Risk of Autism Spectrum Disorder among toddlers aged 16–30 months: insight from a tertiary care hospital in Central India

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Abstract

Background: Autism Spectrum Disorder (ASD), a complex neurodevelopmental condition, has a rising prevalence, affecting 1 in 127 children globally and 1 in 65 in India, making early identification crucial for improved outcomes. The Modified Checklist for Autism in Toddlers (M-CHAT) is a recognized tool for screening and is important across all healthcare settings.

Objective: The primary objective of this study was to screen for Autism Spectrum Disorder among toddlers aged 16 to 30 months attending a tertiary care hospital in Central India by simple random sampling. The study aimed to determine the prevalence of ASD risk within this specific population and to identify potential associations with various demographic factors.

Methodology: This hospital-based cross-sectional study randomly sampled 150 toddlers (16–30 months) from an OPD at a tertiary hospital in Central India. After obtaining ethical clearance and parental consent, the M-CHAT questionnaire was administered. Children were classified as low (0–2), moderate (3–7), or high risk (8–20). For analysis, moderate and high-risk groups were considered "at risk." Data on sociodemographic and behavioural factors were collected using a structured proforma. Statistical analysis included descriptive statistics and chi-square tests, with $p<0.05$ considered significant.

Result: Out of 150 children (mean age 21.7 ± 4.0 months; 52.7% male), 11 (7.3%) were identified as at risk for ASD (4.7% moderate-risk, 2.7% high-risk). The male-to-female ratio among at-risk children was 2.7:1.Factors showed statistically significant associations with ASD risk: low parent education ($p < 0.001$),preterm delivery ($p < 0.001$), place of delivery ($p < 0.001$), not crying immediately after birth ($p < 0.001$), history of NICU stay ($p < 0.001$)lack of exclusive breastfeeding ($p < 0.001$), partial immunization ($p < 0.001$) and mobile screen exposure ($p < 0.001$).

Conclusion: This study identified a 7.3% prevalence of ASD risk among toddlers, aligning with global and Indian estimates. Multiple modifiable factors—including perinatal complications, incomplete immunization, absence of exclusive breastfeeding, and prolonged screen exposure were associated with ASD risk. Early screening using M-CHAT at routine paediatric visits can facilitate timely referral and intervention.

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Introduction

Autism Spectrum Disorder (ASD) is a complex and pervasive neurodevelopmental condition characterized by persistent deficits in social communication and interaction, coupled with restricted, repetitive patterns of behaviour, interests, or activities. In a country with a vast child population and diverse healthcare landscape like India, the accurate and timely identification of ASD is a critical public health priority [1]. Interventions initiated during the critical period of toddlerhood have been consistently shown to significantly improve long-term prognosis and developmental outcomes for affected children, underscoring the urgency of early detection, particularly given reported delays in diagnosis in the region [2]. Current epidemiological reports and local studies suggest that the prevalence of ASD in India is substantial, yet challenges in awareness, infrastructure, and standardized screening often lead to delayed diagnosis, particularly in rural or low-resource settings [3]. To address this gap and promote early intervention within the existing primary care and public health framework, standardized, accessible screening is paramount. The Modified Checklist for Autism in Toddlers (M-CHAT), which is an evidence-based, parent-report instrument, has been validated and culturally adapted for use across various Indian languages and populations, making it a highly relevant and scalable tool for early childhood screening [4].

The M-CHAT is typically administered to toddlers between 16 and 30 months of age in a crucial process designed to efficiently detect a child's risk level for ASD, necessitating objective and precise interpretation of the resultant M-CHAT score. This score is pivotal, serving as the initial determinant that guides healthcare workers or paediatricians on whether to dismiss risk (low score), refer the child for comprehensive diagnostic evaluation (high score), or conduct further follow-up to clarify risk (medium score) [5]. Implementing and correctly interpreting the M-CHAT score is thus the foundational step in streamlining the referral pathway for high-risk toddlers toward comprehensive, multidisciplinary diagnostic assessment across India.

The American Academy of Pediatrics (AAP) recommends routine ASD screening at 18 and 24 month child visits to facilitate early identification[6]. The Modified Checklist for Autism in Toddlers (M-CHAT) is a validated, parent-reported screening tool designed for this purpose, targeting children aged 16-30 months. Despite these recommendations, routine screening is not yet standard practice in many parts of India, and there is a scarcity of prevalence data, particularly in regions like Madhya Pradesh. Given the importance of early detection, this study was designed to screen for ASD among toddlers in a tertiary care hospital in Central India, estimate the prevalence of ASD risk, and identify associated sociodemographic and clinical factors.

Materials and Methods

Study Design and Setting

A hospital-based, cross-sectional observational study was conducted over a **period of one year, from October 2024 to September 2025**, at a tertiary care hospital in Central India. The study was designed to screen toddlers for the risk of Autism Spectrum Disorder (ASD) using a standardized screening tool. The study protocol was reviewed and **approved by the Institutional Ethics Committee of the concerned institution**. Written informed consent was obtained from the parents or primary caregivers of all participating children prior to enrolment in the study.

Participants and Sampling

The study included **150 toddlers aged 16 to 30 months** who attended the outpatient departments of the hospital during the study period. Participants were selected using a **simple random sampling technique**. Children who were acutely ill at the time of screening, receiving central nervous system (CNS) medications, or whose parents or caregivers did not provide informed consent were excluded from the study.

Data Collection and Tools

Data were collected using a **structured and pre-designed proforma**, which included details

regarding sociodemographic characteristics, perinatal history, feeding practices, immunization status, and behavioural factors. Screening for ASD risk was performed using the **Modified Checklist for Autism in Toddlers (M-CHAT)** questionnaire. The M-CHAT is a validated, parent-completed screening tool consisting of **20 yes/no questions**, designed to identify children at risk for Autism Spectrum Disorder.

Outcome Measures and Statistical Analysis

Based on M-CHAT scores, children were categorized into three risk groups:

- **Low Risk:** Score of 0–2
- **Moderate Risk:** Score of 3–7
- **High Risk:** Score of 8–20

For the purpose of statistical analysis, children classified under **moderate-risk and high-risk categories were collectively considered as "at risk for ASD."** Data were entered and analyzed using appropriate statistical software. **Descriptive statistics** were used to summarize demographic and clinical variables. Associations between ASD risk and various sociodemographic, perinatal, and behavioural factors were analyzed using the **chi-square test**. A **p-value of less than 0.05** was considered statistically significant.

Results

Of the 150 toddlers screened, **11 (7.3%) were identified as being "at risk for ASD."** Among this at-risk group, 7 children (4.7%) were classified into the moderate-risk category (M-CHAT score 3-7), and 4 children (2.7%) were in the high-risk category (M-CHAT score 8-20) (Figure 1) . The remaining 139 children (92.7%) were classified as low risk. (Table I)

Table I : ASD Risk Classification in screened toddlers

	Number of Children	Final ASD Risk Status	Prevalence (%)
0 - 2 (Low Risk)	139	Not At Risk	139 (92.7%)
3 - 7 (Moderate Risk)	7	At Risk for ASD	**11 (7.3%)**
8 -20 (High Risk)	4	At Risk for ASD	
Total	**150**		150 (100%)

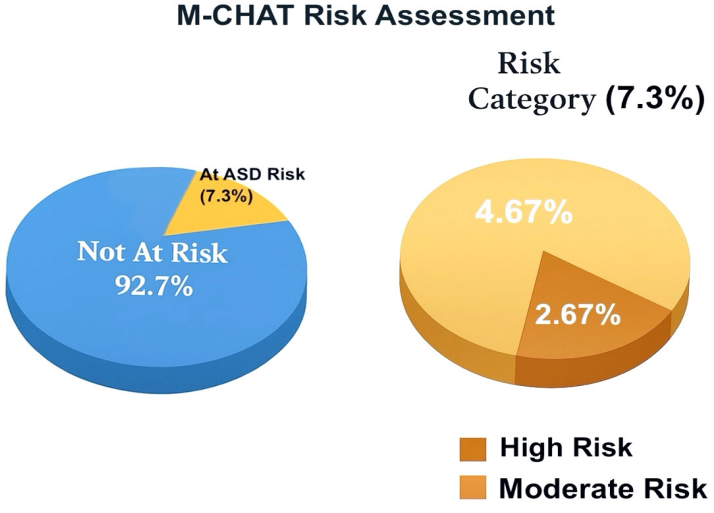

Figure 1 : ASD Risk Classification in 150 Screened Toddlers

The mean age of the participants was 21.7±4.0 months. The study population consisted of 79 males (52.7%) and 71 females (47.3%). Among the 11 children identified as at risk, there was a male predominance, with a **male-to-female ratio of 2.7:1**. A summary of the demographic profile is presented in Table II.

Table II : Summary of the demographic profile of screened toddlers

Variable	Category	ASD Risk Yes (n=11)	ASD Risk No (n=139)	Total (N=150)	Chi-square	df	p-value
Gender	Male	8	71	79	1.916	1	0.166
	Female	3	68	71			
Religion	Hindu	10	130	140	1.584	3	0.663
	Muslim	1	4	5			
	Christian	0	4	4			
	Sikh	0	1	1			
Parent Education	Both>Graduate	0	2	2	14.97	4	**<0.001***
	1 Parent >Graduate	3	17	21			
	Both Parent >12 standard	2	72	74			
	1 Parent>12 standard	4	46	49			
	Both Parent < 12 standard	2	2	4			
Family Type	Nuclear	9	111	120	0.025	1	0.876
	Joint	2	28	30			
Residence	Urban	9	130	139	2.056	1	0.152
	Rural	2	9	11			
Parents Working	Only Father Working	9	116	125	0.224	2	0.894
	Both Parents Working	2	21	23			
	Only Mother Working	0	2	2			

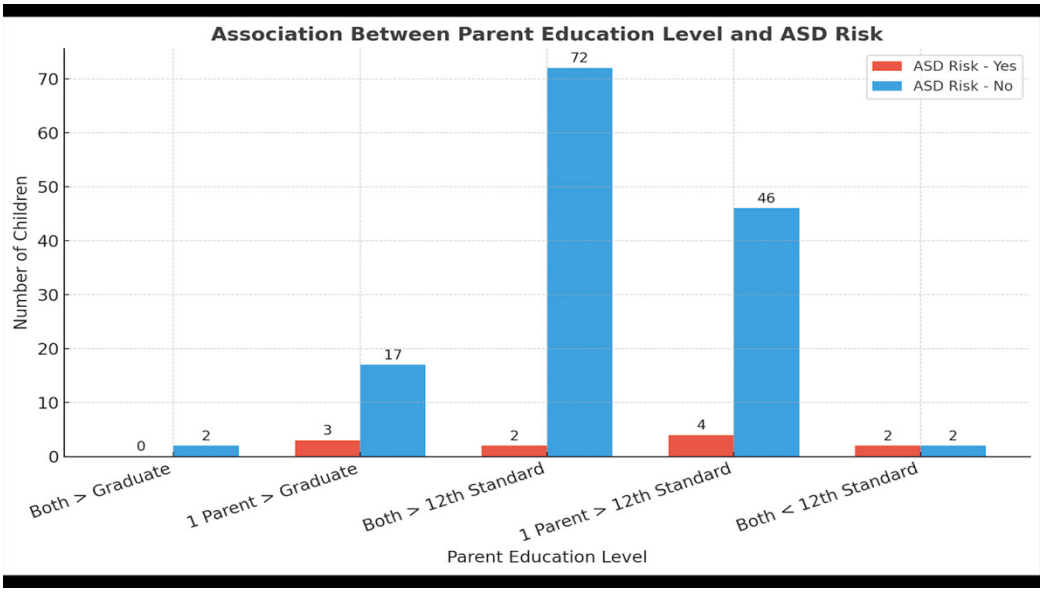

Figure 2 : Association between parent education level and ASD risk

It is statistically significant ($p < 0.05$) for parental education and ASD risk, indicating that children with both parents having less than 12th standard education are at much higher risk for ASD compared to those with higher parental education (Figure 2).

Table III : Maternal & Perinatal Factors Associated with ASD Risk

Variable	Category	ASD Risk Yes (n=11)	ASD Risk No (n=139)	Total (N=150)	Chi-square	df	p-value
Immunisation Status	*Partially Completed*	8	2	10	83.25	1	<0.001*
	Completed till date	3	137	140			
Exclusive Breast Feeding (6 months)	*Yes*	4	122	126	20.04	1	<0.001*
	No	7	17	24			
Birth Order	*First child*	6	96	102	3.992	2	0.136
	Second child	3	37	40			
	Third child	2	6	8			
Number of Siblings	*No siblings*	6	95	101	5.197	2	0.074
	One sibling	2	34	36			
	Two siblings	3	10	13			
Gestation	*Pre-term*	7	7	14	41.4	2	<0.001*
	Full-term	4	129	133			
	Post-term	0	3	3			
Place of Delivery	*Institutional*	10	139	149	12.72	1	<0.001*
	Home delivery	1	0	1			

Mode of Delivery	*Normal Vaginal Delivery*	*5*	*68*	*73*	*0.049*	*1*	*0.825*
	Caesarean	*6*	*71*	*77*			
Cried Immediately After Birth	*Yes*	*8*	*139*	*147*	*38.68*	*1*	*<0.001**
	No	*3*	*0*	*3*			
Stay at NICU	*Yes*	*7*	*20*	*27*	*16.75*	*1*	*<0.001**
	No	*4*	*119*	*123*			

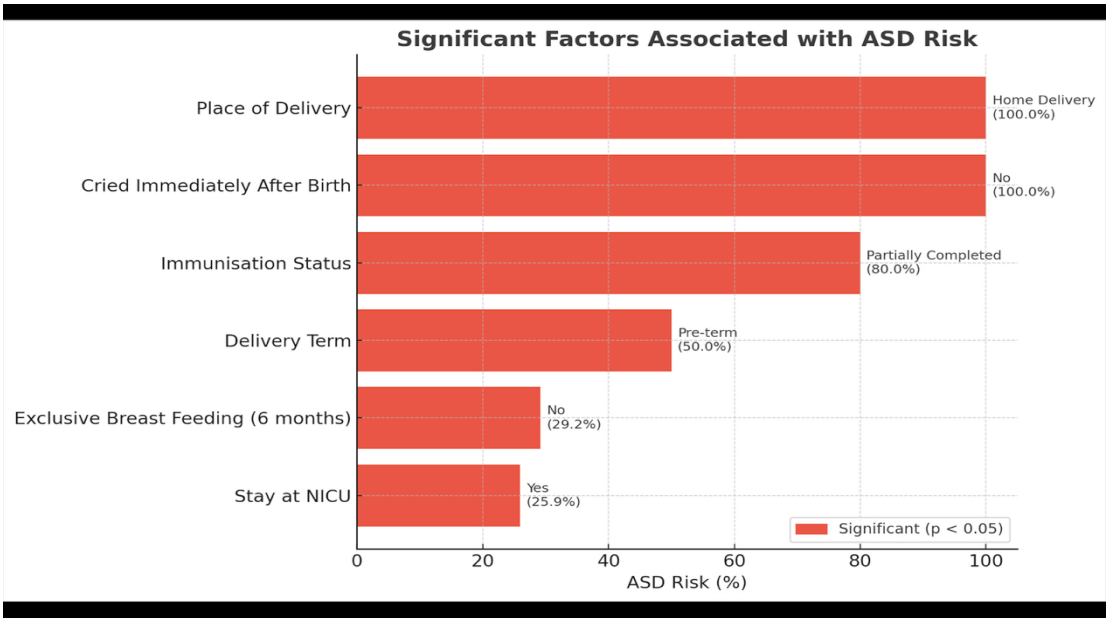

Figure 3 : Statically significant factors associated with ASD risk

Table III explores associations between maternal/perinatal variables and ASD risk among toddlers. Notably, children at risk for ASD were more likely to have had partial immunization, lack of exclusive breastfeeding for 6 months, preterm birth, home delivery, delayed cry at birth, and NICU stay (Figure 3). Each of these factors showed statistically significant associations with ASD risk, highlighting key maternal and perinatal determinants relevant to early ASD risk stratification.

Table IV : Association Between Daily Mobile Usage by Child and Autism Spectrum Disorder (ASD) Risk

Variable	Category	ASD Risk Yes (n=11)	ASD Risk No (n=139)	Total (N=150)	Chi-square	df	p-value
Mobile Usage by Child (Daily)	*Never*	*0*	*11*	*11*	*18.02*	*3*	*<0.001**
	Less than 1 Hour	*1*	*64*	*65*			
	1-3 Hours	*4*	*49*	*53*			
	3-5 Hours	*6*	*15*	*21*			

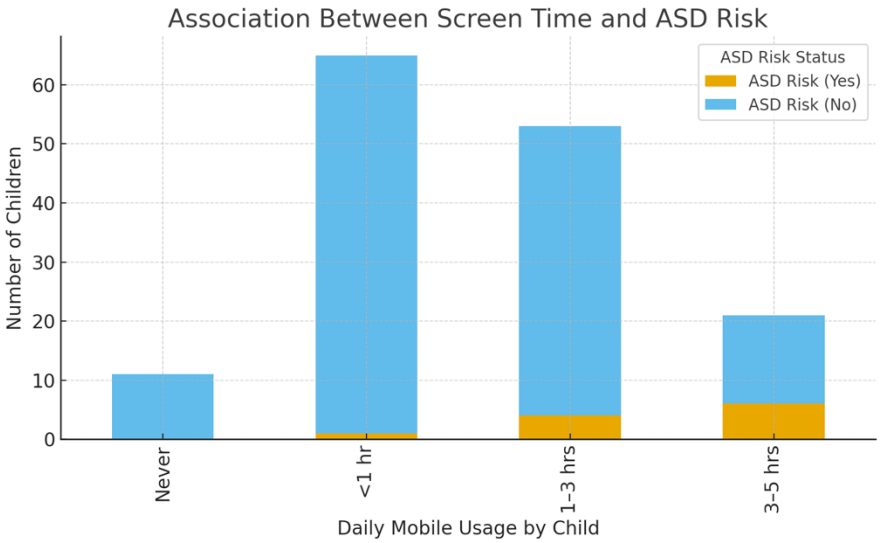

Figure 4 : Association between mobile usage and ASD risk

Table IV and figure 4 shows daily mobile device usage among children as a potential risk factor for ASD. There is a significant association: none of the never-users were at risk, whereas ASD risk increased with greater daily duration of mobile use (especially 3-5 hours/day). This finding suggests excessive screen exposure may be a modifiable risk factor or marker for ASD-related behaviors in early childhood.

Discussion

This study identified a 7.3% prevalence of ASD risk among toddlers in a tertiary care setting in Central India, which is considerably higher than community-based estimates in India that report prevalence rates between 0.15% and 1.01%. However, it is comparable to a study by Arunachalam et al. (2024)[7], which found a 6.6% risk rate in a similar hospital-based well-baby clinic setting. The higher prevalence in our study is likely due to the nature of a tertiary care hospital, which often serves a population with a higher concentration of developmental concerns and referrals. This study also revealed a statistically significant association between **parental education level** and the risk of ASD identification. The pattern was complex, with higher risk observed in families where both parents had less than a 12th Standard education, compared to those where both parents had completed 12th Standard or higher. This finding requires careful interpretation in light of other research. Oneib et al. (2022)[8] found that higher parental education in Morocco correlated strongly with **earlier screening age** and increased information-seeking about ASD, suggesting that higher education might lead to earlier detection rather than indicating a higher biological risk. The increased risk in the lowest education group might relate to other unmeasured environmental factors or barriers to optimal care. This complex association highlights the need for universally accessible information and screening, irrespective of parental education, to ensure equitable early identification. Our study identified a strong association between ASD risk and several perinatal complications. A significant majority (63.6%) of at-risk children were born preterm and required NICU admission. This aligns with extensive literature; a meta-analysis by Agrawal et al. (2018) [9] confirmed that preterm infants have a higher prevalence of ASD, and other Indian studies by Mamidala et al. (2013) [10] and Nath et al.(2012) [11] also identified pre-term birth as a significant risk factor. This study also found a significant association between the place of delivery and ASD risk. Although only one child in the entire cohort was delivered at home, this child fell into the 'At Risk' group. While none of the specifically provided reference articles focused heavily on home versus institutional delivery as a primary risk factor, this finding likely serves as a proxy for reduced access

to skilled perinatal care and potentially lower socioeconomic status. We also found that not crying immediately after birth, a potential indicator of birth asphyxia, was significantly linked to ASD risk, consistent with Mamidala et al. (2013) [10] who identified delayed birth cry and birth asphyxia as significant risk factors. The analysis also revealed critical associations with modifiable nutritional and environmental factors. The finding that 63.6% of at-risk children were not exclusively breastfed for six months is a crucial one, consistent with strong evidence from other Indian studies. Panchanathan et al. (2023) [6]identified a lack of exclusive breastfeeding as a key factor associated with ASD, and a sibling case-control study by Manohar et al. (2018)[12] found that early introduction of top feeds was associated with a six-fold increase in odds for ASD. Similarly, our study found a highly significant correlation between daily mobile usage and ASD risk, with 3-5 hours of daily use increasing the odds by 8.8. This is strongly supported by research from Dikkala et al. (2022)[13] , who established a direct correlation between the duration of screen time and higher M-CHAT scores. One of the most statistically significant findings was the association between **partial immunization** and ASD risk. It is imperative to interpret this finding cautiously. An extensive body of scientific literature, including large-scale cohort studies and meta-analyses reviewed by Çatlı & Özyurt (2025)[14] and Hodges et al. (2020)[15], has **conclusively disproven any causal link between vaccines and autism**. The observed correlation likely reflects other factors, possibly reverse causation where parental developmental concerns lead to vaccine hesitancy. As expected, a lower Developmental Quotient (DQ) was also significantly associated with higher ASD risk, consistent with ASD's nature as a neurodevelopmental disorder and its frequent co-occurrence with intellectual disability, as noted by Bhat et al. (2020) [16] and Al-Beltagi (2021) [17]. The male-to-female ratio of 2.7:1 in our at-risk group aligns with the known male predominance in ASD reported across numerous studies

Conclusion

This study highlights a notable 7.3% prevalence of ASD risk among toddlers in a tertiary care setting and reinforces the association with several key perinatal, nutritional, and environmental factors. The findings underscore the critical importance of integrating standardized ASD screening, such as with the M-CHAT, into routine pediatric health visits to facilitate early identification. Early detection of at-risk children allows for timely referral for diagnostic evaluation and the initiation of vital early intervention services. Public health strategies should focus on promoting exclusive breastfeeding, regulating screen time for toddlers, and optimizing perinatal care to potentially mitigate risk and improve developmental outcomes for all children.

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