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Original Article

Paediatrics Section

Autism Spectrum Disorder among Children Attending a Tertiary Care Centre in Tripura, India: A Cross-sectional Observational Study

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ABSTRACT

Introduction: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterised by impaired social communication, restricted interests, and repetitive behaviours. Data from low- and middle-income countries, particularly from North East India, remains sparse.

Aim: To estimate the burden of ASD and also to describe the sociodemographic and clinical profile of the children with ASD attending a tertiary care hospital in Tripura, India.

Materials and Methods: A cross-sectional observational study was conducted in the Outpatient Department (OPD) of Paediatrics at Agartala Government Medical College and GB Panth Hospital, Agartala, Tripura, India, from November 2022 to May 2024. The study included 32 children aged 2-12 years who visited the Paediatrician for social and communication deficits, repetitive behaviours, or developmental delays. Such children were initially screened using the Modified Checklist for Autism in Toddlers-Revised (M-CHAT-R) and subsequently confirmed with the INCLEN Diagnostic Tool for Autism Spectrum Disorder (INDT-ASD). Sociodemographic characteristics, perinatal factors, co-morbid conditions, and lifestyle histories were systematically recorded. Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 26.0.

Results: Out of 28,252 children attending OPD, 32 (0.11%) were diagnosed with ASD. Male-to-female ratio was 4.3:1. The mean age at diagnosis was 3.59±1.38 years. The majority belonged to Hindu Bengali families and the upper-middle socioeconomic class of the modified Kuppuswamy scale. Common presenting complaints were poor social communication, 19 (59.4%), language delay, 6 (18.8%), repetitive behaviours, 4 (12.5%) and hyperactivity, 3 (9.4%). Antenatal risk factors included Pregnancy Induced Hypertension (PIH), 3 (9.4%), hypothyroidism, 3 (9.4%), and gestational diabetes, 2 (6.3%). Co-morbidities included ADHD in 24 (75.0%), intellectual impairment in 20 (62.5%), sleep disorders in 7 (21.9%), and seizures in 6 (18.8%) cases.

Conclusion: The observed burden of ASD was 0.11% among Paediatric OPD attendees of the Department of Paediatrics, with a clear male predominance, and ADHD was the most frequent comorbidity. Integration of routine screening during OPD visits may improve early recognition and intervention.

Keywords: Child behaviour, Language delay, Neurodevelopmental disorders, Repetitive behaviour, Social communication

INTRODUCTION

The ASD is a heterogeneous group of neurodevelopmental conditions characterised by persistent deficits in social communication and interaction, along with restricted interests and repetitive behaviours or activities that affect their ability to function in different areas of life. Symptoms of ASD generally appear in the first two years of life. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) has consolidated earlier subtypes, including autistic disorder, Asperger's syndrome and Childhood Disintegrative Disorder (CDD), into a single diagnosis under the ASD spectrum [1].

Although years of research have not identified a direct causal relationship or consistent pattern for the development of ASD, it is well-recognised that it is among the heritable and genetically influenced human conditions. A strong genetic component is evident, as monozygotic twins show nearly a 90% concordance rate, compared with only about 5-10% in dizygotic twins. However, no single gene has been definitively linked to autism [2]. In addition to this strong but complex genetic basis, environmental factors are also thought to contribute to ASD. Various and often conflicting theories have suggested roles for factors such as nutrition, socioeconomic status, access to healthcare, environmental pollutants and family life [2].

The global prevalence of ASD has shown an increasing trend, with the latest CDC data reporting a prevalence of one in 36 children [3]. In India, however, prevalence estimates vary, with limited studies from tertiary centres indicating rates between 0.09-0.23% [4-6].

Treatment approaches for ASD have evolved from psychotherapy to structured educational and behavioural interventions, with four main types of comprehensive programs: developmental models (e.g., Denver, floor time), behaviour-focused methods {e.g., Applied Behaviour Analysis (ABA)}, eclectic approaches {e.g., Treatment and Education of Autistic and Communication-Handicapped Children (TEACCH)}, and combined behavioural-developmental therapies (e.g., pivotal response therapy). Among these, ABA has shown significant benefits in intellectual, language, daily living, and social skills. Pharmacological treatment mainly targets associated behavioural symptoms, with antipsychotics (like risperidone), Selective Serotonin Reuptake Inhibitors (SSRIs), mood stabilisers (like valproate) and melatonin used for aggression, hyperactivity, repetitive behaviours, and sleep disturbances. Additional interventions include sensory integration, speech therapy and remedial education with better outcomes, if started early. While newer techniques such as stem cell therapy and hyperbaric oxygenation are being explored, evidence is still lacking, highlighting the need for a multimodal, multidisciplinary approach to ASD management [7,8].

Research from the North Eastern region of India, including Tripura, remains extremely limited [9,10]. To the best of our knowledge, the present study represents the first systematic documentation of

ASD from Tripura and contributes to the sparse body of literature from North-East India. Sociocultural and socioeconomic factors are known to influence early recognition, diagnosis, and management of ASD, further underlining the importance of local data [11].

Therefore, the present study was conducted to describe the clinical and sociodemographic profile of ASD cases and to estimate the burden among children attending a tertiary care hospital in Tripura, India, which will help policymakers to allocate resources, set priorities, and design effective health policies for the state.

MATERIALS AND METHODS

This was a hospital-based cross-sectional observational study conducted in the OPD of Paediatrics, Agartala, Government Medical College (AGMC) and GB Panth Hospital (GBPH), Tripura, India, from November 2022 to May 2024. The study was approved by the Institutional Ethics Committee (vide letter number F.4 (6-13)/AGMC/Medical Education/IEC approval/2022/23,121, Dated 30/01/2023).

Inclusion criteria: Children aged 2-12 years attending Paediatric OPD, from the study population showing deficit in communication and social interaction, repetitive pattern of behaviour and developmental delay were screened by M CHAT-R [11] and children having a score of 3 or more were included in the study.

Exclusion criteria: Children with cerebral palsy, metabolic disorders, sequelae of CNS infections and traumatic brain injury were excluded from the study.

Sample size: Out of 28,252 children attending OPD, 32 eligible children were enrolled in the study as per the inclusion and exclusion criteria by consecutive sampling.

Study Procedure

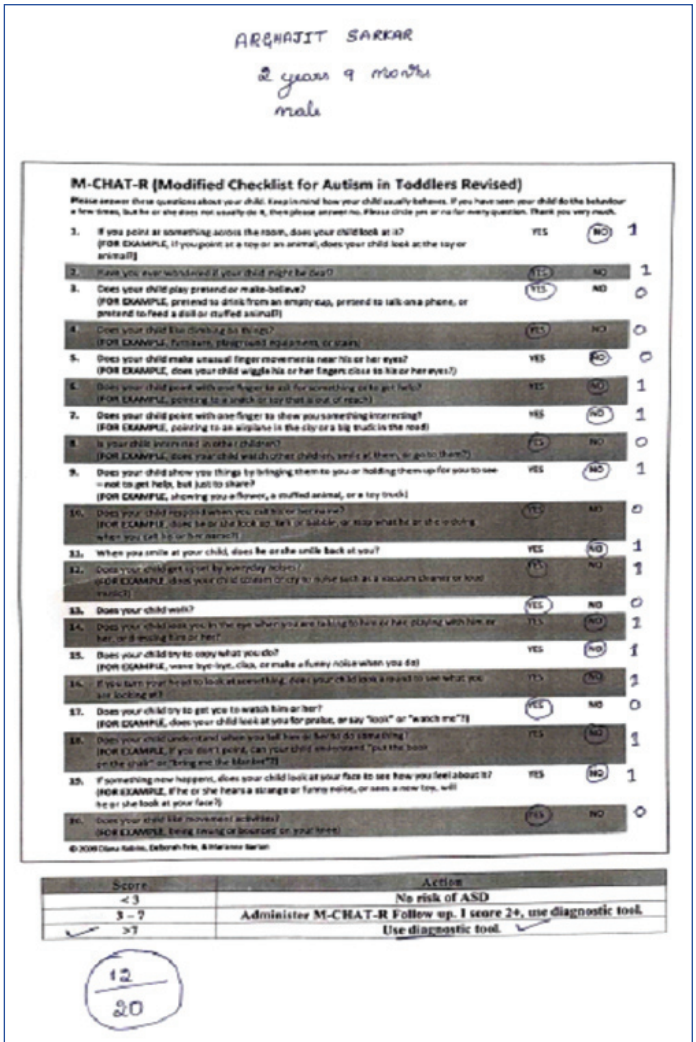
Children aged 2-12 years visiting Paediatric OPD with deficits in communication, social interaction, repetitive behaviours, or developmental delay were screened using the Modified Checklist for Autism in Toddlers Revised with Follow-Up (M-CHAT-R/F) [11]. Children scoring ≥3 were enrolled in the study and were further evaluated using the INDT-ASD, which is a validated tool for Indian settings [12]. Evaluation for co-morbidities such as ADHD, intellectual disability, seizures, and sleep disorders was performed by a child psychologist and paediatrician using tools like the Vanderbilt ADHD Diagnostic rating Scale, DSM-5 criteria etc., [13,14]. All the raw data were systematically entered in the abstraction form.

The M-CHAT-R/F is a screening tool for autism in toddlers comprising 20 items, with each item scored as pass or fail. Total scores ranging from 0-2 indicate low risk, 3-7 indicate medium risk requiring a follow-up interview, and scores between 8-20 indicate a high risk for ASD [11] [Table/Fig-1].

The INDT-ASD consists of 37 items categorised into three domains: social interaction, communication, and restricted/repetitive behaviours. Each item is scored as 0 (No) or 1 (Yes), with a 'Yes' response indicating the presence of abnormal behaviour. Diagnosis is based on domain-specific criteria rather than the total score, and a child meeting the required criteria across domains is diagnosed with ASD [12] [Table/Fig-2].

The Vanderbilt ADHD Diagnostic Rating Scale (VADRS) (3rd edition - 2019) comprise two versions: a parent version with 55 items and a teacher version with 43 items. It utilises a 0-3 Likert scale, with symptoms considered positive at scores ≥2. In the present study, the parent version was used for analysis. A diagnosis of ADHD is suggested when at least six symptoms are present in a domain along with evidence of functional impairment [11-13].

Besides, the presence or absence of factors identified as risk factors in other studies [15-24]- such as maternal PIH, Gestational Diabetes Mellitus (GDM), hypothyroidism, maternal anaemia, maternal and paternal age at conception, perinatal asphyxia, certain food habits, gestational age, and screen time was recorded.

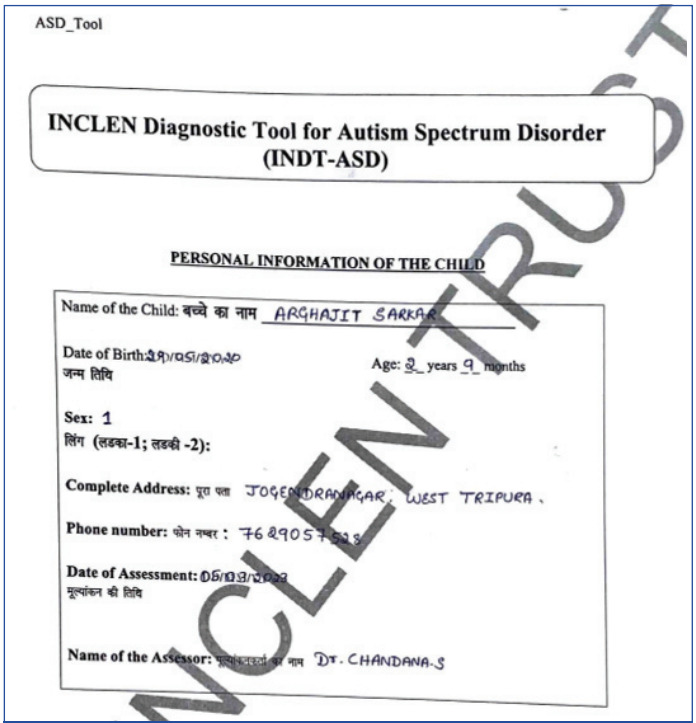

ARGHAJIT SARKAR
2 years 9 months
male

M-CHAT-R (Modified Checklist for Autism in Toddlers Revised)

Score	Action
<3	No risk of ASD
3 – 7	Administer M-CHAT-R Follow up. I score 2+, use diagnostic tool.
>7	Use diagnostic tool.

12/20

[Table/Fig-1]: Scan copy of the filled-up M-CHAT-R form.


ASD_Tool

INCLEN Diagnostic Tool for Autism Spectrum Disorder (INDT-ASD)

PERSONAL INFORMATION OF THE CHILD

Name of the Child: बच्चे का नाम ARGHAJIT SARKAR

Date of Birth: 29/05/2020 जन्म तिथि Age: 2 years 9 months

Sex: 1 लिंग (लड़का-1; लड़की -2):

Complete Address: पूरा पता JOGENDRANAGAR, WEST TRIPURA.

Phone number: फोन नम्बर : 7629057598

Date of Assessment: 05/03/2023 मूल्यांकन की तिथि

Name of the Assessor: मूल्यांकनकर्ता का नाम Dr. CHANDANA.S

INCLEN TRUST

[Table/Fig-2]: Scan copy of fill-in INDT-ASD form.

STATISTICAL ANALYSIS

For data analysis, SPSS version 26.0 was used. Demographic characteristics and clinical profile in terms of age and gender distribution, domicile, ethnicity, social class, presenting features, antenatal, natal, and postnatal variables, dietary habits, screen time, diagnosis, etc., were displayed in a frequency distribution table.

Burden of the disease was expressed in terms of proportion of ASD among Paediatric OPD visitors, mean age and standard deviation of the study population and mean age and standard deviation at diagnosis.

RESULTS

A total of 28,252 children attended the Paediatric OPD of AGMC and GBPH during the study period, among whom 32 cases of ASD were identified, giving a prevalence of 0.11%. The mean age at diagnosis was 3.59±1.38 years, while the mean age of the study population was 4.59±1.90 years [Table/Fig-3].

Variables	Observation
Total OPD attendance	28252
ASD cases detected	32
Proportion of ASD (%)	0.11%
Mean age of study population	4.59±1.90 years
Mean age at diagnosis	3.59±1.38 years
Gender distribution of the ASD cases	4.3:1

[Table/Fig-3]: Proportion of ASD.

The age distribution shows that the majority of children with ASD were diagnosed early, with nearly two-thirds below five years, 22 (68.8%), indicating increased early detection. There is a clear male predominance (male: female=4.3:1), consistent with established epidemiological trends. Most participants belonged to the Hindu community, 29 (90.6%), and the Bengali population, 26 (81.3%), reflecting the local demographic profile of the study area. Socioeconomically, a large proportion of cases were from the upper, 7 (21.9%), and upper middle classes, 21 (65.6%), as per the Modified Kuppuswamy Scale. Clinically, poor social communication, 19 (59.4%) was the most common presenting complaint, followed by speech delay, 6 (18.8%), while fewer cases presented with repetitive behaviours or hyperactivity [Table/Fig-4].

Variables	n (%)
Age-group wise distribution (years)	
<5 years	22 (68.8)
5-<10 years	9 (28.1)
≥10 years	1 (3.1)
Gender-wise distribution	
Male	26 (81.3)
Female	6 (18.8)
Religion-wise distribution	
Hindu	29 (90.6)
Muslim	2 (6.3)
Christian	1 (3.1)

[Table/Fig-4]: Demographic and presenting features (N=32).

On analysis of maternal antenatal history, it revealed that three (9.4%) of the mothers during their pregnancy had PIH, three mothers (9.4%) had hypothyroidism, two (6.3%) of them had gestational diabetes and 1 (3.1%) had anaemia, whereas one had both PIH (3.1%) and Gestational Diabetes (3.1%) and the other one had both PIH and hypothyroidism. The rest of the 65.6% did not have any morbidity during pregnancy. Analysis of parental age at conception shows that fathers had a mean age of 33.75±6.67 years and mothers had a mean age of 27.22±6.76 years when mother conceived [Table/Fig-5].

Gestational age analysis showed that 4 (12.5%) of the children with ASD were born preterm while the rest were born at term. Out of all the enrolled cases there was history of perinatal hypoxia in 2 (6.3%) children. Analysis of activities indicate that ASD cases were maximum (40.63%) in proportion among those who had screen time more than three hours [Table/Fig-6].

Variables	n (%)	
Medical disease in mother		
Maternal PIH	3 9.4)	
Maternal GDM	2 6.3)	
Maternal Hypothyroidism	3 9.4)	
Maternal Anaemia	1 3.1)	
Mean parental age		
Mean maternal age at conception (in years)	-	27.22±6.76
Mean paternal age at conception (in years)	-	33.75±6.67

[Table/Fig-5]: Maternal factors (N=32).

Variables	n (%)
Perinatal asphyxia	
Yes	2 (6.3)
No	30 (93.8)
Food habit	
Sugary diet	17 (53.1)
Cow's milk	11 (34.3)
Artificial feeding	23 (71.9)
Fast foods	14 (43.8)
Gestational age	
Preterm birth	4 (12.5)
Term birth	28 (87.5)
Screen time	
Screen time <1 h	7 (21.9)
Screen time 1-2 h	7 (21.9)
Screen time 2-3 h	5 (15.6)
Screen time >3 h	13 (40.6)

[Table/Fig-6]: Probable risk factors (N=32).

Assessment of all 32 enrolled cases with INDT-ASD resulted in diagnosis of Autism in 26 (81.3%) cases, Asperger's disorder in 4 (12.5%) cases and CDD in 2(6.25%) cases. On further analysis of co-morbid conditions, it was evident that the most common co-morbid condition of ASD was ADHD {24 (75.00%)}, followed by the other co-morbid conditions like intellectual impairment {20 (62.50%)}, sleep disorders {7 (21.90%)} and seizures {6 (18.80%)} [Table/Fig-7].

Variables	n (%)
Final diagnosis	
Autism	26 (81.3)
Asperger's disorder	4 (12.5)
Childhood Disintegrative Disorder (CDD)	2 (6.3)
Co-morbid conditions	
Intellectual impairment	20 (62.5)
ADHD	24 (75.0)
Seizures	6 (18.8)
Sleep disorders	7 (21.9)

[Table/Fig-7]: Final diagnosis and co-morbid conditions (N=32).

DISCUSSION

The present cross-sectional observational study included 28,252 children attending the OPD, of whom 32 were diagnosed with ASD, giving a proportion of 0.11%. This is comparable to Indian studies by Hossain MD et al., Raina SK et al., and Poovathinal SA et al., which reported prevalence between 0.09% and 0.23% [4-6]. However, it is much lower than the CDC estimate of one in 36 children, likely reflecting the hospital-based design and possible underdiagnosis in the community [3].

The mean age of the study population was 4.59±1.90 years, with 68.8% of children below five years [Table/Fig-1]. Bhat BA et al.,

similarly reported that 65% of children were under six years [15]. The mean age at diagnosis was 3.5±1.38 years, comparable to Oneib B et al., (3.1 years) and González-Cortés T et al., (5.52 years) [16,17]. Although ASD can be identified as early as one year, most diagnoses occur around four years, as per Centers for Disease Control (CDC) data [3].

A clear male predominance was observed, with a male-to-female ratio of 4.3:1, consistent with CDC findings that ASD is four times more common in boys [3]. Similar ratios have been reported by Santhosh Raj P et al., (4:1) and González-Cortés T et al., (1:3.9), indicating agreement with existing literature [17,18].

Most children belonged to the Bengali ethnic group (n=26), followed by Indigenous (Tribal) (n=5) and Manipuri (n=1), for which comparable data are lacking. Regarding sibling distribution, 62.5% had no siblings, 31.3% had one sibling, and 6.3% had two siblings. Durkin MS reported decreasing ASD risk with increasing birth order [19], whereas Santhosh Raj P et al., observed higher rates among children with two or more siblings [18].

Socioeconomic analysis showed that 65.63% of children belonged to the upper middle class, 21.9% to the upper class, and 12.5% to the lower middle class, with none from the lower class (Modified Kuppuswamy scale). Kelly B et al., reported higher autism diagnosis rates among children of more educated mothers (1.5% vs. 0.7%) in the UK [20], suggesting a possible influence of socioeconomic and educational factors on diagnosis.

Difficulty in communication was the most common presenting complaint (59.4%), followed by language impairment (18.8%), restricted and repetitive behaviour (12.5%), and hyperactivity (9.4%). In contrast, Oneib B et al., reported delayed language development as the most frequent concern [16], while González-Cortés T et al., reported high rates of social communication impairment (78.42%), language delay (67.57%), and repetitive behaviours (84%) [17].

Among maternal factors, 9.4% had PIH and hypothyroidism each, 6.2% had GDM, and 3.1% had anaemia requiring transfusion. Oneib B et al., highlighted maternal iron deficiency as a risk factor and suggested a protective role of supplementation [16], whereas Santhosh Raj P et al., reported no pregnancy-related complications, with universal iron and folic acid supplementation [18].

The mean parental age at conception was 27±6.7 years for mothers and 34±6.7 years for fathers, similar to findings by Oneib B et al., [16]. Studies by Oneib B et al., and Durkin MS have shown increased ASD risk with advancing parental age [16,19], a trend also reflected in the present findings. Perinatal asphyxia and prematurity were noted in 6.3% and 12.5% of cases, respectively. While Santhosh Raj P et al., found no association between perinatal factors and ASD [18], studies by Oneib B et al., and González-Cortés T et al., reported an increased risk with prematurity [16,17].

Dietary patterns showed that 53% of children preferred sugary foods, 72% consumed artificial or commercial feeds, and 44% regularly consumed fast food. Ahumada D et al., reported dietary difficulties in 46-89% of children with ASD, including food selectivity and preference for energy-dense foods [21]. Sandoiu A reported elevated propionic acid levels in autistic children, suggesting increased intake of processed foods [22].

Screen time exposure exceeding 3 hours per day was reported in 40.63% of children. Westby C reported higher screen dependency among children with ASD and suggested that prolonged exposure may worsen social and communication deficits [23]. However, Ophir Y et al., found insufficient evidence to establish a direct causal relationship [24].

Regarding DSM-IV subtypes, autism, Asperger disorder, and CDD were diagnosed in 81.3%, 12.5%, and 6.3% of children, respectively. Bhat BA et al., reported autism and Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS) in 62% and 32% of cases [15].

Co-morbidities were frequent, with ADHD present in 75%, intellectual impairment in 62.5%, sleep disturbances in 22%, and seizures in 19% of children. Hours C et al., reported ADHD prevalence up to 70% [25]. Khachadourian V et al., reported ADHD (35%), intellectual disability (23%), sleep disorders (21%), and seizures (up to 5%) [26], while Bhat BA et al., documented intellectual disability in over 70% of cases [15]. Comparison of major study variables of some recent studies is shown [Table/Fig-8].

Parameters	Bhat BA et al., [15]	Oneib B et al., [16]	Gonzalez-Cortes T et al., [17]	Santhosh Raj P et al., [18]	Durkin MS et al., [19]	Present study
Place of study	Srinagar, India	Morocco, North Africa	Northern Mexico	Tamilnadu, India	USA	Tripura, India
Year of study	2015-16	2017-19	2019(2014-18)	2020	2008	2022-2024
Number of participants	55	130	203	770	1251	32
Sampling method	Consecutive sampling	Consecutive sampling	Consecutive sampling	Simple stratified random sampling technique	Total population sampling	Consecutive sampling
Study design	Cross-sectional observational study	Descriptive cross sectional study	Descriptive study	Cross-sectional observational study	Population based, case-cohort design	Cross-sectional observational study
Male to female ratio	3.6:1	4.6:1	3.9:1	4:1	4.49:1	4.3:1
Age at diagnosis		3.40±1.5	5.52 years	4 years		3.59±1.38 years
Maternal age		28.2±6.5	26.27±5.56	27	29	27±6.7
Paternal age		36.7±8	29.04±6.61	32.8	31.4	34±6.7
Clinical presentation		Language disorders-90% Social withdrawal-69.2%				Communication deficits-59.4% Language impairment- 18.8% Repititive behaviour-12.5%
Gestational age		Preterm-2.3% Term- 97.7%		Preterm-0% Term – 100%	Preterm-12.5% Term-87.5%	Preterm-12.5% Term- 87.5%
Perinatal asphyxia				Yes-20% No-80%		Yes-6.3% No- 93.7%
No. of siblings				2- 60% 3-40%		0-62.5% 1-31.3% 2-6.3%
Co-morbidities	Intellectual disability-85.45%	Epilepsy-6.1% Genetic disorders-6.9% Mental retardation- 6.9%				ADHD-75% Intellectual impairment- 62.5% Sleep disturbances-22% Seizures-19%

[Table/Fig-8]: Comparative table of some recent studies.

Limitation(s)

The present study was a small sample cross-sectional study prone to random error. The non probability sampling method of the study makes it non generalisable. The present study was an open-label study prone to selection bias and detection bias. The reliability of caregivers' information makes it prone to reporting bias.

CONCLUSION(S)

The present study identified a burden of 0.11% ASD among Paediatric OPD attendees in a tertiary hospital in Tripura. The disorder was more common in males, with social communication deficits being the most frequent presenting complaint. Comorbidities such as language impairment, ADHD, and intellectual disability were highly prevalent. Strengthening awareness among healthcare providers and parents, and incorporating ASD screening into routine paediatric visits, are essential steps to improve outcomes. Besides, a nationwide sample survey to know the actual national prevalence and multicentric case control study in the community setting to ascertain the risk factors are the recommendations for future studies in this field.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jan 03, 2026
- Manual Googling: May 10, 2026
- iThenticate Software: May 12, 2026 (2%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

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