

# An Impending Autism Spectrum Disorder and Various Approaches to Improve the Condition

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**Citation:** Adiba Afreen, Shaik Mohd Khasim, Arshiya Fatima, Fatima Mahek, Huriya Tahreem, Khatija Tul Kubra, Muskaan (2022). An Impending Autism Spectrum Disorder and Various Approaches to Improve the Condition. *Acta Traditional Medicine*. V01i01, 01-05. **DOI:** <http://dx.doi.org/10.5281/zenodo.7588917>

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Received 19 August 2022 | Revised 17 September 2022 | Accepted 27 September 2022 | Available Online October 02 2022

## ABSTRACT

*Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder and is clinically defined by the deficits in communication, social skills and repetitive and/or restrictive interests and behaviours. It is a widespread disorder with no known etiology and pathogenesis and no proper pharmacological approach. Pharmacological treatment can bring down the symptoms to a little extent when compared to the non-pharmacological treatment which includes few therapies to improve the core symptoms of autism. This study aims to determine the knowledge about ASD, the prevalence rate, the brain of an autistic patient when compared to a neurotypical brain, genetic and environmental factors assumed to be responsible for it commonly prescribed medicines, their side effects as well as evaluate the impact of non-pharmacological therapy on Autism. It is revealed that children with ASD who aggressively take non-pharmacological therapies show a significant improvement in symptoms.*

**Keywords:** Autism Spectrum Disorder, Pharmacological Treatment, Prevalence Rate, Autistic Brain, Genetic, Environmental Factors, Non-Pharmacological Therapies.

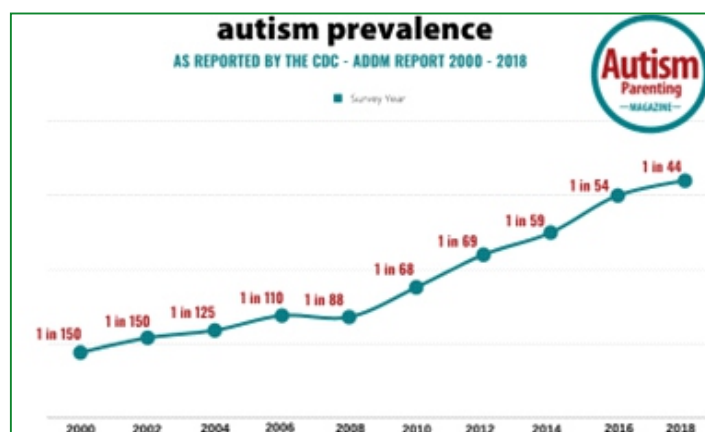
## INTRODUCTION

Autism Spectrum Disorder (ASD) as defined by the Diagnostic and Statistical Manual Fifth Edition of the American Psychiatric Association (DSM 5)\* is a neurodevelopmental disorder associated with the symptoms that include “persistent deficits in social communication and social interaction across multiple contexts” and “restricted, repetitive patterns of behaviour, interests or activities” [1]. Although autism can be diagnosed at any age, it is described as a “developmental disorder” because symptoms generally appear in the first two years of life. It is known as a “spectrum” disorder because there is wide variation in the type and severity of symptoms people experience. The distinctive social behaviours include an avoidance of eye contact, problems with emotional control or understanding emotions of others and a markedly restricted range of activities and interests [2]. Some characteristics of autism are similar in people on spectrum while some also have an intellectual disability or impairment; few have average

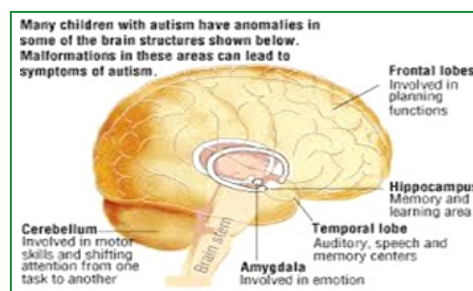
intelligence while others may have above average intelligence. ASD occurs in all ethnic, racial, and economic groups. Although ASD can be a lifelong disorder, treatments and services can improve a person's symptoms and ability to function.

## PREVALENCE

The prevalence has increased in the past two decades. According to the latest CDC statistics around 1 in 44 (or 2.3%) of children in the US were identified with ASD using estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network. The prevalence estimate in the year 2021 from data collected in 2018 is approximately 241% higher than in 2000. ASD is found to be more in male than female, the ratio being 4:1 [3].



**FIG.1. ASD Prevalence Rate Reported By CDC in the US [3]**



**FIG.2 Brain Functioning In Different Regions of a Person with ASD [4]**

The word "Autism" was first introduced by a Swiss Psychiatrist, Paul Eugen Bleuler for describing the symptoms of Schizophrenia in 1912. The term "Autism" was derived from Greek word "autos" meaning "self". Hans Asperger for the first time identified Autism in 1938. In 1943, Leo Kanner that a group of 8 boys and 3 girls had "an innate ability to form usual, biologically provided affective contact with people", and proposed it to be as early infantile autism [5]. The brain development in an individual with ASD is complex and different when compared with a neurotypical individual. Fig.2 depicts the various parts of brain in an individual with ASD compared with a normal brain. In recent study researchers found that ASD patient's Amygdala doesn't function while making psychological inferences with eyes and hence Amygdala is known to be one of the various neural areas which are abnormal in Autism. The other regions of brain like the cerebellum which is responsible for the motor movements, the nucleus accumbens responsible for motivation and reward for behaviours including social interaction are also influenced [4].

## EPIDEMIOLOGY

Global prevalence of ASD is estimated to be about 1 in 100 among children [6]. The estimate gives an average figure while the rate of prevalence varies across studies. The rate of ASD prevalence in many low and middle income countries is unknown. It is found in all socioeconomic, racial and ethnic groups. According to the Centers for Disease Control and Prevention, the prevalence rate in the US has increased about 246% in 2018 from 2000. A study on sex chromosome aneuploidy children found a particular male social functioning profile causing more susceptibility to autism [7].

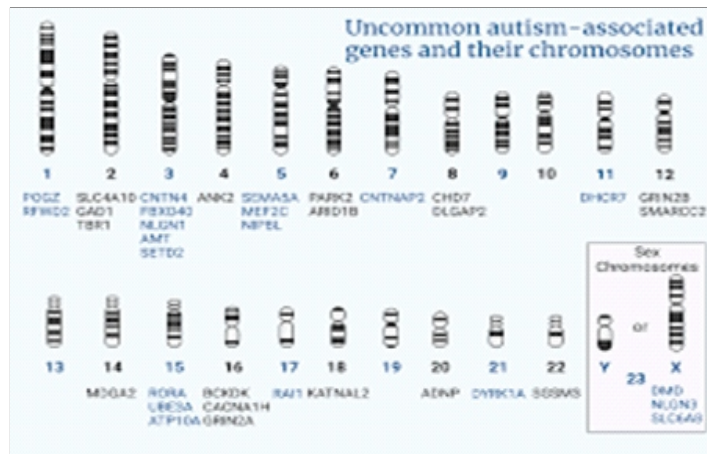
## CAUSES

There is no particular known factor responsible for causing Autism Spectrum Disorder. Studies have suggested that there are many probable factors which may cause Autism in children, including environmental and genetic factors. Research is still going on to understand and the potential causative mechanisms in ASD but currently no single cause have been explained. Neuropathology studies are limited but have shown difference in brain size as discussed earlier. A study of neocortical architecture in young children showed the presence of focal disruption which suggests problems with cortical layer formation and neuronal differentiation [8].

## GENETIC FACTORS

Genetic factors play a vital role in ASD having potential risk in subjects having siblings with ASD when compared to normal population [9]. One of the most evident genetic mutations which leads to autism is related to the uneven ratio of males when compared to females with autism diagnosis contributing to the current ratio of 3:1, male: female [10]. This ratio indicates that there may be genes on the X chromosome which can cause ASD. A gene named Fragile X mental retardation 1 (FMR1, also known as FMRP) causes Fragile X syndrome and it was found that 30% of patients with FMR1 also had ASD [11]. There are few other X chromosome linked disorders such as Turner's and Klinefelter's syndrome which are also associated with ASD patients. Klinefelter's syndrome is characterized by and extra chromosome in males while Turner's syndrome is characterized by either a missing or incomplete X chromosome in females. It was found that ASD was diagnosed in 30% of Klinefelter's syndrome and in more than 25% of Turner's

syndrome individuals which indicates that there various genes on the X chromosome alone that are associated with ASD phenotypes expression. Since there is only one X chromosome in male, any mutations in the X chromosome will affect all the cells while females will require more mutations to show ASD symptoms [11]. SHANK 3, TSC1 and TSC2 are other genes which are involved with autism.



**FIG 3. Autism Associated Uncommon Genes and Their Chromosomes [11]**

## ENVIRONMENTAL FACTORS

There are many environmental factors associated with ASD. Most of environmental factors is related to fetal development as well as maternal diseases such as fever and infections during pregnancy, including influenza [12]. A case control study in paediatrics with ASD and neurodevelopmental disorders found that maternal influenza as a cause and found that there is an association between the two [12]. It was also noted that maternal diabetes can also be the cause associated with autism [13]. However, type 1 diabetes was found to have no relation with the disease while type 2 diabetes was observed with autism in a retrospective longitudinal cohort study [14]. Gestational diabetes was also found to have link with autism. Use of drugs during pregnancy was also found to play role in development of ASD in particular usage of antidepressants. In a population based study another drug, Valproate which is an anti-epileptic drug was also found to raise the risk of ASD if taken during pregnancy [15]. Smoking during pregnancy can also have effect on the severity of autism as brain development occurs in after third trimester [16].

## SCREEN EXPOSURE

Usage of electronic screen media among children below 3 years of age was found to be the most prevalent factor contributing to autism symptoms which include decreased cognition, impaired language development, mood, hyperactivity, short attention span and irritability. Increased screen time was also found to significantly reduce melatonin concentration along with deficiency of various neurotransmitters such as dopamine, acetylcholine, GABA and 5-HT [17-18]. All these factors showed positive effect on white matter volume and grey matter volume in rain correlating with verbal competence, aggression and cognitive abilities.

## TREATMENT

Numerous behavioural and educational treatments which come under non pharmacological approach are the cornerstone for management of ASD symptoms and are found

to significantly reduce the symptoms such as aggression, irritability, repetitive and self-injurious behaviour.

### PHARMACOLOGICAL TREATMENT

This treatment includes the usage of medicines to increase the interest of patient and includes typical and atypical antipsychotics, antidepressants, selective serotonin reuptake inhibitors, mood stabilisers and anticonvulsants [19-20]. Pharmacological drugs play no role in improving social communication in autistics [21] but are mainly used to treat the other morbidities associated with ASD such as obsessive compulsive disorder, schizophrenia, mood disorder and intellectual disability [22]. Antipsychotics help in reducing the repetitive behaviours in children with ASD but was not as effective and safe in adolescents and adults [23].

### NON PHARMACOLOGICAL TREATMENT

This type of treatment involves specialists from different areas characterized by extensive and intense programs encircling both patients and families. Early intervention is the most important criteria which can help the family in increasing child's brain plasticity which enhances outcomes. The non-pharmacological intervention programs significantly help to develop social, communication and cognitive problems in autism. The treatment is planned based on the abilities and difficulties faced by the patient and hence it is to be customized. It includes ABA (Applied Behaviour Analysis) Therapy, Occupational Therapy and Speech Therapy. These therapies are either given in combination or alone to improve the independent functioning of patient and improve the quality of life. There are other methods too which are available for treatment according to National Autism Centre's Standard Report.

### Applied Behaviour Analysis (ABA)

It is a scientific approach which is highly effective in teaching basic communication, games, sports, social interaction, daily routine and self-help skills. ABA therapy was found to contribute to the increased intelligence, social activity and speech in children with autism [24]. Recently, various other interventions which are based on ABA are developed and have common features, like Early start denver model (EDSM), Picture Exchange communication system (PECS), Discrete trail training (DTT), Pivotal Response Treatment (PRT).

EDSM teaches the strategies which helps in engaging with real life activities and concentrates on verbal and non-verbal communication [25]. PECS is a common manual program for non-verbal children with ASD which makes the child use a communication system based on exchange of picture [26].

DTT comprises of direct instruction methods used repeatedly until child learns it and focuses on even minute things [27]. PRT intervention concentrates on arranging the environment with objects such that the child uses these objects in interaction [28].

### SPEECH THERAPY

Children with ASD are challenged with language and communication impairment and hence speech therapy is modulated to help the speech and language concerns including delayed language development and social communication skills. Speech therapy was therefore found to be effective in improving speech in individuals with ASD [29]. In general, speech therapy improved overall conversational competence, social and communication and learning skills in ASD patients [30].

### OCCUPATIONAL THERAPY

Individuals on the autism spectrum experience delay and deficit in gross motor coordination and fine motor skills [31-32]. To develop and improve gross and fine motor skills occupational therapy is employed. Occupational therapy is described as art and science of helping people do daily activities which are essential to the health and well-being of a person. It considerably improves not only gross and fine motor skills but also improves visual motor integration skills, visual perception, sensory perception and behavioural regulation [33-34].

### CONCLUSION

Developmental monitoring is crucial for children below 5 years. Autism Spectrum Disorder is a serious and complex neurodevelopmental disorder which requires both pharmacological and non-pharmacological treatment throughout life. The current study analysed the symptoms, prevalence rate, and the brain of an autistic, factors responsible for ASD and the treatment involved. There are many factors such as genetic, environmental and screen exposure which are considered to be contributing to ASD. Pharmacological treatment such as typical and atypical antipsychotics, antidepressants, selective serotonin reuptake inhibitors, mood stabilizers and anticonvulsants which help in reducing irritability, social and behavioural symptoms but may cause side effects in patients. Non pharmacological treatments such as applied behaviour analysis (EDSM, PECS, DTT, PRT), Speech therapy, occupational therapy, etc. are proven to be the great boon for patients with ASD as they not only significantly help in improving social and behavioural problems but also have no side effects.

### CONSENT AND ETHICAL APPROVAL

As per the university standard guideline, authors consent and ethical approval.

### FUNDING

No funding was required during this study.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### AUTHOR'S CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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