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Environmental and Structural Correlates of Alzheimer's Disease and Autism: A Cross-National Ecological Analysis Using Artificial Intelligence

Patrick J Kearney*

Medical Advisor, MD, MPH, Fairfax Virginia, 22031 USA.

***Corresponding Author(s): Patrick J Kearney**
Medical Advisor, MD, MPH, Fairfax Virginia, 22031 USA.
Tel: 6038521237; Email: patrickkearney20@gmail.com

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Abstract

Background: Alzheimer's Disease (AD) and Autism Spectrum Disorder (ASD) vary widely across countries. While genetics contribute substantially, environmental and structural factors may also influence population-level patterns. This ecological analysis evaluates whether aluminum consumption, aluminum can usage, air pollution, water quality, and urbanization co-vary with national burdens of AD and ASD. Artificial Intelligence (AI) was used as an analytic tool to support data processing and correlation assessment.

Methods: Ten countries representing diverse environmental and demographic contexts were selected. Publicly available data on AD incidence, ASD prevalence, aluminum consumption, aluminum can usage, air pollution indices, water quality indices, and urbanization rates were compiled. Correlation analyses were conducted using AI-assisted tools, and results were visualized in a correlation matrix heatmap.

Results: AD incidence demonstrated strong positive correlations with aluminum consumption (r=0.96) and aluminum can usage (r=0.94). A strong negative correlation was observed with air pollution (r=−0.96). ASD prevalence showed moderate to strong positive correlations with aluminum consumption (r=0.80), aluminum can usage (r=0.84), and urbanization (r=0.76). Environmental metrics were highly interrelated, including a strong inverse correlation between air pollution and water quality (r=−0.99).

Conclusions: A consistent ecological pattern emerged: higher aluminum consumption and greater urbanization were associated with higher national burdens of AD and ASD. These findings are hypothesis-generating and underscore the need for individual-level research to clarify mechanisms and disentangle environmental exposures from diagnostic and structural influences.

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Introduction

Alzheimer's Disease (AD) and Autism Spectrum Disorder (ASD) are complex neurological conditions with multifactorial origins. While genetics contribute significantly, environmental exposures and structural factors may also influence risk. Aluminum exposure has long been debated in relation to neurodevelopment and neurodegeneration, though evidence remains mixed. Animal studies demonstrate neurotoxicity at high doses [2,3,17], and aluminum is ubiquitous in modern environments due to industrial use, food packaging [9,12] and consumer products. In addition, research has ruled out multiple causes to include vaccines that contain aluminum [9,14,15,16]. Interestingly, there was recently published evidence that vaccines might be useful to decrease dementia, which similarly to Alzheimer's disease and autism, can have a severe impact on cognition [18,21,22].

Deodorants containing aluminum were considered in this paper, but the prevailing evidence excludes deodorants as a cause since very little aluminum is dermally absorbed [1].

It was also known that previous research on autism found links to public awareness and medical care. Countries with higher education rates and better medical care will also have more resources to diagnose autism, leading the prevalence to increase worldwide. Families with better education would be more capable of identifying autistic tendencies in their children, leading to medical attention and diagnosis. Our current definition of autism spectrum disorder has been so broad that in less developed countries, only individuals with life-changing symptoms may be diagnosed.

Aluminum cans used for beverages were determined as not causal because the amounts of aluminum present in the beverages were quite small and at approximately, 0.05 to 0.3 mg per can used [17,27].

Anecdotally, it could be possible that the higher prevalence of autism occurs in countries like Japan and South Korea, which have significant industries of car production and aluminum consumption on a per capita basis [7].

For Alzheimer's disease, pathologic tangles are composed of aluminum, but it is largely believed that it may reflect the accumulation of aluminum from dialysis for the treatment of kidney failure [24]. There were many similar symptoms of AD that link might link it ASD through common causes, such as aluminum exposure, especially true for cognitive changes and deterioration [23].

Furthermore, the use of Artificial Intelligence (AI) is used more and more in research with pros, cons, and limitations very well specified [21,22].

This population-based research examines possible causes: whether aluminum consumption, aluminum can usage, the air pollution index, the water quality index, and urbanization covary with national burdens of Alzheimer's disease and autism (not vaccine related) from environmental and possibly occupational exposures. This research used artificial intelligence as a tool for data analysis.

Materials and methods

Study design: This ecological, cross-national analysis included ten countries selected for their diverse environmental, cultural, and demographic characteristics. Publicly available data sources were used to compile national estimates of AD incidence [8], ASD prevalence [7] for 8-year-olds, aluminum consumption, aluminum can usage [25] in Table 1. Air pollution indices, water quality indices, and urbanization rates data was compiled by AI.

Data sources

AD and ASD data were obtained from World Population Review [7,8,11]. Aluminum consumption and can usage data were compiled from publicly available environmental and industrial datasets [25] but used can recycling data as a proxy since aluminum can consumption per se was not available. Air pollution and water quality indices were generated using AI-assisted autofill functions based on global environmental databases [13]. Urbanization rates were derived from international demographic sources.

Analytic approach

Data were organized into a spreadsheet and analyzed using AI-assisted correlation tools (Microsoft CoPilot). Pearson correlation coefficients were calculated for all variable pairs. Results were visualized in a correlation matrix heatmap, Figure 1.

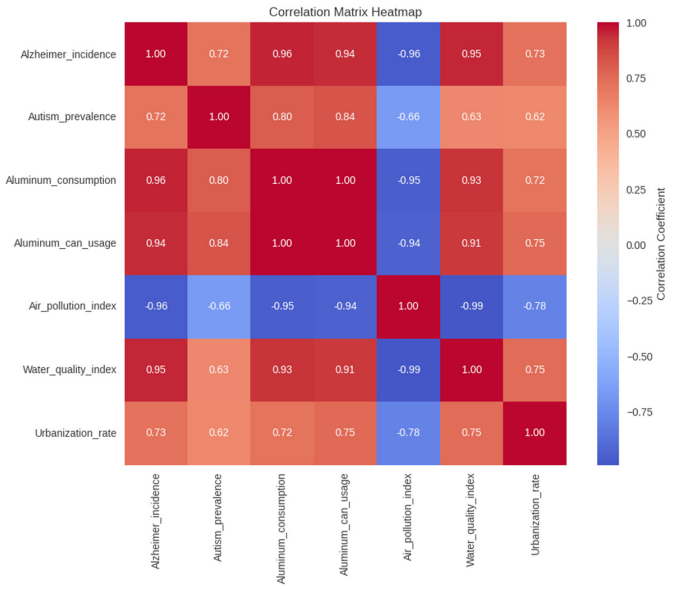

Figure 1: Algorithm for management of Postoperative Neck He

Results

The following results demonstrated the most notable correlations across 10 countries:

Alzheimer's Disease

- Aluminum consumption: r=0.96 (very strong positive correlation)
- Aluminum can usage: r=0.94 (strong positive correlation)
- Water quality index: r=0.95 (higher water quality associated with higher AD incidence; may reflect healthcare access or longevity)
- Air pollution index: r=−0.96 (strong negative correlation; may reflect underdiagnosis or reduced life expectancy in high-pollution settings)

Autism Spectrum Disorder

- Aluminum consumption: r=0.80 (moderate positive correlation)

- Aluminum can usage: r=0.84 (moderate to strong positive correlation)
- Urbanization: r=0.76 (higher urbanization associated with higher ASD prevalence, likely reflecting diagnostic access)
- Environmental Metrics
- Air pollution vs. water quality: r = −0.99 (strong inverse relationship)
- Air pollution vs. urbanization: r = −0.78 (more urbanized countries tend to have better air quality)

Table 1: Alzheimer's disease incidence, autism prevalence, aluminum consumption, and aluminum can usage across ten countries.

Country	Alzheimer Incidence (per 100k)	Autism Prevalence (per 10k children)	Aluminum Consumption (kg/year)	Aluminum Can Usage (cans/year)
USA	700	36	30	300
Canada	650	30	28	280
Germany	680	28	27	270
Japan	720	25	25	250
South Korea	600	40	22	240
Brazil	500	20	15	180
India	450	15	10	120
Australia	670	32	26	260
UK	690	34	29	290
China	480	18	12	150

Discussion

This ecological analysis revealed a coherent and method-robust pattern: countries with higher aluminum consumption and greater urbanization consistently exhibit higher burdens of AD and ASD. Urbanization's strong association with autism aligns with known relationships between diagnostic access, healthcare infrastructure, and public awareness. Air pollution might be confounding with the possibly negative correlation or protection, but it was proven that there are higher environmental/pollution controls in urban areas.

These findings suggest that future investigation of aluminum and autism risk should prioritize individual level exposure assessment and designs that can disentangle environmental influences from differential diagnosis. Aluminum consumption's consistent positive association suggests it may be part of a broader environmental exposure characteristic of industrial settings.

Ideally for future research, studies focused on well-characterized cohorts, with standardized diagnostic procedures and direct aluminum exposure measures (e.g. biomarkers or detailed dietary assessments), are far better suited to address mechanistic questions than ecological analysis from population data.

Furthermore, with the strong correlation between environmental exposure to aluminum as a probable contribution to autism and Alzheimer's, further research is warranted. In addition, there are policy implications: Countries with high aluminum exposure and good water quality may need targeted Alzheimer's autism screening. Again, further research is indicated.

Lastly, similar possible Diethylstilbestrol (DES) long term effects on in-utero health and development (4) might be established or excluded for aluminum from future research.

AI-assisted analysis facilitated rapid data processing and visualization, demonstrating the utility of AI as a research tool [5,6,19,20]. However, AI-generated environmental variables should be interpreted cautiously and validated against primary data sources.

Conclusions

This cross-national ecological analysis identified strong correlations between aluminum consumption, urbanization, and national burdens of AD and ASD. These findings are hypothesis-generating and highlight the need for individual-level studies incorporating direct exposure assessment, standardized diagnostic criteria, and mechanistic evaluation.

Study limitations

1. This is an ecological population study.
2. The incidence data of autism is limited, but prevalence data is available and widespread.
3. The potential lag effect of cause and outcome complicates direct evidence because sometimes cohorts of different years are compared for analysis.
4. Possible surveillance bias in modern countries (PAS): Previous work done on autism found links to public awareness and medical care. Countries with higher education rates and better medical care will also have more resources to diagnose autism, leading the prevalence to increase. Families with better education would be more likely to identify autistic tendencies in their children, leading to medical attention and diagnosis (26).
5. Small sample size.
6. Aluminum can usage per capita was approximated by data for aluminum can recycling since the former data was not available. Author acknowledged that recycling rates vary widely, and aluminum can consumption may be grossly overestimated or underestimated.

The entire research manuscript was reviewed by Microsoft Word and CoPilot.

References

1. Flarend R, Bin T, Elmore D, Hem SL. A preliminary study of the dermal absorption of aluminum from antiperspirants

using aluminum-26. Food Chem Toxicol. 2001; 39: 163-168.

2. Yuan CY, Lee YJ, Hsu GSW. Aluminum overload increases oxidative stress in four functional brain areas of neonatal rats. J Biomed Sci. 2012; 19: 51.

3. Golub MS, Germann SL, Han B. Neurobehavioral evaluation of developmental toxicity of aluminum in mice. Neurotoxicol Teratol. 1987; 9: 219-224.

4. Walker BE, Haven MI. Exposure to diethylstilbestrol during sensitive life stages: A legacy of heritable health effects. Birth Defects Res C Embryo Today. 2007; 81: 27-34.

5. Ghani KR. Use of AI in medical publishing. Can Urol Assoc J. 2023; 17: 79-80.

6. AlHawaj FA. Artificial intelligence in medical publications: Pros and cons. Saudi Med J. 2025; 46.

7. World Population Review. Autism rates by country. 2023. Available from: https://worldpopulationreview.com/country-rankings/autism-rates-by-country

8. World Population Review. Alzheimer's rates by country. 2023. Available from: https://worldpopulationreview.com/country-rankings/alzheimers-rates-by-country

9. The Coconut Mama. The 25 biggest soda-drinking states. 2023. Available from: https://thecoconutmama.com/the-25-biggest-soda-drinking-states-21-beat-new-york/

10. Maenner MJ, Shaw KA, Bakian AV, et al. Prevalence and characteristics of autism spectrum disorder among children aged 8 years: Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2023. MMWR Surveill Summ. 2023; 72: 1-14.

11. World Health Organization. Autism spectrum disorders. WHO Fact Sheet. 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders

12. Soman M, Kurian J, Mathew S. Migration of aluminum from food contact materials into beverages: An assessment of exposure and health risk. Food Addit Contam Part A Chem Anal Control Expo Risk Assess. 2020; 37: 640-650.

13. European Environment Agency. Industrial emissions of aluminum and aluminum compounds: EEA air pollutant emission inventory. 2023. Available from: https://www.eea.europa.eu/themes/air/air-pollution-sources-1

14. Hertz-Picciotto I, Croen LA, Hansen R, et al. The CHARGE study: An epidemiologic investigation of environmental factors and autism. Environ Health Perspect. 2006; 114: 1119-1125.

15. Newschaffer CJ, Croen LA, Daniels J, et al. The Early Autism Risk Longitudinal Investigation (EARLI). Epidemiology. 2012; 23: 364-365.

16. Schendel DE, Rice C, Cunniff C, et al. The Study to Explore Early Development (SEED): A multisite investigation of autism risk factors. Paediatr Perinat Epidemiol. 2012; 26: 267-277.

17. White T, Muetzel RL, El Marroun H, et al. Neuroimaging and neurodevelopmental outcomes in the Generation R Study. Dev Cogn Neurosci. 2018; 30: 1-16.

18. Alzheimer's Disease International. World Alzheimer report 2023: Reducing dementia risk—Never too early, never too late. 2023. Available from: https://www.alzint.org/resource/world-alzheimer-report-2023/

19. Fahim YA, Hasani IW, Kabba S, et al. Artificial intelligence in healthcare and medicine: Clinical applications, therapeutic advances, and future perspectives. Eur J Med Res. 2025; 30: 848.

20. Editorial. Artificial intelligence in medical publications: Pros and cons. Saudi Med J. 2025; 46: 3-8.

21. Pomirchy M, et al. Herpes zoster vaccination and incident dementia in Canada: An analysis of natural experiments. Lancet Neurol. 2026.

22. McEwan WA, Hunt DPJ. The potential for dementia prevention through vaccination. Lancet Neurol. 2026.

23. Stahl T, Falk S, Rohrbeck A, Georgii S, Herzog C, Wiegand A, et al. Migration of aluminum from food contact materials to food: A health risk for consumers? Environ Sci Eur. 2017; 29: 19.

24. McDermott JR, Smith AI, Ward MK, Parkinson IS, Kerr DN. Brain-aluminium concentration in dialysis encephalopathy.

25. Google Search. Aluminum can consumption per capita by country. Accessed 2026.

26. Ostrowski J, Religioni U, Gellert B, Sytnik-Czetwertyński J, Pinkas J. Autism spectrum disorders: Etiology, epidemiology, and challenges for public health. Med Sci Monit. 2024; 30: e944161.

27. Seruga M, Grgić J, Mandić M. Aluminum content of beers. Z Lebensm Unters Forsch. 1994; 198: 313-316.