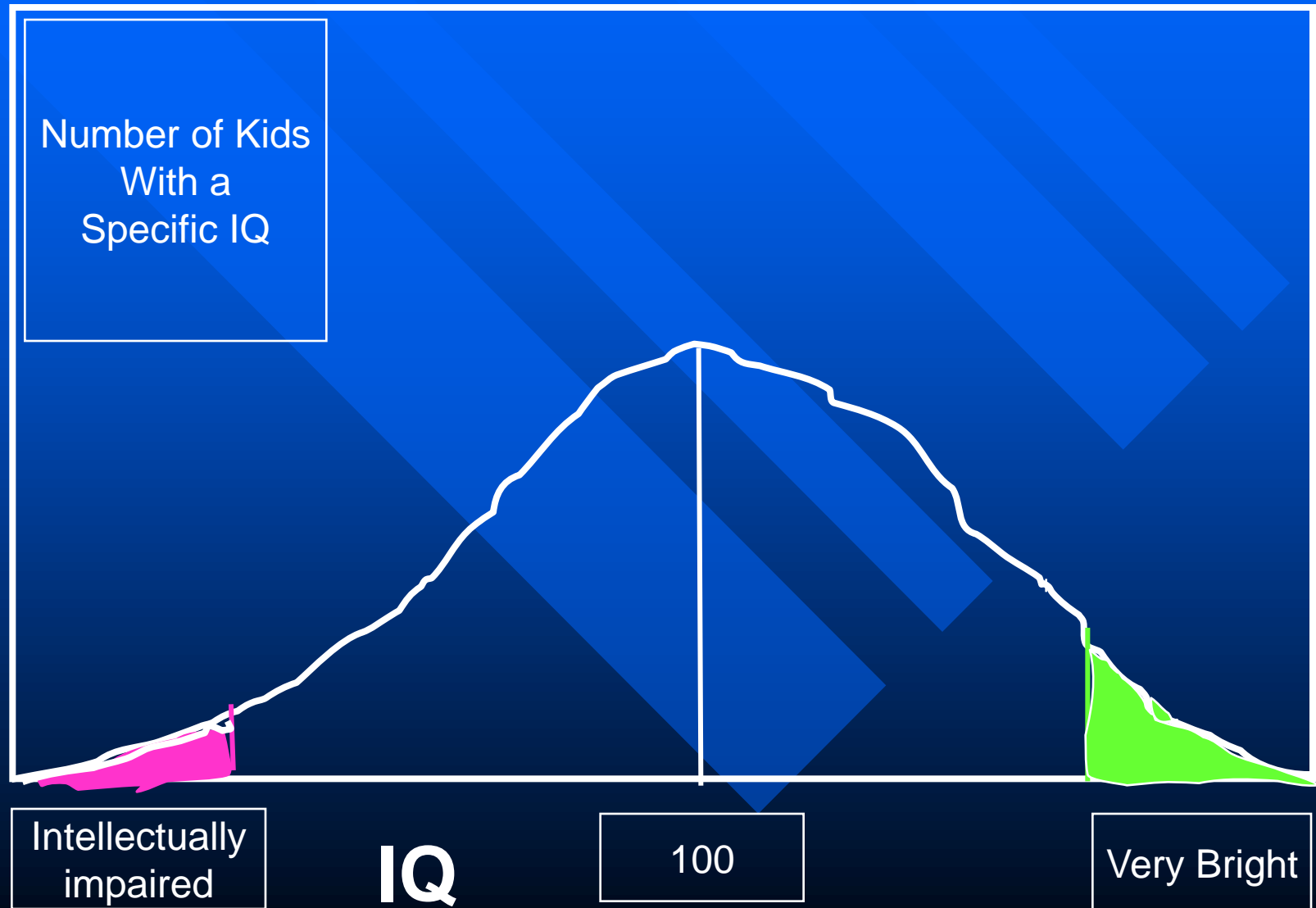


Why a loss of 5  
IQ points is so  
serious at the  
population level

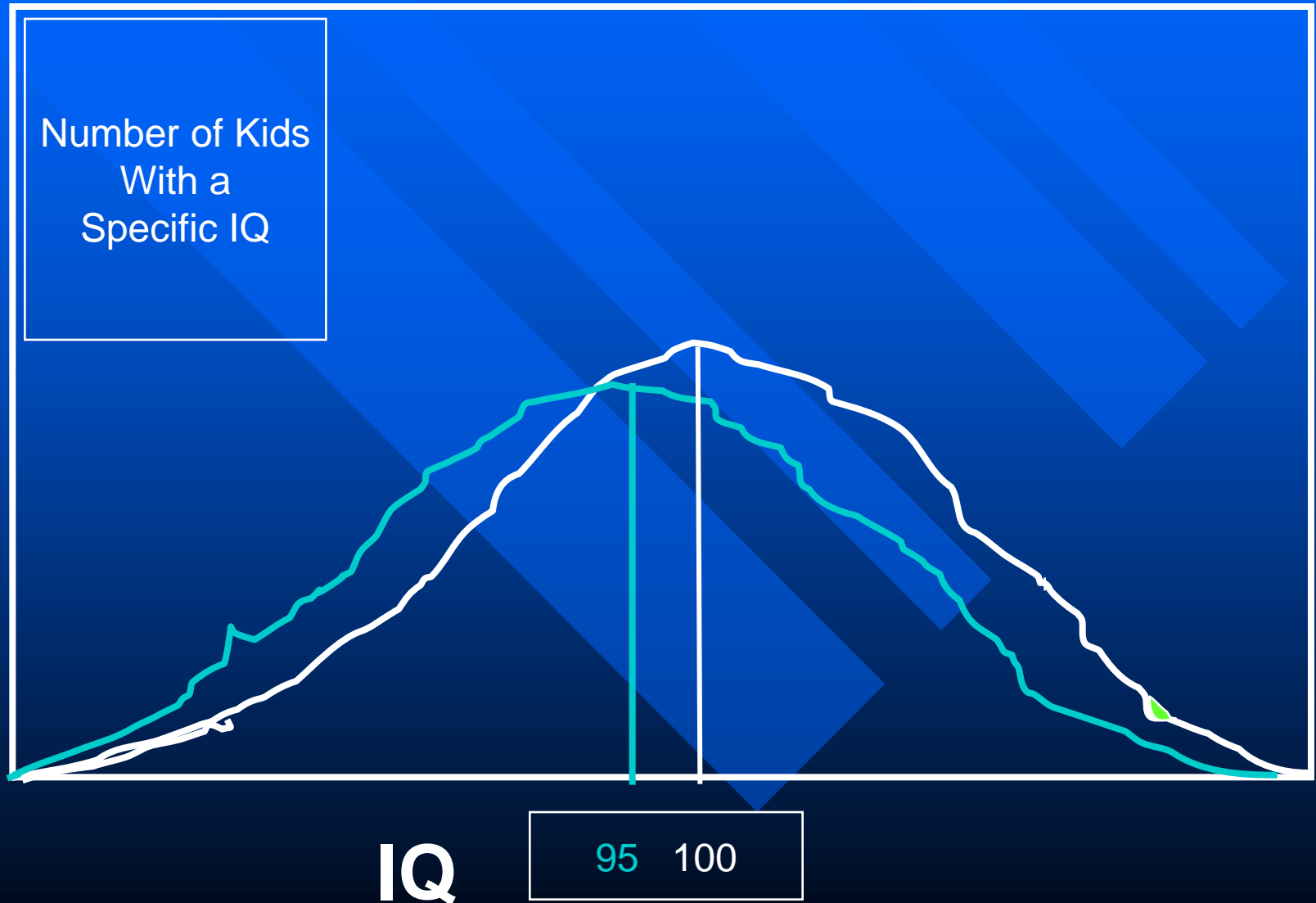
# IQ and population



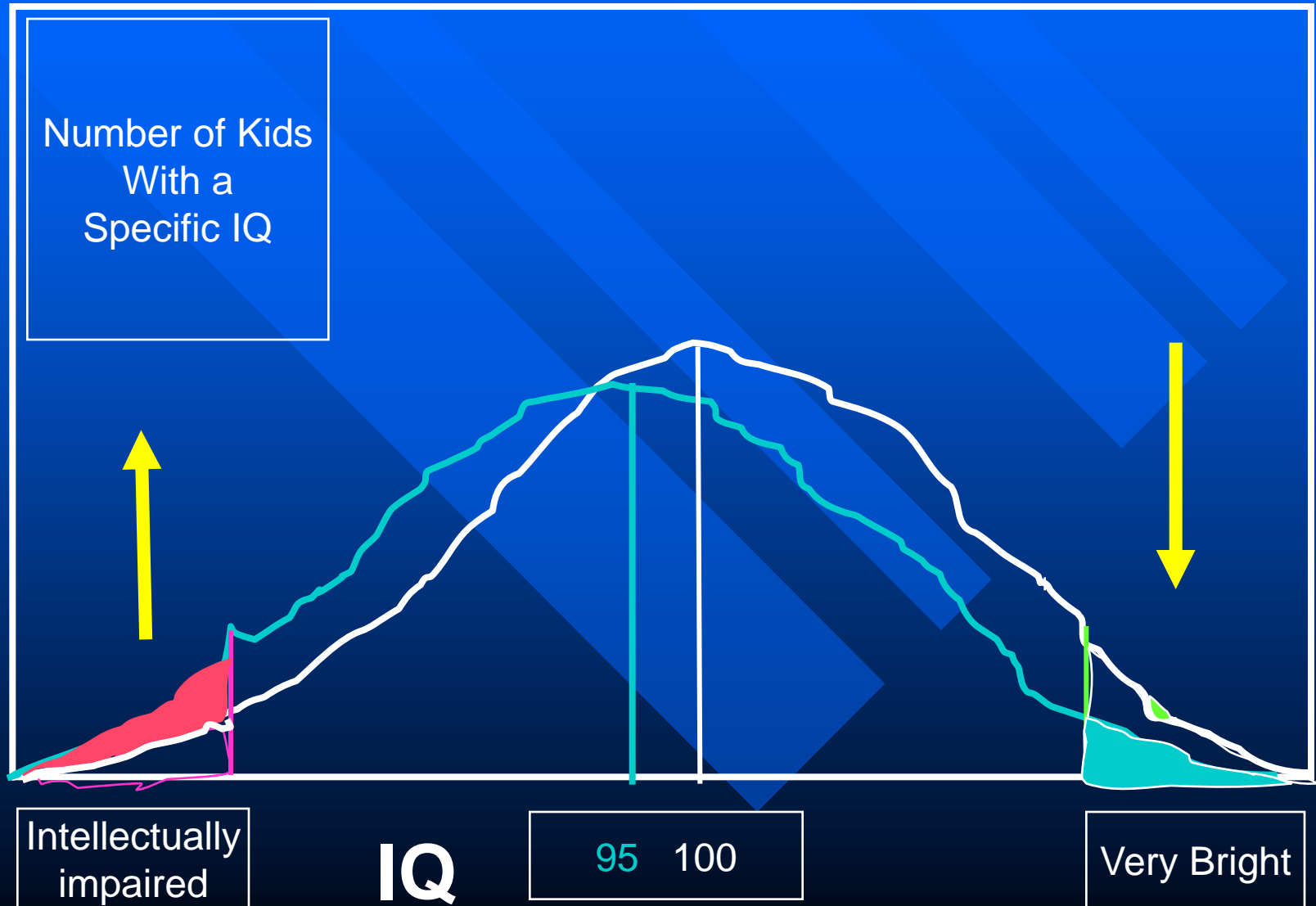
# IQ and population



# IQ and population



# IQ and population





Within a few minutes of the publication the Bashash, 2017 study the ADA stated that:

- **“the findings are not applicable to the U.S.”**

# The response of the principle author –Dr. Howard Hu – to the ADA

- “This is a very rigorous epidemiology study. You just can’t deny it. It’s directly related to whether fluoride is a risk for the neurodevelopment of children. So to say it has no relevance to the folks in the U.S. seems disingenuous.”

# Dr. Howard Hu (Toronto U.)



## Till et al., 2018

Found levels of fluoride in the urine of pregnant women in **fluoridated communities in Canada** that were approximately the same as the levels in the Bashash study done in Mexico City.

# Urinary fluoride levels in pregnant women in Canada (Till, 2018)





# Review by David Bellinger, in *Pediatric Medicine*, 2018

Review Article



Page 1 of 13

## Environmental chemical exposures and neurodevelopmental impairments in children

David C. Bellinger<sup>1,2,3</sup>

<sup>1</sup>Department of Neurology and Psychiatry, Boston Children's Hospital, Boston, MA, USA; <sup>2</sup>Department of Neurology and Psychiatry, Harvard Medical School, Boston, MA, USA; <sup>3</sup>Department of Environmental Health, Harvard T.H. Chan School of Public Health, Boston, MA, USA

Correspondence to: David C. Bellinger. Boston Children's Hospital, 300 Longwood Avenue, Boston, MA 02115, USA.

Email: david.bellinger@childrens.harvard.edu.

**Abstract:** Children are widely viewed as the population subgroup that is most vulnerable to the toxicities that result from exposure to environmental chemicals. Their enhanced vulnerability is due to a variety of behavioral and physiologic factors. For many chemicals, the central nervous system (CNS) is the most sensitive target organ. In general, the impacts depend on a chemical's mode of action, the dose, and the stage of development at which exposure occurs. This paper surveys the toxicology of environmental chemicals, specifically the impacts on children's intellectual development. It focuses on metals (or metalloids), including mercury, lead, arsenic, fluoride, as well as on pesticides, air pollution, synthetic organic chemicals, and endocrine disruptors. The final section discusses issues germane to estimating the global burden of disease associated with exposures to neurotoxic environmental chemicals.

**Keywords:** Chemicals; children; epidemiology; neurodevelopment; toxicology

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doi: 10.21037/pm.2018.11.03

View this article at: <http://dx.doi.org/10.21037/pm.2018.11.03>

David Bellinger is one of the world's leading neuroscientists and the leading authority on the neurotoxicity of lead

1. Department of Neurology and Psychiatry, Boston Children's Hospital.
2. Department of Neurology and Psychiatry, Harvard Medical School.
3. Department of Environmental Health, Harvard T.H. Chan School of Public Health.

# Bellinger - section on fluoride

A review of nearly three dozen studies conducted in China, mostly ecologic in design and comparing children from a low-exposure village to a high-exposure village, concluded that exposure to water with greater fluoride concentrations is associated with lower IQ scores (66). Such studies provide only weak evidence, however, lacking data on internal exposures (i.e., blood concentrations of fluoride in individual participants or severity of dental fluorosis). Also the villages compared likely differed not only in water fluoride concentrations, but in also in terms of other factors that might affect the distributions of their IQ scores (e.g., socioeconomic status, access to medical care, quality of schools, etc.). Recently, studies that address these limitations have been reported. In a relatively small pilot study in China, negative associations were found between fluorosis severity, reflecting lifetime exposure, and children's scores on some neuropsychological tests (67). Similar findings were reported in India (68), while in a Mexican study, children's prenatal fluoride exposure (concentration in maternal urine during pregnancy) were inversely associated with IQ scores at ages 4 and 6–12 years (69). Increased exposure to fluoride has also been linked, ecologically, to ADHD prevalence in the U.S. (70) and, in a cohort study, to increased ADHD symptoms in Mexican children (71).

66. Choi AL, Sun G, Zhang Y, et al. Developmental fluoride neurotoxicity: a systematic review and meta-analysis. *Environ Health Perspect* 2012;120:1362-8.
67. Choi AL, Zhang Y, Sun G, et al. Association of lifetime exposure to fluoride and cognitive functions in Chinese children: a pilot study. *Neurotoxicol Teratol* 2015;47:96-101.
68. Khan SA, Singh RK, Navit S, et al. Relationship between dental fluorosis and intelligence quotient of school going children in and around Lucknow district: a cross-sectional study. *J Clin Diagn Res* 2015;9:ZC10-5.
69. 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.
70. Malin AJ, Till C. Exposure to fluoridated water and attention deficit hyperactivity disorder prevalence among children and adolescents in the United States: an ecological association. *Environ Health* 2015;14:17.
71. Bashash M, Marchand M, Hu H, et al. Prenatal fluoride exposure and attention deficit hyperactivity disorder (ADHD) symptoms in children at 6-12 years of age in Mexico City. *Environ Int* 2018;121:658-66.

## Malin et al., 2018

Found that fluoride exposure increased TSH levels ( a biomarker of hypothyroidism – underactive thyroid) in those already compromised by low iodine intake

*A pregnant woman with lowered thyroid function has a greater risk of producing a child with lowered IQ*

# The weight of evidence

*No human epidemiological experiment can prove “cause and effect” but the findings are strengthened when the results are:*

*a) consistent with other studies (i.e. the weight of evidence of animal and human Studies)*

*b) The study is replicated, and*

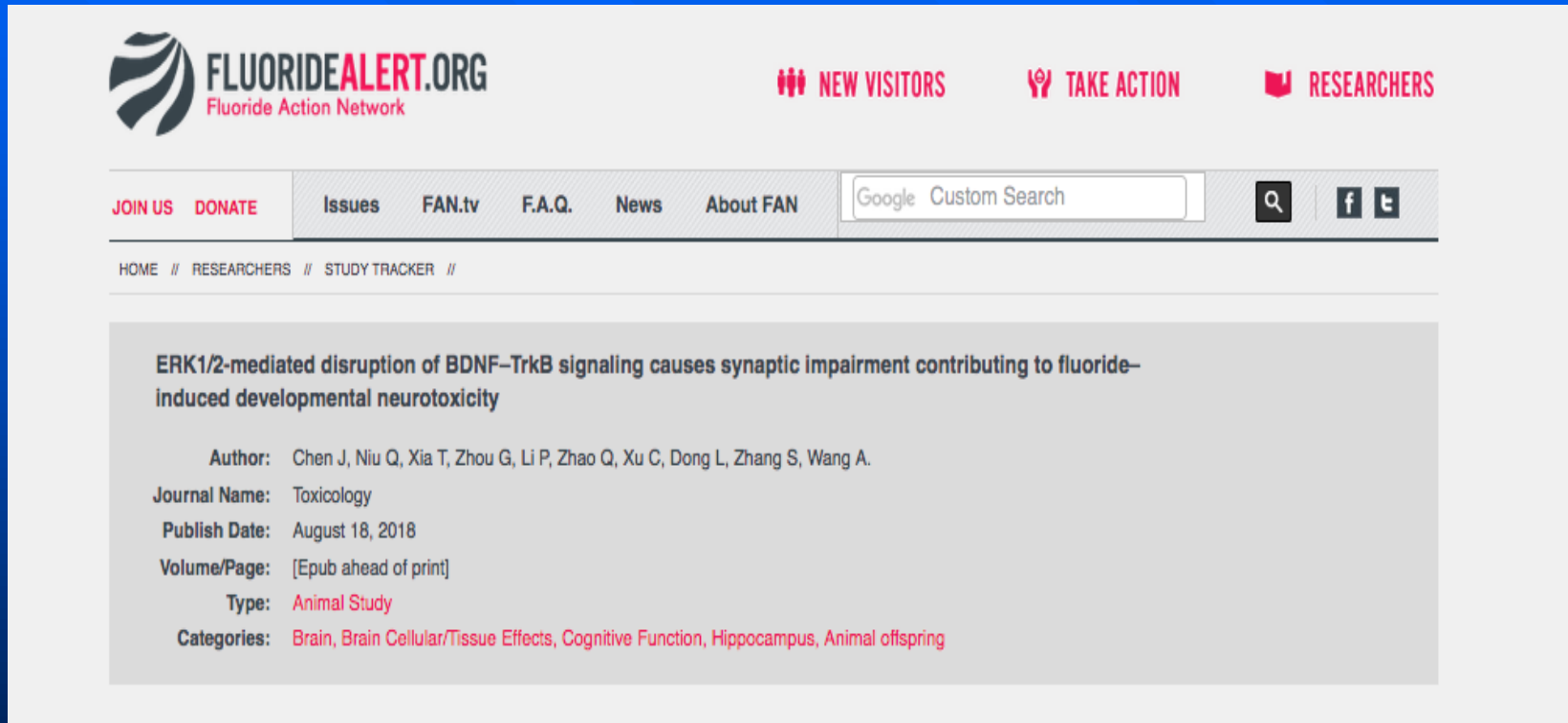
*c) Can be shown to be biologically plausible*



# WEIGHT OF EVIDENCE ON FLUORIDE'S NEUROTOXICITY

- **Over 200 animal studies** show that fluoride can cause biochemical and physical changes to the brain
- **34 out of 36 animal studies** show rodents exposed to fluoride have a decreased ability to learn
- **Over 50 (out of 60) human studies** link fluoride exposure to lowered IQ
- **12 studies** (7 human, 5 animal) link fluoride with other brain function deficits
- **3 human studies** show fluoride impacts fetal brain

# A biological mechanism, Chen et al., 2018



The screenshot shows the FluorideAlert.org website. The header includes the logo and name 'FLUORIDEALERT.ORG Fluoride Action Network', along with navigation links for 'NEW VISITORS', 'TAKE ACTION', and 'RESEARCHERS'. A secondary navigation bar contains 'JOIN US', 'DONATE', 'Issues', 'FAN.tv', 'F.A.Q.', 'News', and 'About FAN', followed by a search bar and social media icons for Facebook and Twitter. The breadcrumb trail reads 'HOME // RESEARCHERS // STUDY TRACKER //'. The main content area features the title 'ERK1/2-mediated disruption of BDNF-TrkB signaling causes synaptic impairment contributing to fluoride-induced developmental neurotoxicity'. Below the title, the author list is 'Chen J, Niu Q, Xia T, Zhou G, Li P, Zhao Q, Xu C, Dong L, Zhang S, Wang A.'. The journal information is 'Toxicology', published on 'August 18, 2018', in 'Volume/Page: [Epub ahead of print]'. The study type is 'Animal Study', and the categories are 'Brain, Brain Cellular/Tissue Effects, Cognitive Function, Hippocampus, Animal offspring'.

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**ERK1/2-mediated disruption of BDNF-TrkB signaling causes synaptic impairment contributing to fluoride-induced developmental neurotoxicity**

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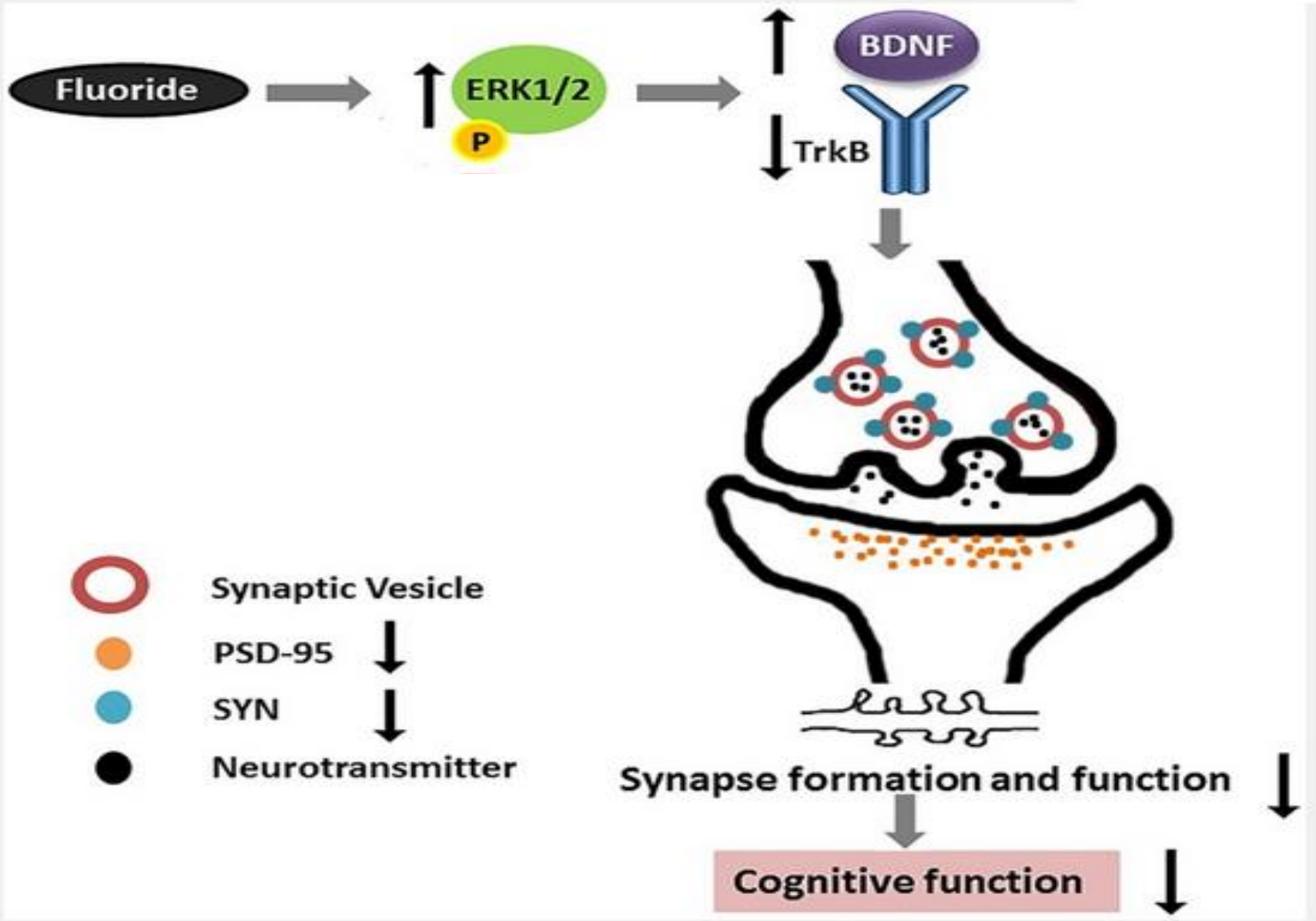
**Publish Date:** August 18, 2018

**Volume/Page:** [Epub ahead of print]

**Type:** Animal Study

**Categories:** Brain, Brain Cellular/Tissue Effects, Cognitive Function, Hippocampus, Animal offspring

Chen et al. offer a possible biochemical mechanism for how fluoride damages neurodevelopment



# Conclusions

1. For any community to continue fluoridation with all these studies - including several US-government funded studies - on the table is reckless.
2. The **risks** to fetal and infant brain development far outweigh any **benefit** to teeth from ingestion of fluoride during fetal and infant development.
3. Other countries have shown that these benefits can be secured by other and more appropriate means : better diet (less sugar); better education and topical treatment (e.g. use of fluoridated toothpaste)