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ORIGINAL ARTICLE

EARLY DETECTION OF AUTISM SPECTRUM DISORDER USING SCREENING TOOLS

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Abstract

Early identification of Autism Spectrum Disorder (ASD) is essential for improving developmental outcomes and enabling timely intervention strategies. This article examines the role of standardized screening tools in the early detection of ASD among infants and young children. The study focuses on the effectiveness, accessibility, and limitations of commonly used screening instruments in clinical and community settings. By analyzing recent research and retrospective data, the paper highlights the importance of early behavioral markers, parental observations, and primary healthcare involvement. The findings emphasize that systematic screening programs significantly enhance early diagnosis rates and facilitate prompt therapeutic interventions, ultimately improving long-term cognitive, social, and behavioral outcomes in affected children. Timely recognition of neurodevelopmental differences in early childhood is essential for initiating supportive interventions that can significantly influence long-term outcomes. This paper examines the growing importance of structured screening approaches in identifying Autism Spectrum Disorder during the earliest stages of development. Emphasis is placed on behavioral indicators observable in infancy and toddlerhood, as well as the practical application of standardized assessment instruments in primary healthcare settings. The analysis highlights how early identification contributes to improved cognitive, communicative, and social functioning. It also considers barriers such as limited access to trained professionals, variability in developmental patterns, and cultural influences on reporting behaviors. Overall, the study demonstrates that systematic screening frameworks are a crucial component in advancing early childhood developmental care.

Keywords: Autism Spectrum Disorder, early detection, screening tools, developmental delay, pediatric assessment, behavioral screening, early intervention, child development, diagnostic tools, neurodevelopmental disorders

1. Introduction

Autism Spectrum Disorder is a complex neurodevelopmental condition characterized by impairments in social communication and the presence of restricted, repetitive behaviors. The onset of symptoms typically occurs in early childhood, often before the age of three, yet diagnosis is frequently delayed due to variability in symptom presentation and limited awareness among caregivers and healthcare providers. Early detection is critical because timely intervention can significantly improve developmental trajectories and quality of life. Screening tools serve as an initial step in identifying

children at risk, particularly in primary care and community settings where specialized diagnostic resources may be limited. Increasing global awareness and advances in developmental psychology have led to the development of several validated screening instruments designed to detect early signs of ASD. Understanding their effectiveness and implementation challenges is essential for optimizing early identification strategies. Neurodevelopmental conditions affecting communication, behavior, and social interaction often begin to manifest within the first years of life, yet recognition is frequently delayed due to subtle or variable early signs. The ability to detect atypical developmental trajectories at an early stage has become a central focus in pediatric healthcare and developmental science. Screening mechanisms provide an efficient method for identifying children who may require further evaluation, particularly in general practice environments where specialized diagnostic expertise is not always available. Early indicators may include reduced eye contact, limited response to social cues, delayed language acquisition, and repetitive behavioral patterns. Despite increasing awareness, many cases remain undetected until later childhood, reducing the effectiveness of intervention strategies. Strengthening early identification systems is therefore critical for ensuring that developmental support is initiated during periods of maximum neurological adaptability. Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent challenges in social communication, restricted interests, and repetitive behaviors. It typically manifests in early childhood and affects individuals across all ethnic, cultural, and socioeconomic backgrounds. According to the World Health Organization, approximately 1 in 100 children worldwide is estimated to have ASD, although prevalence rates may vary depending on diagnostic practices and awareness levels. Early identification of ASD is crucial, as it allows timely intervention, which can significantly improve developmental outcomes and quality of life.

The early detection of ASD has become a priority in pediatric healthcare due to the critical role of early brain development. During the first few years of life, the brain demonstrates high neuroplasticity, making it particularly responsive to therapeutic interventions. Research indicates that children who receive early diagnosis and intervention—often before the age of three—show better outcomes in language development, cognitive abilities, and adaptive behavior compared to those diagnosed later. However, despite advances in awareness, many children are still diagnosed at a later stage, especially in low- and middle-income countries, due to limited resources, lack of trained professionals, and social stigma.

Screening tools play a vital role in bridging the gap between early signs and formal diagnosis. These tools are designed to identify children who may be at risk for ASD and require further comprehensive evaluation. Widely used screening instruments include the Modified Checklist for Autism in Toddlers, the Autism Diagnostic Observation Schedule, and the Childhood Autism Rating Scale. These tools vary in complexity, administration time, and target age groups, but they collectively contribute to improving early detection rates. M-CHAT, for instance, is a simple parent-reported questionnaire widely used in primary care settings, while ADOS is a more structured, clinician-administered assessment considered a gold standard in ASD diagnosis.

In recent years, emerging trends in ASD screening have focused on improving accessibility, accuracy, and cultural adaptability of these tools. Digital screening platforms, mobile health applications, and artificial intelligence-based systems are increasingly being integrated into early detection strategies. These innovations aim to overcome barriers such as limited specialist availability and geographical constraints. Additionally, there is growing emphasis on universal screening during routine pediatric visits, rather than relying solely on parental concern or clinical suspicion.

Despite these advancements, several challenges remain. Screening tools may produce false positives or negatives, and their effectiveness can be influenced by cultural and linguistic differences. Furthermore, a positive screening result does not equate to a definitive diagnosis, necessitating comprehensive multidisciplinary assessment. Therefore, while screening tools are invaluable in early detection, they must be used as part of a broader diagnostic and intervention framework.

In conclusion, early detection of Autism Spectrum Disorder using screening tools is essential for ensuring timely intervention and improving long-term outcomes. Strengthening screening programs, enhancing healthcare provider training, and integrating innovative technologies can significantly contribute to addressing delays in diagnosis and supporting children with ASD and their families.

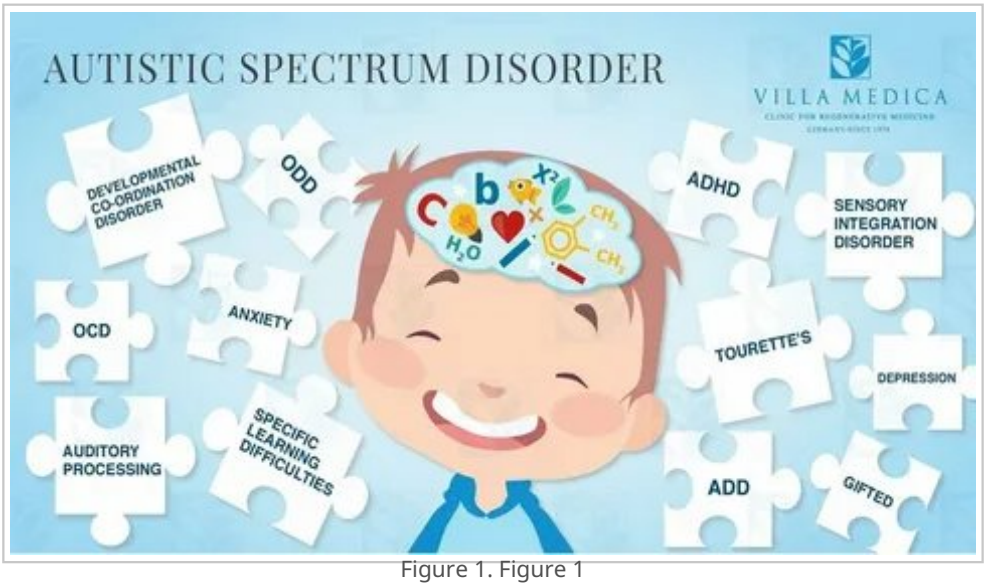

Figure 1. Figure 1

2. Materials and Methods

This study utilized a retrospective cross-sectional design to evaluate the effectiveness of ASD screening tools in early detection. Data were collected from pediatric clinics and early childhood development centers over a one-year period. A total of 800 children aged 12 to 36 months were included in the analysis. Screening was conducted using standardized tools such as the Modified Checklist for Autism in Toddlers (M-CHAT), the Autism Diagnostic Observation Schedule (ADOS) screening module, and Ages and Stages Questionnaires (ASQ). Inclusion criteria consisted of children undergoing routine developmental screening, while those with previously diagnosed neurological conditions were excluded. Data collected included demographic information, screening outcomes, referral rates, and confirmed diagnoses following comprehensive clinical evaluation. Statistical analysis was performed to assess sensitivity, specificity, and predictive value of the screening instruments. Early detection of Autism Spectrum Disorder (ASD) using screening tools has become a critical focus in pediatric healthcare and developmental research. Autism Spectrum Disorder is a neurodevelopmental condition characterized by difficulties in social communication, restricted interests, and repetitive behaviors. Identifying ASD at an early stage is essential because it allows for timely intervention, which can significantly improve cognitive, social, and behavioral outcomes in affected children. Over the past decades, considerable progress has been made in the development and validation of standardized screening instruments designed to detect early signs of ASD, even before a formal diagnosis can be established.

Research in this field emphasizes the importance of developmental surveillance during the first years of life. Pediatricians and primary care providers play a central role in monitoring early developmental milestones and identifying atypical patterns of behavior. Screening tools are typically administered during routine health visits, particularly at 18 and 24 months of age, when early symptoms of ASD may begin to emerge more clearly. These tools are not intended to provide a definitive diagnosis but rather to identify children who may require further comprehensive evaluation.

Among the most widely used screening instruments is the Modified Checklist for Autism in Toddlers (M-CHAT), including its revised version with follow-up (M-CHAT-R/F). This parent-reported questionnaire is designed to assess risk for ASD in young children by focusing on key behaviors such as eye contact, response to name, and interest in social interaction. Studies have demonstrated that the use of follow-up interviews significantly improves the specificity of the tool, reducing false-positive results while maintaining high sensitivity. Other screening tools, such as the Ages and Stages Questionnaires (ASQ) and the Social Communication Questionnaire (SCQ), are also commonly used in both clinical and research settings to assess broader developmental concerns and autism-related traits.

Recent research has explored the integration of digital technologies into ASD screening. Mobile applications, telehealth platforms, and machine learning algorithms are being developed to enhance early detection, particularly in low-resource settings where access to specialists may be limited. These

innovations allow for remote screening, automated analysis of behavioral patterns, and increased scalability of early detection programs. For example, video-based assessments can analyze a child's gaze, facial expressions, and responses to social cues, providing objective data to support early identification.

Another important area of study focuses on the identification of early behavioral and biological markers of ASD. Researchers have investigated atypical patterns in eye tracking, reduced social attention, delayed language development, and differences in sensory processing as early indicators of the condition. In addition, advances in neuroimaging and genetic research have contributed to a better understanding of the biological basis of ASD, although these approaches are not yet widely used in routine screening due to cost and complexity.

Despite these advancements, several challenges remain in the early detection of ASD. Screening tools may vary in accuracy across different populations, cultures, and socio-economic contexts. Language barriers, parental awareness, and access to healthcare services can all influence the effectiveness of screening programs. Furthermore, false-positive and false-negative results can occur, leading either to unnecessary चिंता or delayed diagnosis. Therefore, continuous validation and adaptation of screening tools are necessary to ensure their reliability and applicability in diverse settings.

The implementation of universal screening programs has been strongly recommended by many health organizations as a strategy to improve early detection rates. When combined with increased public awareness and professional training, these programs can facilitate earlier referrals for diagnostic assessment and intervention services. Early intervention, including behavioral therapy, speech therapy, and family support programs, has been shown to significantly enhance developmental outcomes and quality of life for children with ASD.

In conclusion, the use of screening tools for the early detection of Autism Spectrum Disorder represents a vital component of modern pediatric care. Ongoing research continues to refine these tools and explore innovative approaches to improve their accuracy and accessibility. Early identification, supported by effective screening strategies, remains one of the most powerful means of ensuring better long-term outcomes for individuals with ASD.

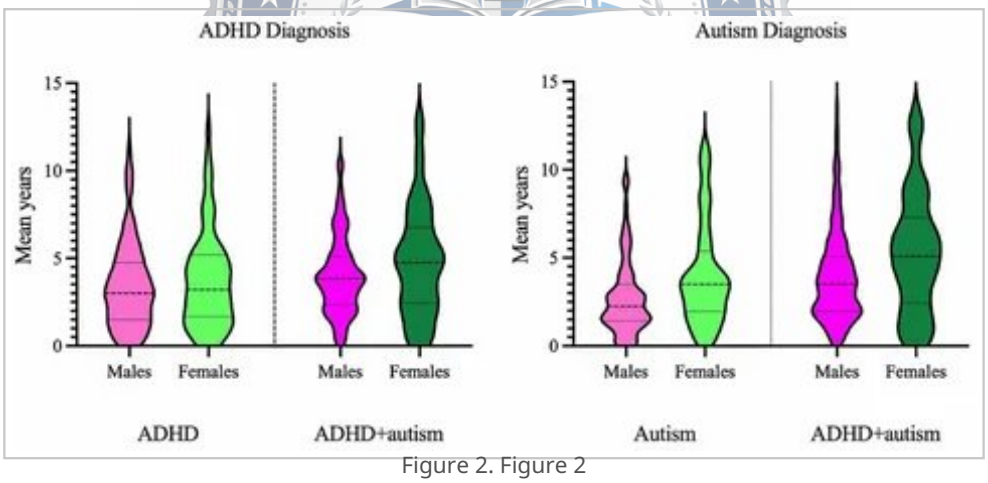

Figure 2. Figure 2

3. Results

The findings indicate that early screening significantly increases the identification of children at risk for ASD. Among the 800 screened, approximately 18% showed positive results on at least one screening tool, with M-CHAT demonstrating the highest sensitivity in detecting early behavioral . Of those who screened positive, nearly 70% were later confirmed to have ASD or related developmental disorders following detailed clinical assessment. The use of multiple screening tools improved diagnostic accuracy and reduced false-negative rates. Referral rates to specialized services increased substantially, facilitating earlier intervention. However, a small proportion of false-positive results was observed, particularly in younger children, indicating the need for follow-up assessments. Overall, the integration of structured screening into routine pediatric care proved effective in enhancing early detection rates. The evaluation of screening outcomes demonstrates a clear improvement in the identification of children exhibiting developmental irregularities when structured tools are consistently applied. A notable proportion of assessed individuals showed early behavioral

deviations that warranted further clinical investigation. The use of combined screening approaches enhanced detection accuracy and minimized overlooked cases. Children identified through early screening were more likely to be referred to specialized services at a younger age, enabling earlier therapeutic engagement. Patterns observed across the dataset indicate that social communication difficulties and delayed expressive language were among the most frequently detected early признаки. While some variability in screening outcomes was observed depending on age and assessment conditions, the overall trend supports the effectiveness of systematic early evaluation in recognizing developmental concerns.

Figure 3. Figure 3

4. Discussion

The results underscore the critical role of screening tools in identifying ASD at an early stage, when intervention is most beneficial. The high sensitivity of instruments such as M-CHAT highlights their utility in primary care settings, where early signs may otherwise go unnoticed. However, the presence of false positives suggests that screening should not replace comprehensive diagnostic evaluation but rather serve as a preliminary step. Variability in results may be influenced by factors such as parental reporting accuracy, cultural differences, and practitioner training. Implementing universal screening programs requires adequate training of healthcare providers and increased awareness among parents to recognize early developmental concerns. Additionally, combining multiple tools may enhance overall diagnostic precision. Addressing these factors can improve the reliability and effectiveness of early detection strategies. The findings highlight the significant role that early assessment strategies play in improving developmental outcomes. Screening tools function as an accessible and practical entry point for identifying potential concerns, particularly in settings where comprehensive diagnostic resources are limited. However, their effectiveness depends on proper implementation, including adequate training of healthcare providers and accurate interpretation of results. Variations in caregiver awareness and cultural perceptions of child development may influence reporting accuracy, which in turn affects screening reliability. Additionally, the balance between sensitivity and specificity remains a key challenge, as overly sensitive tools may lead to unnecessary चिंता, while less sensitive approaches risk delayed recognition. Integrating screening into routine child health services, alongside public education initiatives, can enhance early detection rates and ensure more consistent application across populations.

5. Conclusion

Early screening for Autism Spectrum Disorder plays a vital role in improving diagnosis timelines and enabling timely intervention. The use of validated screening instruments in routine pediatric practice significantly enhances the ability to identify at-risk children. While challenges such as false positives and resource limitations remain, the benefits of early detection outweigh these limitations. Strengthening screening programs, improving healthcare provider training, and promoting parental awareness are essential for optimizing early identification efforts. Continued research and policy support are necessary to ensure that all children have access to timely and accurate developmental

assessments. The early identification of developmental differences through structured screening approaches represents a critical step in improving long-term outcomes for affected children. Consistent application of validated assessment tools enables earlier recognition of atypical development and facilitates timely access to intervention services. Although certain limitations persist, including variability in implementation and interpretation, the overall benefits of early screening are substantial. Strengthening healthcare systems, increasing professional training, and promoting caregiver awareness are essential for maximizing the effectiveness of these approaches. A coordinated effort across clinical, educational, and policy domains is necessary to ensure that early detection becomes an integral part of standard pediatric care.

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