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Original Research Article

Autism spectrum disorder risk among toddlers in selected villages of Ambala, Haryana: a community-based cross-sectional study using the M-CHAT-R/F

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ABSTRACT

Background: Rabies is an autism spectrum disorder (ASD) is a neurodevelopmental condition marked by deficits in social communication and restricted, repetitive behaviors. Early identification is essential, as timely intervention in toddlers can significantly improve long-term outcomes. The Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F) is a widely used screening tool for early detection.
Methods: This study assessed ASD risk among toddlers aged 1-3 years in selected villages of Ambala, Haryana, and examined associations with sociodemographic and perinatal factors. A cross-sectional descriptive design was used, with 135 toddlers selected through purposive sampling. Data were collected via structured caregiver interviews and analyzed using descriptive and inferential statistics (independent t-test and chi-square test) at a significance level of $p \leq 0.05$.
Results: Among participants, 33.3% were aged 1 year, 45.9% aged 2 years, and 20.7% aged 3 years, with nearly equal gender distribution. Most were born at term (85.9%), delivered vaginally (64.4%), and in private facilities (60.7%). Exclusive breastfeeding (83.7%) and complete immunization (92.6%) were common. The mean M-CHAT-R/F score was 4.14±3.64, with 40.0% classified as low risk, 33.3% medium risk, and 26.7% high risk for ASD.
Conclusions: A significant association was found only between child age and ASD risk ($\chi^2 = 81.02$, $p<0.001$). The findings highlight a considerable proportion of toddlers at elevated risk, emphasizing the importance of routine, culturally appropriate early screening and the need for larger, representative studies.

Keywords: Autism spectrum disorder, Toddlers, M-CHAT-R/F, Early screening, Community health

INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopment disorder that typically becomes apparent during early childhood. ASD is characterized by significant deficits in social interaction and communication, along with the presence of restricted and repetitive behaviors.[1] Early identification of these features offers a window of opportunity: interventions initiated during the toddler years can mitigate developmental impacts and improve quality of life. Despite global recognition of ASD as a public health concern, data on early autism risk in many developing countries, including India, remain sparse.[2]

In recent years, the growing prevalence of ASD has spurred the development and dissemination of standardized screening instruments. Among these, the Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F) is notable for its application during 12-to-36-month well-child visits. Its ease of administration and acceptable sensitivity and specificity

has made it a popular choice for preliminary screening in diverse clinical and community settings.[3] However, in India particularly in rural or semi-urban regions social and cultural factors may delay or complicate early recognition. Limited studies have addressed how demographic variables affect screening outcomes in such contexts.

Ambala, located in Haryana, presents a mix of rural and urban communities where healthcare access can vary considerably. Toddlers in these villages might not benefit from routine developmental screening, owing to both infrastructural challenges and a lack of specialized expertise. Moreover, socio-demographic characteristics such as parental education, gestational factors, and breastfeeding practices are known to influence developmental trajectories. Research exploring the association between these factors and ASD risk in community samples is therefore highly warranted in order to develop appropriately tailored screening and intervention programs.[4]

Early identification does not equate to an immediate Screening. However, by using tools such as the M-CHAT-R/F, healthcare providers can promptly flag children who may require comprehensive diagnostic evaluation.[5] As such, community-based screening is an indispensable first step. In addition, understanding the interplay between various risk factors and screening outcomes helps in refining public health policies. In resource-limited settings, equipping primary care nurses and community health workers with the knowledge and tools to screen for ASD can bridge the gap between early suspicion and formal Screening.[6]

By focusing on Ambala, this study contributes to the limited but growing body of literature on autism risk in Indian communities. It also provides practical implications for public health, suggesting that routine M-CHAT-R/F screening integrated into preschool and immunization programs could yield substantial clinical benefits. A robust screening infrastructure has the potential not only to identify at-risk children but also to facilitate early intervention and mitigate long-term behavioral and learning challenges.[7] The following sections describe the methodology, findings, and implications of our study in detail.

METHODS

Study design and setting

This descriptive, cross-sectional study was carried out in selected villages of Ambala, Haryana. The study setting was chosen due to the mixture of rural and semi-urban populations, where healthcare resource disparities are common. This environment provided an opportunity to assess autism risk in an understudied community context. The target population for the study was toddlers aged 1 to 3 years.

Inclusion criteria

Toddlers aged between 1 and 3 years, residency in one of the selected villages, and availability of a primary caregiver who could provide informed consent and respond to the screening questions in either Hindi or English.

Exclusion criteria

Exclusion criteria included toddlers with severe physical illnesses, neurodegenerative disorders, or any conditions that might confound developmental screening outcomes.

Sampling technique

A purposive sampling technique, 135 toddlers were recruited over the study period. Although a non-probability sampling method, this approach was chosen for its feasibility under the logistical constraints of field research in a rural setting, where random sampling was not practical. Purposive sampling ensured that only eligible toddlers with available caregivers were included, thereby meeting the study objectives within the logistical limitations. While this approach limits generalizability, it is consistent with similar exploratory studies in resource-limited contexts and provides valuable preliminary data for future large-scale investigations.

Data collection instruments

Sociodemographic and perinatal characteristics questionnaire

A structured instrument was developed to capture information on child age, gender, residence, gestational history (preterm, term, post-term), delivery method (normal vaginal delivery [NVD] vs. cesarean section [LSCS]), and place of delivery (government vs. private), exclusive breastfeeding status, immunization completeness, and parental education. This questionnaire was developed based on current literature and validated by a panel of experts.

Modified checklist for autism in toddlers, revised with follow-up (M-CHAT-R/F)

This 20-item screening tool is designed to identify children at risk for ASD. Caregivers answered “yes” or “no” to items reflecting behavioral characteristics. Scores were categorized into risk groups: low (0-2), medium (3-7), and high (8-20). Prior to the study, the instrument was pilot-tested on 15 toddlers to ensure clarity and reliability; a KR20 reliability coefficient of 0.8 was obtained. The KR-20 is used to measure internal consistency reliability for dichotomous items (e.g., yes/no responses). The formula is:

$$KR20 = \frac{k}{k-1}\left(1-\frac{\sum p_i q_i}{\sigma^2}\right)$$

Where; k= total number of items in the test (e.g., 20 items in M-CHAT-R/F), p_i= proportion of participants who answered item i correctly (or "yes"), $q_i = 1 - p_i$= proportion who answered item i incorrectly (or "no"), σ^2= variance of the total test scores.

Data collection procedure

After obtaining ethical clearance from the Institutional Ethics Committee of MMIMS&R Hospital, Mullana (Approval No. MMDU/IEC/2371), field visits were scheduled with local health authorities and community leaders. The community-based cross-sectional study was conducted from January 2023 to May 2023 in selected villages of Ambala district, Haryana. During these visits, the study purpose was explained to caregivers, and written informed consent was obtained. The interviews were conducted in person, and the M-CHAT-R/F screening was completed through both caregiver reports and observation of child behavior. Each session lasted approximately 15-20 minutes.

Sample size

The study employed a cross-sectional descriptive design. For prevalence studies, the standard formula is:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{d^2}$$

Where; n= required sample size, Z= standard normal value at 95% confidence (1.96), p= expected prevalence of autism risk (taken from prior studies, often around 10-15%), d= margin of error (commonly 5-10%).

Using, $p = 0.10$, $Z = 1.96$, and $d = 0.05$, the minimum sample size comes to approximately 138. Your achieved sample size of 135 is therefore very close to the calculated requirement, making it statistically acceptable.

Feasibility considerations

Data collection was restricted to very few communities setting due to time, resource, and logistical constraints. Recruiting toddlers requires parental consent and cooperation, which naturally limits participation. Given these constraints, 135 participants represent a feasible and realistic sample size for a community-based study.

Statistical power

With 135 participants, the study retains sufficient power to detect moderate associations (e.g., between age and autism risk). While larger samples would improve generalizability, the current size is adequate for exploratory research and provides a foundation for future, larger-scale studies.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 20. Descriptive statistics such as frequency distributions, percentages, means, standard deviations, medians, and ranges were computed. For inferential analysis, an independent t-test was used to compare mean autism risk scores, and chi-square tests were employed to assess the association between categorical variables (e.g., risk category versus age or gender). A p value ≤0.05 was considered statistically significant.

RESULTS

Socio demographic characteristics

The study enrolled 135 toddlers. Age distribution was as follows: 1 year: 45 toddlers (33.3%), 2 years: 62 toddlers (45.9%) and 3 years: 28 toddlers (20.7%). Gender distribution was nearly balanced with 50.4% male and 49.6% female participants. In terms of residence, 54.8% of toddlers were from rural areas while 45.2% were from urban settings. Concerning birth history, the majorities (65.9%) were born at term; with 23.0% born preterm and 11.1% post term. Regarding the mode of delivery, 64.4% underwent normal vaginal delivery (NVD), and 35.6% were delivered by LSCS. Sixty percent-plus were born in private hospitals (60.7%), compared to 39.3% in government facilities. Additionally, most toddlers (83.7%) were exclusively breastfed, and 92.6% were reported to be fully immunized. Parental educational status indicated that 61.5% of families had only one parent with some education, 21.5% had both parents educated, and 17.0% had neither parent with formal education (Table 1).

Frequency, percentage distribution showing level of autism score among toddlers. Most of the toddlers (40%) were having very low risk of Autism whereas (33.3%) were having medium risk of Autism and there are very few toddlers (26.7%) those were at the category of high risk of autism. The relatively high percentage of medium and high-risk toddlers suggests possible environmental, social, or healthcare-related factors influencing developmental outcomes in these villages (Figure 1).

Association with selected variables

Age

A significant association was detected between the toddler's age and M-CHAT-R/F risk classification (χ^2=81.03, df=4, p<0.001). Toddlers aged 2 years showed distinct risk group trends compared to those aged 1 and 3 years.

Table 1: Frequency percentage distribution of toddlers residing in selected villages of Ambala Haryana in terms of selected sample characteristics (n=135).

Sample Characteristics	Frequency	Percent
Age in years		
1	45	33.3
2	62	45.9
3	28	20.7
Gender		
Male	68	50.4
Female	67	49.6
Place of residence		
Rural	74	54.8
Urban	61	45.2
Gestational age		
Preterm	31	23
Term	89	65.9
post term	15	11.1
Type of delivery		
NVD	87	64.4
LSCS	48	35.6
Place of delivery		
Government	53	39.3
Private	82	60.7
Exclusive breastfeed		
Yes	113	83.7
No	22	16.3
Is immunization complete till date		
Yes	125	92.6
No	10	7.4
Parents education		
One	83	61.5
Both	29	21.5
None of them are educated	23	17.0

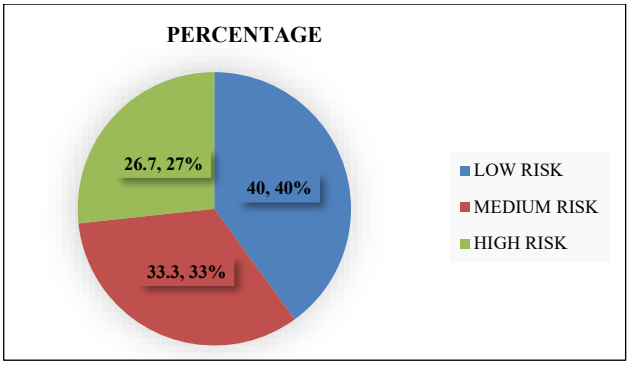

Figure 1: Percentage distribution of risk of autism among toddlers in selected villages of Ambala Haryana.

Gender

No statistically significant difference was found between males and females ($\chi^2 = 0.60$, df = 2, p = 0.74).

Residence

Rural versus urban status was not significantly related to autism risk ($\chi^2 = 2.19$, df = 2, p = 0.33).

Gestational age, mode of delivery, place of delivery, exclusive breastfeeding, immunization status, parental education

None of these variables were significantly associated with autism risk scores (p>0.05 for each).

Thus, among all the demographic and perinatal factors studied, only the age of the toddler showed a significant relationship with the autism risk category (Table 2).

Table 2: Chi- square value showing association of autism score among toddlers with selected sample characteristics (n=135).

Selected Variable	Low	Medium	High	χ^2	df	P value
Age in years						
1	3	15	27			
2	23	30	9	81.03	4	0.00*
3	28	0	0			
Gender						
Male	25	24	19	0.60	2	0.74^{NS}
Female	29	21	17			
Place of residence						
Rural	31	27	16	2.19	2	0.33^{NS}
Urban	23	18	20			
Gestational age						
Preterm	13	12	6			
Term	35	27	27	2.07	4	0.72^{NS}
Post term	6	6	3			
Type of delivery						
NVD	33	33	21	2.40	2	0.30^{NS}

Continued.

Selected Variable	Low	Medium	High	χ^2	df	P value
LSCS	21	12	15			
Place of delivery						
Government	20	19	14	0.28	2	0.86^{NS}
Private	34	26	22			
Exclusive breastfeed						
Yes	44	37	32	0.98	2	0.61^{NS}
No	10	8	4			
Is Immunization complete till date						
Yes	50	41	34	0.32	2	0.85^{NS}
No	4	4	2			
Parents education						
One	33	23	27			
Both	11	14	4	5.93	4	0.20^{NS}
None of them are educated	10	8	5			

DISCUSSION

This community-based study found that a considerable proportion of toddlers (nearly 60%) in selected villages of Ambala scored in the medium to high-risk categories on the M-CHAT-R/F. Such a finding is important because early indicators of ASD, when identified through a standardized instrument, provide an opportunity for prompt specialist referrals and early intervention programs.

The significant association between age and autism risk is an interesting outcome. Behavioral characteristics assessed by the M-CHAT-R/F may evolve or become more apparent with age, a notion supported by previous literature (Robins et al). Toddlers at 2 years of age demonstrated differences in risk classification compared to 1- or 3-year-olds. This suggests that the timing of screening is critical; the sensitivity of the instrument may vary at different developmental stages.

Other variables including gender, residence, gestational factors, and parental education were not significantly correlated with risk scores. While some international studies have highlighted a male predominance in ASD, our results showed an almost equal distribution between boys and girls. Similarly, the lack of association with factors such as mode of delivery and exclusive breastfeeding may be due to the relatively homogeneous distribution of these factors among the study population or the multifactorial etiology of ASD that is not solely dependent on one or two perinatal factors.

Our findings are in partial agreement with studies conducted in both developed countries and other low- and middle-income settings. Previous research has demonstrated that the M-CHAT-R/F is a sensitive tool when applied in community contexts; however, cultural differences and variations in caregiver interpretation can influence screening outcomes. In India, limited research has been conducted using standardized tools in community-based settings. Our study contributes to this growing body of evidence by providing local data and highlighting the need for culturally adapted screening strategies.

The absence of significant associations with most perinatal and sociodemographic variables suggests that early childhood autism risk in this community may be more closely linked to developmental stage rather than the external factors measured. This underscores the importance of repeated screening during the critical developmental window of two to three years, as a single early screening may not adequately capture the dynamic nature of symptom presentation.

In the present study, no significant associations were found between levels of autism risk and the selected variables, as the calculated p-values exceeded 0.05. This indicates that autism risk levels are not dependent on the measured sociodemographic or perinatal factors. However, autism scores were significantly associated with age ($\chi^2 = 81.02$, $p = 0.00$). These findings are partially consistent yet also divergent from a cross-sectional study conducted by Al-Mazidi et al, which enrolled 223 participants. In their study, 62% of ASD patients were screened by three years of age, with most screenings (66%) initiated by non-physicians. Furthermore, 40.8% of parents reported that required services were available in their area, but only 7.9% expressed satisfaction with these services. Parents who received psychological support (9.9%) initiated early intervention, which was associated with better prognosis ($p \leq 0.005$). Conversely, stigmatized parents were more likely to delay intervention ($p \leq 0.005$). Their findings emphasize the importance of family-centered medical homes for ASD patients, which could enhance parental satisfaction, reduce stress, and facilitate smoother transitions into adolescence.[8]

In our study population of 135 toddlers, the majority were two years old (45.9%), followed by one-year-olds (33.3%), with the smallest proportion being three-year-olds (20.7%). Gender distribution was nearly equal, with

50.4% male and 49.6% female participants. These findings are partially consistent yet also contradictory to a cross-sectional study conducted by Saito et al, which reported a male-to-female ratio of 2.2:1 in ASD prevalence. Their study found a cumulative incidence of ASD up to five years of age at 1.31% (95% CI 1.00-1.62%). Only 11.5% of children had ASD alone, while 88.5% presented with at least one co-existing neurodevelopmental disorder.[9]

In the present study, most toddlers (40%) were categorized as low risk for autism, while 33.3% were at medium risk, and 26.7% were at high risk. These findings are partially consistent yet also divergent from a cross-sectional study conducted by Sunita et al, which compared the Checklist for Autism in Toddlers (CHAT) with the Modified Checklist for Autism in Toddlers (M-CHAT). Their study emphasized that characteristic behaviors of autism should be evident before 18 months of age, and screening at 24 months is critical for identifying children who regress. They concluded that administering screening tools during 18–24-month well-child visits improves early identification, with M-CHAT demonstrating slightly better sensitivity and specificity compared to CHAT, making it preferable for developmental surveillance.[10]

Implications for practice and policy

These findings have several practical implications.

Early Screening Programs: The high proportion of toddlers at medium to high risk underscores the importance of integrating developmental surveillance into primary healthcare settings. Routine use of the M-CHAT-R/F at immunization visits or well-child clinics can facilitate early identification.

Training for Healthcare Providers: Frontline workers, especially nurses in community health centers, should be trained in administering and interpreting the M-CHAT-R/F. This can help bridge the gap in early detection and create a smoother referral pathway for screening and follow-up.

Parental Education and Awareness: Informing caregivers about early warning signs of ASD could enhance early help-seeking behaviour. Community outreach programs and health education campaigns can demystify ASD and reduce stigma, enabling a timelier response.

Future Research and Resource Allocation: The study calls for further research with larger and more geographically diverse samples. Policymakers could also use these findings to advocate for broader implementation of early screening and resource allocation to support intervention services.

This study has few limitations. The study was confined to small sample size (135 samples) owing to shortage of time for data collection; hence generalization cannot be done. The study was confined to selected villages of Ambala, Haryana. This narrow scope means the results may not represent broader populations across India or other regions. Only toddlers whose parents provided consent were included. This introduces potential selection bias, as families more aware or concerned about developmental issues may have been more likely to participate. A descriptive cross-sectional study, it captures data at a single point in time. This limits the ability to assess changes in autism risk over developmental stages or to establish causal relationships.

CONCLUSION

This study assessed the risk of autism spectrum disorder among toddlers residing in selected villages of Ambala, Haryana, using the M-CHAT-R/F. Our results revealed that 40% of the toddlers were at low risk while nearly 60% fell into medium or high-risk categories-a finding that highlights the pressing need for routine developmental screening in community settings. Among the variables examined, only age was significantly associated with autism risk, suggesting that developmental stage plays a critical role in the manifestation and detection of ASD-related behaviors.

The implications for public health are significant. Implementing systematic screening programs at primary care and immunization clinics, training healthcare professionals in early identification, and enhancing caregiver education could collectively reduce the burden of undetected ASD and improve long-term outcomes for affected children. Furthermore, these findings provide a foundation for future research in similar settings, where larger and more representative samples could clarify the interplay between various risk factors and ASD.

In summary, the present study contributes to the emerging data on ASD in the Indian context and underscores the value of the M-CHAT-R/F as an effective community-based screening tool. Through early screening and timely intervention, it is possible to positively influence developmental trajectories and ultimately enhance the quality of life for children at risk of ASD.

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