



Autism Spectrum Disorder: Epidemiology, Pathophysiology and the Emerging Evidence for Homoeopathic Intervention—A Critical Review of Current Evidence and Research Gaps

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Article Received: 15 / 07 / 2026

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Article Published: 15 / 09 / 2026

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DOI: 10.5281/zenodo.22806559

Abstract

Background

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition characterized by persistent difficulties in social communication and interaction together with restricted or repetitive patterns of behaviour, interests or activities. Autism represents a major global developmental-health concern, although reported prevalence differs considerably between populations because of variations in diagnostic criteria, screening practices, case ascertainment and availability of healthcare services. The biological basis of ASD is complex and involves interactions between genetic susceptibility and developmental and environmental factors. Although homoeopathy is used by some families as a complementary approach, the scientific evidence concerning its role in ASD remains limited.

Objective

This review aims to summarize current evidence regarding the definition, epidemiology, prevalence, pathophysiology, risk factors and prevention of ASD, with particular emphasis on the



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Indian context, and to critically examine available research concerning homoeopathic intervention in ASD and identify important research gaps.

Methods

A narrative critical review was undertaken using information from PubMed/MEDLINE-indexed literature, World Health Organization resources, Centers for Disease Control and Prevention surveillance reports, Central Council for Research in Homoeopathy publications and relevant scholarly literature. Literature relating to autism epidemiology, pathophysiology, risk factors, prevention and homoeopathic research was examined. Particular attention was given to study design, population characteristics, outcome measures, treatment standardization, concomitant interventions and duration of follow-up.

Results

Current evidence indicates that ASD arises from complex neurodevelopmental processes involving genetic susceptibility, altered neuronal development, synaptic organization, neural connectivity and potentially interacting immune, metabolic and environmental mechanisms. WHO estimated that approximately 1 in 127 people worldwide had autism in 2021. In the United States, CDC surveillance identified ASD in approximately 1 in 31 children aged 8 years in 2022. Indian epidemiological evidence remains limited; a systematic review of community-based studies reported pooled prevalence estimates of 0.11% in rural children and 0.09% in urban children, while emphasizing the scarcity of high-quality population-based studies. Homoeopathic literature includes case reports, case series and institutional clinical research. CCRH has reported a randomized, placebo-controlled, cross-over clinical trial of individualized homoeopathic medicines in autism. However, the available published evidence remains heterogeneous and insufficient to establish the efficacy of homoeopathy for the core characteristics of ASD.

Conclusion

ASD is a complex neurodevelopmental condition with substantial global and public-health significance. The epidemiological evidence from India remains inadequate, creating a need for standardized population-based surveillance. Homoeopathic research in ASD provides preliminary clinical observations and demonstrates an area requiring further investigation; however, current evidence does not establish homoeopathy as an effective treatment for the core features of ASD. Future research should prioritize adequately powered multicentre randomized controlled trials, standardized diagnostic and outcome measures, transparent individualized



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prescribing methods, documentation of concomitant developmental interventions and long-term follow-up.

Keywords

Autism spectrum disorder, autism; neurodevelopmental disorder; epidemiology; prevalence; pathophysiology, homoeopathy, individualized homoeopathy, complementary medicine, India, research gap.

Introduction

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition associated principally with differences or difficulties in social communication and interaction and with restricted, repetitive patterns of behaviour, interests or activities. The term “spectrum” reflects the marked variability between individuals in language, intellectual functioning, adaptive behaviours, sensory characteristics, behaviour manifestations and support requirements. Autism may be recognized during early childhood, although diagnosis can occur considerably later, particularly when developmental demands increase. [1,2]

Autism has become an important global health and social concern. According to the World Health Organization (WHO), approximately 1 in 127 people worldwide were estimated to have autism in 2021. WHO also emphasizes that this represents a global average and that substantial variation occurs between studies and geographical areas. Data from many low- and middle-income countries remain insufficient. [1] In the United States, surveillance conducted through the Autism and Developmental Disabilities Monitoring Network reported that 32.2 per 1,000, equivalent to approximately 1 in 31, children aged 8 years were identified with ASD in 2022. [3]

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In India, reliable national prevalence estimates remain difficult to establish. A systematic review and meta-analysis published in *Neurology India* identified only four relevant community-based



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studies and reported pooled prevalence estimates of 0.11% in rural children and 0.09% in urban children. The authors emphasized the scarcity of high-quality population-based epidemiological studies in India. [5] Consequently, these figures should not be interpreted as definitive national prevalence estimates. The pathogenesis of ASD is multifactorial. Genetic factors contribute substantially to susceptibility, but genetic variation alone does not explain all cases. Research has examined abnormalities in neuronal development, synaptic function, brain connectivity, neurotransmission, immune signalling, neuroinflammation, mitochondrial function and the gut-brain axis. Current evidence supports a complex interaction between biological susceptibility and developmental exposures rather than a single pathological mechanism. [1,4,6-8]

Homoeopathy has been investigated as a complementary approach in developmental and behavioural disorders. Research from the Central Council for Research in Homoeopathy (CCRH) has included clinical investigation of individualized homoeopathic medicines in autism, including a randomized, placebo-controlled, cross-over trial. [10,11] Published homoeopathic literature also contains case reports and case-series-based observations. [12,13] However, the presence of clinical reports does not by itself demonstrate treatment efficacy.

The purpose of the present review is therefore not to assume therapeutic effectiveness but to critically examine the existing evidence, identify methodological limitations and propose research priorities for future investigation of homoeopathy in ASD.

Pathophysiology

The pathophysiology of ASD is complex and heterogeneous. There is no single pathological pathway that accounts for all individuals with ASD.

Genetic mechanisms

Genetic susceptibility has a major role in ASD. Numerous genetic variants have been associated with autism, including rare variants and common genetic variation. Genes implicated in ASD participate in processes such as neuronal development, synaptic organization, chromatin regulation and intracellular signalling. [4,6] Importantly, identification of an autism-associated genetic variant does not imply that the variant independently causes autism in every carrier. Genetic effects can be variable and may interact with environmental and developmental factors.



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Neuronal and synaptic mechanisms

Altered neuronal development and synaptic organization have been proposed as important mechanisms. Changes in synaptic formation, maturation and pruning could affect the efficiency of communication between neuronal networks.

Brain connectivity

Research has identified differences in functional and structural connectivity in some individuals with ASD. Altered coordination between neural networks may contribute to differences in social cognition, sensory integration, language and repetitive behaviour.

Neurotransmitter systems

The glutamatergic, GABAergic, serotonergic and dopaminergic systems have all been investigated in ASD. These systems participate in neuronal communication, excitation-inhibition balance, reward processing, learning and behaviour.

Immune dysregulation and neuroinflammation

Immune mechanisms are increasingly studied in ASD. Research has identified immune-system alterations in some autistic individuals, including findings involving innate immune responses, cytokines and microglial activity. However, these findings are heterogeneous and do not establish neuroinflammation as the universal cause of ASD. [7]

Mitochondrial and metabolic mechanisms

Mitochondrial dysfunction and metabolic abnormalities have been reported in subsets of individuals with ASD. Their exact contribution to autism remains under investigation.

Gut-brain mechanisms

The relationship between intestinal microbiota and ASD is another active research area. Differences in gut microbial composition and metabolites have been reported in some studies. However, it remains uncertain whether these changes contribute to ASD, result from dietary or behavioural differences, or represent interactions among several factors.

Thus, current evidence supports a multidimensional neurodevelopmental model rather than a single biochemical explanation.

Risk Factors

Available evidence suggests that ASD develops through interactions among genetic susceptibility and environmental/developmental factors. WHO identifies several factors associated with



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increased likelihood, including advanced parental age, maternal diabetes, prenatal exposure to some environmental pollutants, prematurity, low birth weight and severe birth complications. [1] Other research has examined prenatal medication exposure, maternal disorders and nutritional factors. However, association does not necessarily establish causation, and the magnitude and certainty of individual risk factors differ. [4]

Prevention

There is currently no established intervention that can prevent all cases of ASD.

Prevention should therefore be discussed at several levels.

Primary prevention and healthy development

Appropriate preconception and antenatal care, management of maternal medical conditions, avoidance of harmful environmental exposures, appropriate nutrition and prevention or treatment of significant pregnancy complications are important components of healthy neurodevelopment.

Secondary prevention

Early developmental surveillance and prompt assessment of children with developmental concerns can facilitate earlier diagnosis.

Tertiary prevention

Early access to appropriate educational, behavioural, speech-language, occupational and psychosocial interventions can improve functioning and participation. Vaccination should not be omitted from public-health recommendations because of misinformation concerning autism. Extensive research has found no causal relationship between vaccines and ASD. [1,9]

Homoeopathic Research in Autism

Homoeopathic research concerning ASD remains limited but is not completely absent.

The CCRH has reported a randomized, placebo-controlled, cross-over clinical trial of homoeopathic medicines in autism. The institutional description states that the study involved individualized homoeopathic prescribing and included children aged 3-16 years. The research was designed to investigate effectiveness, identify potentially useful medicines and assess quality-of-life outcomes. [10,11].

A 2022 publication by Gilla, Sreeja and Resmy described an analysis of 20 ASD cases managed with individualized homoeopathic medicines. The publication provides clinical observations but, because of its case-based design and absence of a randomized control comparison, it cannot independently establish treatment efficacy. [12]



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A 2024 case report described a 5-year-old child with ASD who received *Theridion currasavicum* selected using a group approach. The report documented changes in clinical features during treatment. [13]

A 2025 case report described a 3-year-old child with ASD treated with *Natrum muriaticum* selected through repertorial analysis using the Synthesis Repertory, with the Indian Scale for Assessment of Autism used to assess change over one year. [14]

A recent 2026 case report described individualized constitutional homoeopathic treatment in a child with global developmental delay and ASD, reporting changes in Vineland Social Maturity Scale and Indian Scale for Assessment of Autism scores over 13 months. As a single uncontrolled case, this type of evidence remains hypothesis- generating rather than confirmatory. [15]

Existing Evidence Gap

An earlier systematic review examining homoeopathy in people with intellectual disabilities identified only one trial concerning ASD and judged the evidence inadequate for recommendations. The authors emphasized major gaps in evidence relating to autism and other developmental conditions. [16]

The subsequent appearance of additional Indian clinical literature and CCRH research demonstrates that the research field has developed, but significant methodological limitations remain.

Research Gaps and Future Directions

Several research priorities emerge from the available evidence.

Epidemiological research

India requires large, representative, multicentre population-based studies using standardized screening and diagnostic procedures. Studies should include rural, urban and socioeconomically diverse populations.

Standardized diagnosis

Future studies should clearly state the diagnostic criteria used and distinguish screening-positive children from clinically confirmed ASD.

Adequately powered clinical trials

Future homoeopathic studies should move beyond isolated case reports and small case series toward multicentre randomized controlled trials.



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Standardize outcome measures

Studies should select validated instruments before commencement and define primary and secondary outcomes prospectively.

Documentation of individualized prescribing

Because individualized prescribing is central to homoeopathic practice, research should document:

- Presenting symptoms;
- Characteristic symptoms;
- Mental and physical generals;
- Modalities;
- Repertorial methodology;
- Final totality;
- Selected medicine;
- Potency
- Repetition

Long-term follow-up

Studies should assess whether improvements are maintained after 6, 12 or more months.

Independent replication

Positive findings should be reproduced by independent investigators and institutions.

Safety reporting

All clinical studies should systematically report adverse events and treatment discontinuations.

Mechanistic research

If clinical studies demonstrate reproducible effects, translational research may subsequently investigate possible biological correlates. Such investigations should be hypothesis-driven rather than assuming a mechanism before clinical efficacy is established.

Research methodology

Future studies should follow recognized reporting standards such as CONSORT for randomized controlled trials, STROBE for observational research and CARE for case reports.

The most important research gap is therefore not simply the absence of homoeopathic publications. Rather, it is the **absence of a sufficiently large, reproducible and methodologically rigorous evidence base capable of determining whether individualized**



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homoeopathy provides benefits beyond placebo, natural developmental change and concomitant interventions.

Conclusion

Autism spectrum disorder is a heterogeneous neurodevelopmental condition with substantial global health, educational and social implications. Current scientific evidence supports a multifactorial model involving genetic susceptibility and complex developmental interactions, with contributions from neuronal, synaptic, connectivity, immune and metabolic mechanisms in different individuals.

Global prevalence estimates demonstrate that autism is common, although substantial differences exist between populations and surveillance systems. WHO estimated that approximately 1 in 127 people worldwide had autism in 2021, while US surveillance identified approximately 1 in 31 children aged 8 years in 2022. [1,3] In India, available population-based evidence remains insufficient, emphasizing the need for large standardized epidemiological studies. [5]

There is currently no established method for completely preventing ASD. Appropriate maternal and neonatal healthcare, developmental surveillance, early identification and timely access to evidence-based developmental interventions remain important. Vaccination should continue according to established public-health recommendations because scientific evidence does not support vaccines as a cause of autism. [1,9]

Homoeopathic research in ASD has progressed from isolated observations to institutional clinical research, including CCRH's reported randomized placebo-controlled cross-over trial, as well as published case reports and case series. [10-15] Nevertheless, the available evidence remains insufficient to establish homoeopathy as an effective treatment for the core manifestations of ASD.

Future research should focus on multicentre randomized controlled trials, validated outcome measures, transparent individualized prescribing methodology, careful recording of concomitant therapies, adequate sample sizes, long-term follow-up and independent replication. A scientifically rigorous research programme would allow the potential role of homoeopathy in comprehensive ASD care to be evaluated objectively while avoiding unsupported claims of cure or prevention.



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