

Commentary

Extreme Ecological Fallacy Can Explain Why Study Was Unable to Detect IQ Loss From Fluoridation

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This brief commentary argues that major methodological limitations in Warren et al.'s study likely prevented it from detecting potential IQ effects associated with fluoride exposure. The author contends that the study misclassified exposure in an extreme case of the ecological fallacy by labeling entire counties as fluoridated based on a single well measurement, despite most residents using low-fluoride water and Community Water Fluoridation not yet existing during participants' birth years. The resulting exposure misclassification greatly overestimated the numbers supposedly exposed at birth and early life. Additional concerns include minimal prenatal and early childhood fluoride exposure among subjects and reliance on adolescent rather than childhood IQ measurements. The commentary concludes that these limitations substantially weaken the study's ability to assess neurodevelopmental risk and contrasts its findings with other studies and systematic reviews reporting associations between early-life fluoride exposure and reduced IQ at concentrations relevant to community water fluoridation.

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Warren et al. [1] conclude that water fluoridation is not associated with IQ loss. However, three fundamental flaws—especially a severe misclassification where most subjects deemed “Exposed from Birth” were actually *unexposed* during early life—render this study incapable of detecting developmental neurotoxicity from community water fluoridation (CWF) exposure levels.

1. Extreme Ecological Fallacy. Warren et al. classify every subject in a county as “exposed” if a single well in USGS's database had natural fluoride ≥ 0.7 mg/L, even if the majority of wells tested far below this threshold. In 11 of the 13 counties categorized as entirely “exposed,” no more than 1 in 4 wells had ≥ 0.7

mg/L and most counties averaged 0.2 mg/L (Table 1). In extreme cases like Portage and Sheboygan Counties, “exposed” status was driven by just one outlier out of 36+ wells. In Figure 1, the single Sheboygan County well testing ≥ 0.7 mg/L is not only in a sparsely populated area, but the USGS database reveals it was a 1-foot deep “monitoring well” rather than a drinking water well, so even less appropriate for assigning county-wide exposure. Furthermore, the majority of Wisconsin’s population lived in cities and towns using low-fluoride (pre-CWF) water from lakes or rivers instead of wells (Fig. 1). Assigning exposure from rare, geographically remote outlier wells to everyone in a county guaranteed severe misclassification.

This faulty exposure method classified 25.2% of the cohort as “Exposed from Birth.” However, calculating more realistic 1940 exposure from public water system (PWS) records [2][3], extensive Wisconsin DNR well data [4], and population distribution estimates [5] suggests only about 6% were truly exposed at birth. Thus, most subjects classified “exposed” were actually unexposed. This profound misclassification creates a severe directional bias that would counteract any true adverse effect. Even a large real reduction in IQ would likely be unobservable with this degree of exposure misclassification [6].

2. Omission of the Critical Window. Participants were born around 1939, six years before any CWF existed. Consequently, all but the small percentage with naturally elevated fluoride missed the prenatal and infancy windows of exposure, which modern research [7] identifies as periods of highest susceptibility to fluoride’s neurotoxicity. Studying exposures at later ages fails to address early-life vulnerability.

3. Reduced Sensitivity of Adolescent IQ. The reliance on adolescent IQ (age 16) further reduces statistical power. Behavioral genetics research [8] demonstrates that shared environmental factors explain substantial IQ variance in childhood but negligible variance by adolescence. Consequently, statistical controls used by Warren et al. (e.g. family income) were less effective at filtering background noise than in studies of children, further obscuring any neurotoxicity signals.

Finally, the authors claim IQ loss is only observed at exposures “far exceeding” CWF. This is incorrect. Of 23 high-quality studies in the National Toxicology Program’s systematic review [9], 19 found significantly reduced IQ; 12 at concentrations below 1.5 mg/L, considered directly applicable to CWF; and two at < 0.7 mg/L. Furthermore, protecting susceptible individuals requires a 10x safety factor [10] placing all 19 studies within CWF-relevant levels.

County	N wells	N wells ≥0.7 mg/L F	% wells ≥0.7 mg/L F	At least 1 well ≥0.7 in county	Mean of F (mg/L)
Brown*	7	5	71.4%	Yes	1.6
Outagamie*	7	4	57.1%	Yes	1.0
Waupaca	15	2	13.3%	Yes	0.2
Waushara	15	2	13.3%	Yes	0.2
Winnebago	8	2	25.0%	Yes	0.3
Calumet	4	1	25.0%	Yes	0.4
Fond du Lac	13	1	7.7%	Yes	0.2
Oconto	8	1	12.5%	Yes	0.2
Portage	38	1	2.6%	Yes	0.2
Racine	11	1	9.1%	Yes	0.3
Shawano	15	1	6.7%	Yes	0.3
Sheboygan	36	1	2.8%	Yes	0.2
Waukesha	16	1	6.3%	Yes	0.2
Adams	1	0	0.0%	No	0.0
Ashland	1	0	0.0%	No	0.4
Bayfield	1	0	0.0%	No	0.4
Chippewa	1	0	0.0%	No	0.0
Columbia	4	0	0.0%	No	0.0
Dane	1	0	0.0%	No	0.0
Dodge	1	0	0.0%	No	0.4
Dunn	2	0	0.0%	No	0.2
Eau Claire	1	0	0.0%	No	0.0
Forest	4	0	0.0%	No	0.0
Grant	1	0	0.0%	No	0.1
Green Lake	3	0	0.0%	No	0.1
Jefferson	2	0	0.0%	No	0.2
Kenosha	2	0	0.0%	No	0.2
La Crosse	1	0	0.0%	No	0.1
Langlade	6	0	0.0%	No	0.2
Lincoln	1	0	0.0%	No	0.0
Manitowoc	1	0	0.0%	No	0.0
Marathon	3	0	0.0%	No	0.2
Marinette	4	0	0.0%	No	0.0
Marquette	11	0	0.0%	No	0.1
Milwaukee	1	0	0.0%	No	0.4
Monroe	5	0	0.0%	No	0.2
Ozaukee	3	0	0.0%	No	0.1
Pierce	1	0	0.0%	No	0.1
Richland	4	0	0.0%	No	0.1
Rusk	1	0	0.0%	No	0.1
Sauk	3	0	0.0%	No	0.0
Trempealeau	1	0	0.0%	No	0.2
Vilas	5	0	0.0%	No	0.0
Walworth	7	0	0.0%	No	0.3
Washington	7	0	0.0%	No	0.3

Table 1. Numbers of USGS database wells in each Wisconsin county used by Warren et al. to classify exposure. Notes: All 45 counties (out of 72 in Wisconsin) that had any wells in USGS database, ordered by number of wells with water fluoride concentrations ≥ 0.7 mg/L and then alphabetically. Warren et al. classified all WLS subjects living in a county as “exposed” if at least 1 well was ≥ 0.7 mg/L. Asterisk * for counties with at least 50% of wells ≥ 0.7 mg/L and mean fluoride of all wells ≥ 0.7 mg/L. Data provided in personal correspondence from J. R. Warren and corroborated with original USGS data.

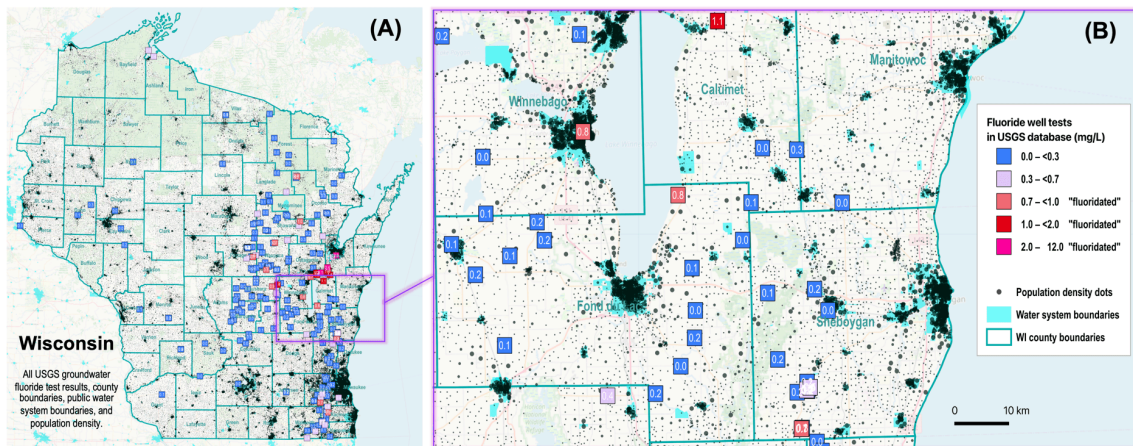


Figure 1. (A) Map of Wisconsin USGS well fluoride data overlain on population density, public water system areas, and county boundaries. Population density indicated by black dots at US Census Block centroids. (B) Inset showing USGS wells with ≥ 0.7 mg/L fluoride (red markers) used for assigning county-wide exposure geographically distant from population centers. In Sheboygan County, the single well testing ≥ 0.7 mg/L is in a geographically isolated and sparsely populated area. The USGS database reveals it was a 1-foot deep “monitoring well” rather than a drinking water well. In Winnebago County, the well testing 0.8 mg/L is located in the City of Oshkosh WI whose population has always received public water supplied from low-fluoride Lake Winnebago so the well does not reflect the city’s exposure.

Statements and Declarations

Author Contributions

C.N. designed research, analyzed data, and wrote the paper.

Potential Competing Interests

The author is employed by AEHSP which has a division, the Fluoride Action Network (FAN), which is a citizen organization plaintiff in a civil action against the U.S. Environmental Protection Agency on the neurotoxic risk of fluoridation. FAN is a non-profit that advocates against fluoridation.

References

1. [△]Warren JR, Rumore G, Sicinski K, Herd P, Engelman M (2026). "Municipal Water Fluoridation, Adolescent IQ, and Cognition Across the Life Course: Evidence from the Wisconsin Longitudinal Study." *Proc Natl Acad S ci USA*. 123:e2536005123. doi:10.1073/pnas.2536005123.
2. [△]U.S. Public Health Service (1969). "Natural Fluoride Content of Community Water Supplies." *Public Health Service, NIH, Dental Service*. <https://archive.org/details/naturalfluoridec00nati>.
3. [△]U.S. Public Health Service Centers for Disease Control (PHS/CDC) (1988). "Fluoridation Census 1985." *U.S. Dept of Health & Human Services, Public Health Service, Centers for Disease Control*. <https://stacks.cdc.gov/view/cdc/154464>.
4. [△]Wisconsin Department of Natural Resources (DNR) (2026). "DNR Groundwater Retrieval Network Website." *Wisconsin DNR*. <https://apps.dnr.wi.gov/grnext/SampleHistory/Search>.
5. [△]US Census Bureau (2026). "Explore Census Data." *US Census*. <https://data.census.gov>.
6. [△]International Agency for Research in Cancer (IARC) (2024). *Statistical Methods in Cancer Research Volume V: Bias Assessment in Case-Control and Cohort Studies for Hazard Identification*. Lyon (FR): WHO, IARC. <https://publications.iarc.who.int/634>.
7. [△]Till C, Grandjean P, Martinez-Mier EA, Hu H, Lanphear B (2025). "Health Risks and Benefits of Fluoride Exposure During Pregnancy and Infancy." *Annu Rev Public Health*. 46:253–274. doi:10.1146/annurev-publhealth-060722-023526.
8. [△]Plomin R, Kawakami K (2026). "Nurture and Nonshared Environment in Cognitive Development." *Psychol Rev*. 133:187–196. doi:10.1037/rev0000551. <https://osf.io/preprints/psyarxiv/qndj6v1>.

9. [△]Taylor KW, et al. (2025). "Fluoride Exposure and Children's IQ Scores: A Systematic Review and Meta-Analysis." *JAMA Pediatr*. doi:[10.1001/jamapediatrics.2024.5542](https://doi.org/10.1001/jamapediatrics.2024.5542).
10. [△]Chen EM (2024). "Findings of Fact and Conclusions of Law; Food & Water Watch et al vs US Environmental Protection Agency, 17-cv-02162-EMC." United States District Court Northern District of California. <https://www.courtlistener.com/docket/6201332/445/food-water-watch-inc-v-environmental-protection-agency>.

Declarations

Funding: No specific funding was received for this work.

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