Turkish Archives of Pediatrics

SCIENTIFIC LETTER
DOI: 10.5152/TurkArchPediatr.2025.25304

Autism Spectrum Disorder: The Possible Etiopathogenetic Role of Electromagnetic Pollution

Annio Posar[1,2], Paola Visconti[1]

[1]IRCCS Istituto delle Scienze Neurologiche di Bologna, UOSI Disturbi dello Spettro Autistico, Bologna, Italy
[2]Dipartimento di Scienze Biomediche e Neuromotorie, Università di Bologna, Bologna, Italy

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition - Text Revision (DSM-5-TR), autism spectrum disorder (ASD) is an early onset and usually life-long condition included among neurodevelopmental disorders, characterized by deficits in social communication skills and by restricted and repetitive interests and behaviors.[1] Some individuals with ASD show a severe disability, often due to neuropsychiatric and medical comorbidities.[2,3] From an etiopathogenetic perspective, today ASD is considered a multifactorial neurobiological condition, in which genetic factors play a predominant role.[3] Nowadays, an increasing number of genes have been implicated in ASD, although a well-defined genetic cause can be demonstrated only in a minority of cases.[4] The most recent epidemiological multicentric study carried out in the United States (USA) found that in 2022 ASD prevalence at age 8 was 3.22%, corresponding to 1 affected child every 31.[5] The prevalence of this condition has therefore increased enormously in recent decades, given that in the 1960s there were only 4 cases affected in 10 000 children.[6] Part of this increase in prevalence is due to a change in ASD diagnostic criteria, which today are more "inclusive," and to an increased awareness of ASD, but part of it is real.[7] This phenomenon has led to enhanced attention being paid to the role of possible environmental factors in the etiopathogenesis of ASD, in addition to genetic ones.[7,8] According to the meta-analysis of Dutheil et al,[9] early air pollution exposure, especially to particulate matter with a diameter of less than 2.5 micrometers (PM2.5) during pregnancy and postnatal periods, was associated with a higher ASD risk.[9] Could this type of pollution, then, be the main culprit in the increase in the ASD prevalence? In reality, we know that air pollution in the USA has been decreasing in recent years, according to data from the Environmental Protection Agency (EPA) that monitors environmental pollution. In fact, the EPA website states: "...air quality based on concentrations of the common pollutants has improved nationally since 1980...".[10] Data specifically referring to PM2.5 are available on the EPA website from the year 2000 onwards and highlight a 37% decrease in PM2.5 average concentrations in the period from 2000 to 2023.[11] So, how can we explain the increase in the ASD prevalence in the USA, which has continued in recent years reaching its peak in 2022 (data for subsequent years are not yet available), if air pollution has decreased in the USA over the last decades? Is there perhaps some other type of environmental factor that has continued to increase in recent years and which could therefore be hypothesized to be behind the increasing prevalence of ASD? Here we intend to discuss a possible answer to this question. In recent decades there has been an enormous growth in electromagnetic pollution, and in particular radio-frequency electromagnetic fields (RF-EMF), which are characterized by high frequencies (from 100 kHz to 300 GHz).[12] The use of RF-EMF is mainly related to telecommunications, including mobile telephony as well as radio and television broadcasting, but also to industry, domestic appliances, and medical instruments in both diagnostic and therapeutic fields.[12] Unfortunately, there is no data available for trend over time of RF-EMF pollution as detailed as that for air quality (see above); however, the increase in electromagnetic pollution in recent decades is indisputable and it appears to overlap with the ASD prevalence increase. Obviously, this chronological overlap does not demonstrate a causal link between RF-EMF and ASD, but it should raise some suspicions that deserve careful consideration also with a view to implementing appropriate prevention measures. With this hypothesis,

Corresponding author:
Annio Posar
✉ annio.posar@unibo.it
Received: July 28, 2025
Revision Requested: August 24, 2025
Last Revision Received: August 24, 2025
Accepted: September 14, 2025
Publication Date: December 22, 2025

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Cite this article as: Posar A, Visconti P. Autism spectrum disorder: The possible etiopathogenetic role of electromagnetic pollution. *Turk Arch Pediatr.* 2026;61(5):450-451.

which is at this time merely speculative, we do not intend to underestimate the importance of the role of genetic factors in the etiopathogenesis of ASD, confirmed by the most recent epidemiological studies conducted in the USA, according to which in 8-year-old children, ASD is 3.4 times more frequent in males than in females.[5] In fact, if ASD was caused exclusively by environmental factors such as electromagnetic pollution, the higher prevalence of this condition in males would not be explained, given that exposure to electromagnetic waves is ubiquitous and affects both males and females without distinction. To date, most research into the potential adverse health effects of electromagnetic pollution has focused on the hypothesis of its carcinogenicity,[13] while the scientific literature regarding the possible role of electromagnetic pollution in the etiopathogenesis of ASD (as well as of other neurodevelopmental disorders such as attention-deficit/hyperactivity disorder) is still today surprisingly lacking. Theoretically, there are several possible pathogenic mechanisms at the cellular level through which electromagnetic pollution could lead to ASD in a developing individual, such as DNA damage, oxidative stress, neuroinflammation, increase in intracellular calcium, immune system dysfunction, blood-brain barrier disruption, and epigenetic mechanisms which modify DNA expression without changing its sequence (through microRNA modulation, histone modification, and chromatin condensation).[13-15] Further, electromagnetic pollution can have a negative impact at the level of the neural networks by early altering brain wave activity and this too could be a pathogenic mechanism potentially leading to the development of ASD.[13-15] A perspective multicentric study evaluating the effects of different levels of an early RF-EMF exposure could be useful to verify the possible involvement of this type of environmental pollution in the etiopathogenesis of ASD.[7] While waiting for clearer data from scientific research regarding the possible harmful effects of early exposure to RF-EMF on the neurodevelopment, according to Sage and Burgio, we believe that reducing avoidable RF-EMF exposure should be considerd as a public health priority.[13] While it is unthinkable to put a brake on technological progress, of which the development of modern telecommunications is one of the most important achievements, it is also true that measures can be implemented to safeguard public health when there is reasonable doubt that electromagnetic pollution could have harmful effects. A first step in this direction could be a widespread information campaign on the possible health risks of electromagnetic pollution, particularly in the pre-, peri-, and postnatal periods, and on the importance of minimizing, as far as possible, the duration and intensity of exposure to RF-EMF.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – A.P., P.V.; Design – A.P.; Supervision – P.V.; Materials – A.P.; Data Collection and/or Processing – A.P.; Analysis and/or Interpretation – A.P.; Literature Search – A.P.; Writing – A.P.; Critical Review – P.V.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: The authors declare that this study received no financial support.

REFERENCES

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR)*. 5th ed. Arlington, VA: American Psychiatric Publishing; 2022. [CrossRef]
2. Bougeard C, Picarel-Blanchot F, Schmid R, Campbell R, Buitelaar J. Prevalence of autism spectrum disorder and co-morbidities in children and adolescents: a systematic literature review. *Front Psychiatry*. 2021;12:744709. [CrossRef]
3. Posar A, Visconti P. Autism spectrum disorder in 2023: a challenge still open. *Turk Arch Pediatr*. 2023;58(6):566-571. [CrossRef]
4. Viggiano M, Ceroni F, Visconti P, et al. Genomic analysis of 116 autism families strengthens known risk genes and highlights promising candidates. *NPJ Genom Med*. 2024;9(1):21. [CrossRef]
5. Shaw KA, Williams S, Patrick ME, et al. Prevalence and early identification of autism spectrum disorder among children aged 4 and 8 years - Autism and Developmental Disabilities Monitoring Network, 16 sites, United States, 2022. *MMWR Surveill Summ*. 2025;74(2):1-22. [CrossRef]
6. Rutter M. Incidence of autism spectrum disorders: changes over time and their meaning. *Acta Paediatr*. 2005;94(1):2-15. [CrossRef]
7. Posar A, Visconti P. Autism in 2016: the need for answers. *J Pediatr (Rio J)*. 2017;93(2):111-119. [CrossRef]
8. Posar A, Visconti P. Autism spectrum disorder today: not only genetics. *Turk Pediatri Ars*. 2019;54(2):137-138. [CrossRef]
9. Dutheil F, Comptour A, Morlon R, et al. Autism spectrum disorder and air pollution: a systematic review and meta-analysis. *Environ Pollution*. 2021;278:116856. [CrossRef]
10. United States Environmental Protection Agency website. *Air Quality - National Summary*. Available at: https://www.epa.gov/air-trends/air-quality-national-summary. Accessed July 26, 2025.
11. United States Environmental Protection Agency website. *Particulate Matter (PM2.5) Trends*. Available at: https://www.epa.gov/air-trends/particulate-matter-pm25-trends. Accessed July 26, 2025.
12. Bosch-Capblanch X, Esu E, Oringanje CM, et al. The effects of radiofrequency electromagnetic fields exposure on human self-reported symptoms: a systematic review of human experimental studies. *Environ Int*. 2024;187:108612. [CrossRef]
13. Sage C, Burgio E. Electromagnetic fields, pulsed radiofrequency radiation, and epigenetics: how wireless technologies may affect childhood development. *Child Dev*. 2018;89(1):129-136. [CrossRef]
14. Herbert MR, Sage C. Autism and EMF? Plausibility of a pathophysiological link - Part I. *Pathophysiology*. 2013;20(3):191-209. [CrossRef]
15. Herbert MR, Sage C. Autism and EMF? Plausibility of a pathophysiological link part II. *Pathophysiology*. 2013;20(3):211-234. [CrossRef]