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SCREENING, DEVELOPMENT, AND INTERVENTIONS IN AUTISM SPECTRUM DISORDER: A SYSTEMATIC REVIEW

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ABSTRACT

Objective: To analyze the scientific production on Autism Spectrum Disorder (ASD), in order to investigate the relationship between early screening, the recognition of risk factors and the impact of therapeutic models in promoting better prognosis for pediatric patients. Methodology: A literature review was carried out using the PubMed and VHL databases, with the descriptors: autism, screening, early diagnosis, risk factors, and therapeutic intervention, from 2019 to 2023. A total of 312 articles were identified, and, after applying inclusion and exclusion criteria, 32 studies were selected for analysis, but only 7 were used to compose the collection. Results: ASD is characterized by a wide clinical heterogeneity, manifesting itself in symptoms such as delays in expressive communication, deficits in social interaction, and restricted and repetitive patterns of behavior. Among the most frequently reported risk factors are genetic predispositions, perinatal complications, and environmental influences. The literature analyzed highlighted the importance of methods such as the Modified Checklist for Autism in Children (M-CHAT-R/F), eye tracking, and machine learning algorithms in the early screening of ASD, allowing interventions initiated in the first years of life. Studies have also highlighted that therapeutic models based on

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multidisciplinary approaches, such as multiaxial diagnosis and the D.I.R./Floortime® model, are fundamental to improve social, communicative, and emotional skills, promoting greater inclusion and quality of life. Conclusion: Early identification of the signs and symptoms of ASD, coupled with the use of innovative screening tools and integrated therapeutic interventions, plays an essential role in promoting better prognosis for autistic children. Strategies that consider the individuality of each case and the complexity of the factors involved can transform the developmental trajectory of these children, ensuring more adequate and effective support.

Keywords: Autism Spectrum Disorder. Early screening. Risk factors. Multidisciplinary intervention. Prognosis.

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that profoundly affects social interaction, communication, and behavior, and is characterized by restricted interests and repetitive behaviors (VACAS et al., 2021; Baghdadli et al., 2019; Burns et al., 2023). This spectrum represents a diversity of clinical manifestations, whose complexity reflects both the individual variability of symptoms and the difficulties for an early and effective diagnosis (VACAS et al., 2021). Recent data point to a significant increase in global ASD diagnosis rates, with a prevalence of 1 in 36 children by the age of 8, according to CDC reports (Burns et al., 2023). Although this increase is attributed in part to increased public awareness and the sensitivity of diagnostic methods, the clinical heterogeneity of cases represents a substantial obstacle to full understanding of the disorder (Burns et al., 2023).

Advances in methodologies such as eye tracking have played a key role in identifying early markers of ASD, such as atypical patterns of social attention, from the earliest years of life (VACAS et al., 2021). These methods not only aid in early detection, but also reveal patterns related to difficulties in processing emotional and social stimuli, which can directly influence prognosis and intervention approaches (VACAS et al., 2021). In addition, the presence of comorbid conditions such as attention deficit hyperactivity disorder (ADHD) and language disorders increases the complexity of clinical management, requiring integrated and personalized strategies to meet the needs of each individual (Burns et al., 2023).

To conduct a systematic review of the clinical manifestations and prognoses of ASD, with the aim of consolidating existing knowledge, identifying gaps in the literature, and providing subsidies for the improvement of early diagnosis and interventions. Given the growing prevalence of ASD and the significant heterogeneity of its clinical manifestations, it is essential to organize and critically analyze the available evidence on the subject. A systematic review will allow the identification of recurrent clinical patterns and potential prognostic markers, as well as highlight approaches that promote better outcomes for individuals with ASD and their families. In-depth understanding of these variables will not only contribute to science, but also offer practical guidance for multidisciplinary management and support for affected communities.

METHODOLOGY

This is a literature review that seeks to understand the aspects related to Autism Spectrum Disorder (ASD), analyzing early screening methods, associated risk factors and

therapeutic interventions, with the aim of improving the diagnosis and prognosis of pediatric patients. For the development of this research, a guiding question was elaborated through the PVO strategy (population, variable and objective): **"What is the importance of early screening, risk factors and therapeutic interventions in the clinical management and prognosis of children diagnosed with ASD?"**

The searches were carried out through the PubMed Central (PMC) and Virtual Health Library (VHL) databases. The following descriptors were used in combination with the Boolean term "AND": Autism, Early Screening, Risk Factors, Therapeutic Interventions, Prognosis. The search strategy in the PMC database was: ((Autism) AND (Early Screening)) AND (Risk Factors) AND (Prognosis), and in the VHL it was: (((Autism) AND (Early Screening)) AND (Therapeutic Interventions)) AND (Prognosis). From this search, 312 articles were found, which were subsequently submitted to the selection criteria.

The inclusion criteria adopted were: articles available in English, Portuguese and Spanish; published in the period from 2019 to 2023; and that directly addressed the proposed theme. Review, observational, and experimental studies were included, all of which were made available in full. The exclusion criteria consisted of: duplicate articles, available only in abstract form, that did not directly address the topic studied or that did not meet the inclusion criteria.

After associating the descriptors and applying the selection criteria, 312 articles were identified, 298 from the PubMed database and 14 from the Virtual Health Library. After applying the inclusion and exclusion criteria, a total of 32 articles were selected to compose the analysis and 7 were used to compose the collection.

DISCUSSION

Understanding the etiology, risk factors, and prognosis of Autism Spectrum Disorder (ASD) plays a key role in enhancing the care and support offered to individuals diagnosed with this condition. The natural history of ASD, which refers to the evolution of the disorder over time without specific intervention, offers an essential basis for recognizing developmental patterns and identifying therapeutic approaches that can promote better outcomes. Findings about the factors influencing ASD provide an opportunity to develop personalized and targeted interventions, which can positively transform the life trajectory of diagnosed children (Baghdadli et al., 2019).

ASD is marked by a wide diversity of clinical manifestations and developmental trajectories, evidencing its highly heterogeneous nature. The natural history of ASD demonstrates that there is no single developmental path common to all diagnosed

individuals. Instead, children may follow distinct trajectories, ranging from significant symptom improvement to persistent lifelong challenges. This diversity is influenced by factors such as intellectual capacities, adaptive abilities, the presence of comorbidities, and family and environmental support (Baghdadli et al., 2019).

Some children demonstrate substantial progress in developing social and communicative skills when exposed to early and intensive interventions, while others face long-lasting challenges. Genetic and biological factors also play an important role, highlighting the need for comprehensive evaluations to understand the specifics of each case. This variability reinforces the importance of individualized approaches that meet the unique needs of each child (Baghdadli et al., 2019).

The risk factors for the development of ASD are varied and cover genetic, biological and environmental aspects. Genetic factors have a significant impact, with specific mutations and genetic inheritance associated with increased likelihood of developing the disorder. Hereditary conditions can predispose individuals to neurological changes that influence the development of ASD (Baghdadli et al., 2019).

In addition, biological factors, such as complications during pregnancy and childbirth, are also considered of great relevance. Prematurity, exposure to toxic substances during pregnancy, and maternal infections have been linked to an increased risk of ASD. These conditions can affect the neurological development of the fetus, contributing to the onset of the disorder. However, it is important to note that these influences often interact with genetic predispositions, making it difficult to establish direct causal relationships (Baghdadli et al., 2019).

Environmental factors, such as exposure to pollutants and adverse socioeconomic conditions, are also associated with ASD. For example, studies indicate that viral infections during pregnancy or exposure to chemicals can act as triggers for changes in neurological development in genetically predisposed fetuses. However, it is essential to continue investigating these factors to refine preventive strategies and identify effective interventions (Baghdadli et al., 2019).

The prognosis of children with ASD is largely determined by early identification and the quality of therapeutic interventions implemented. Behavioral, educational, and psychosocial interventions, especially when initiated during the first years of life, can significantly improve social, cognitive, and communicative skills. Children who have intellectual abilities in the middle range or above and who demonstrate greater adaptability to the environment tend to have better long-term outcomes (Baghdadli et al., 2019).

In addition, family and social support is one of the most determining factors for the success of interventions. Families who have access to appropriate resources and who are actively involved in the therapeutic process are often able to foster an environment conducive to the child's development. Inclusive school environments and communities that offer adequate support also play a crucial role in improving prognosis (Baghdadli et al., 2019). Comorbidities, such as sleep disturbances, gastrointestinal conditions, and psychiatric problems, can complicate the prognosis, requiring a multidisciplinary and comprehensive approach to meet the child's physical and emotional needs. Addressing these conditions in an integrated manner is essential to ensure a higher quality of life and more harmonious development (Baghdadli et al., 2019).

Longitudinal research, such as the ELENA study, provides crucial insights into the factors that influence the development and prognosis of children with ASD. By following individuals over time, these studies help identify patterns of progress, genetic, and environmental factors that contribute to the severity and evolution of symptoms. This data is essential for refining intervention strategies and personalizing care, maximizing developmental opportunities for each child (Baghdadli et al., 2019). In addition, advances in genetic and biomedical research have the potential to identify biomarkers that help predict the course of ASD and personalize therapeutic interventions. Understanding how biological, environmental, and social factors interact can transform the way ASD is diagnosed and treated, paving the way for a brighter future for affected children and their families (Baghdadli et al., 2019).

The analysis of the etiology, risk factors, and prognosis of ASD reveals the complexity of this disorder and the importance of a multidimensional approach in the care and support of diagnosed individuals. The study by Baghdadli et al. (2019) emphasizes that, although ASD is characterized by great heterogeneity, early identification and the development of personalized interventions can significantly transform the life trajectory of affected children. With the advancement of research and the implementation of more effective intervention strategies, it is possible to promote a better quality of life and a fuller development for children with ASD, providing them with real opportunities to reach their full potential.

SCREENING AND EARLY IDENTIFICATION OF AUTISM SPECTRUM DISORDER (ASD)

Early diagnosis and intervention allow therapeutic measures to be initiated as early as possible, during critical periods of brain plasticity, maximizing the child's potential to develop social, communicative, and cognitive skills. Recent studies have explored

innovative approaches that integrate machine learning and traditional screening techniques to improve the accuracy and efficiency of ASD identification.

Early identification of ASD is critical to initiating behavioral and educational interventions before the symptoms of the disorder become more evident. As highlighted by Cary et al. (2021), machine learning has shown to be a promising approach to analyzing biomedical data and identifying markers associated with ASD in newborns. This method makes it possible to analyze information collected during pregnancy and childbirth, such as ultrasound measurements and biological variables. The algorithm used in the study demonstrated effectiveness in classifying babies into two groups: those with and without ASD. Despite limitations, such as a 41% hit rate for true positives, the results indicate that machine learning can be a powerful tool to support diagnostic processes and thus potentially positively influence the prognosis of these children (Cary et al., 2021).

The use of modern technologies, such as artificial neural networks, has been studied to automate and enhance ASD screening. According to Achenie et al. (2019), the implementation of the feed-forward neural network (fANN) represents a significant advancement in terms of efficiency and accuracy. This technique was used to interpret the 20 items of the Revised Modified Checklist for Autism in Children (M-CHAT-R), demonstrating exceptional classification accuracy, reaching up to 99.72% in certain samples. The reduction in human error and faster data processing make this approach a valuable alternative to traditional practices, especially in diverse populations. In addition, the results of the study indicate that fANN can be adapted for different demographic subgroups, further increasing its relevance and applicability (Achenie et al., 2019).

M-CHAT-R/F is widely recognized for its effectiveness in screening children at risk for ASD. As reported by Medeiros et al. (2019), the revised and culturally adapted version of this tool for specific populations, such as in the Chilean context, reinforces its applicability and usefulness in different clinical settings. The validation of M-CHAT-R/F demonstrated its high sensitivity and specificity, characteristics that are critical to differentiate children with ASD from those without the disorder. This distinction allows for the proper allocation of therapeutic resources and avoids misdiagnosis. In addition, the training of health professionals for the application and interpretation of this tool is indispensable, ensuring accuracy and quality in the subsequent screening and intervention processes (Medeiros et al., 2019).

While M-CHAT-R/F has proven to be highly effective, its integration with machine learning can further enhance screening processes. As evidenced in the study by Achenie et al. (2019), the combination of traditional techniques and advanced technologies can reduce

the reliance on subjective interpretations and increase the accuracy of identifying children at risk. This synergy between human and technological methods represents a significant step towards addressing the heterogeneity of ASD and ensuring that no at-risk child is overlooked.

Advances in screening and early identification of ASD have direct implications for public health. The ability to detect ASD at early stages not only improves individual outcomes for affected children, but also reduces costs associated with delayed management and complications of the disorder. Tools such as machine learning and culturally adapted M-CHAT-R/F are examples of solutions that can be implemented at scale, promoting equity in access to diagnosis and treatment (Cary et al., 2021; Medeiros et al., 2019).

In conclusion, screening and early identification of ASD is an ever-evolving field, driven by technological innovations and refinements in clinical practices. Studies such as those by Cary et al. (2021), Achenie et al. (2019), and Medeiros et al. (2019) show that the integration of machine learning with traditional tools, such as M-CHAT-R/F, offers opportunities for a more accurate and comprehensive diagnosis. These approaches have the potential to transform the way ASD is detected and treated, contributing significantly to improving the quality of life for children and their families.

Early intervention has been shown to be one of the most effective tools to improve the prognosis of children with Autism Spectrum Disorder (ASD). The adoption of therapeutic models that integrate different approaches, such as multiaxial diagnosis and evidence-based therapies, is essential to understand the particularities of each case and offer personalized support. The model developed at the Center for Baby and Child Studies (CEBC), in Portugal, is a pioneering example of how the joint action of professionals from different specialties can contribute to an accurate diagnosis and effective interventions (Silva et al., 2021).

The use of the DC:0-5™ rating system, which adopts a multiaxial approach, has been central to the CBBC model. This approach allows a comprehensive view of the clinical picture, by considering not only the diagnostic criteria, but also the contextual conditions, psychosocial stressors, physical conditions, and developmental competencies. Each of the five axes provides critical information for a more accurate diagnosis, identifying both the child's specific difficulties and the environmental factors that may be contributing to the condition (Silva et al., 2021)

In addition, the multiaxial approach facilitates the systematization of clinical data and highlights the relationships between individual and contextual factors. This makes it

possible to identify interactions that can influence the child's development, allowing for more targeted and effective interventions. Such an approach reflects a deep understanding of the complexities associated with ASD, emphasizing that the diagnosis goes beyond observing the core symptoms of the disorder (Silva et al., 2021).

The CBBC takes an innovative approach, combining weekly diagnostic and therapeutic sessions based on the D.I.R./Floortime® model. This therapeutic model emphasizes the development of emotional competencies and the construction of relational bonds, involving both the child and caregivers in an environment of structured interaction. The approach focuses on promoting social-emotional development through activities that stimulate communication, creativity, and emotional regulation (Silva et al., 2021).

The therapeutic sessions include Occupational Therapy, Speech Therapy and Psychology, seeking to meet the specific needs of each child. Occupational Therapy, for example, works directly with sensory and motor difficulties, helping children to develop functional skills and participate in everyday activities. Speech Therapy, on the other hand, focuses on the development of expressive and receptive language, while psychological support addresses emotional and behavioral issues (Silva et al., 2021).

The CBBC model highlights that early and frequent interventions can significantly change the developmental trajectories of children with ASD. By identifying the early signs of ASD and starting treatment at an early age, it is possible to minimize developmental delays and maximize the child's potential in areas such as communication, social skills, and emotional regulation (Silva et al., 2021)

Another essential aspect is the inclusion of parents in the therapeutic process. The active involvement of the family, both in diagnosis and treatment, not only strengthens family bonds but also facilitates the generalization of acquired skills to other contexts. In addition, caregivers play a vital role in identifying subtle changes in the child's behavior, contributing to adjustments in the intervention, when necessary (Silva et al., 2021).

While the CBBC model is considered a benchmark, it faces significant challenges, such as a shortage of specialized human resources. This limitation often restricts the number of children who can be served, directly impacting the accessibility to essential services for the development of children with ASD. In addition, the cultural and social diversity of the families served demands even more personalized approaches to ensure that interventions are effective and culturally appropriate (Silva et al., 2021). The intervention model adopted by the CBBC exemplifies a comprehensive and effective approach to the diagnosis and treatment of ASD. By combining multiaxial diagnosis with early, individualized therapeutic interventions, the center provides essential support for children

and their families, helping to improve prognosis and quality of life. However, the success of this model depends on the continuous expansion of resources and the improvement of therapeutic strategies, ensuring that more children can benefit from an integrated and innovative approach like this (Silva et al., 2021).

PSYCHOMOTOR DEVELOPMENT AND WARNING SIGNS

Psychomotor development is a fundamental aspect of child health and well-being, encompassing the acquisition of motor, cognitive, communication, and socio-emotional skills, which are crucial for the full development of children. For premature babies, whose pregnancies were terminated before 37 weeks, these aspects become even more critical due to the increased risks of developmental delays and conditions. With the growing understanding of the impact of these delays and the associated warning signs, health professionals have emphasized the importance of identifying potential developmental deviations early and implementing specific and timely interventions (Taczala et al., 2021).

"Warning signs" are specific indicators of possible delays or problems in child development. These signs are observed in different areas, such as gross motor skills, fine motor skills, communication, cognitive and socio-emotional skills. For premature infants, signs may include difficulties in achieving expected developmental milestones, such as sitting without support, crawling, vocalizing, or showing interest in the environment. Identifying these signs early is essential, as it provides healthcare professionals with the opportunity to implement therapeutic interventions that can compensate for difficulties and prevent long-term complications (Taczala et al., 2021).

For example, in gross motor skills, it is expected that at 9 months a baby will be able to roll to both sides and sit without support, while by 24 months he should be able to run, jump and kick a ball. The inability to achieve these milestones within the expected period can be a strong indication of motor delay. Similarly, in communication, the absence of vocalizations or the inability to form two-word sentences at 24 months are clear signs that require immediate attention. These signals allow parents and health professionals to direct their efforts to specific areas that need support (Taczala et al., 2021).

Language regression is another significant issue in child development, especially among children diagnosed with Autism Spectrum Disorder (ASD). This condition, characterized by the loss of previously acquired language skills, can be deeply concerning for caregivers. However, as highlighted by Pickles et al. (2022), language regression, which affects about 22% of children with ASD, does not necessarily imply a worse prognosis. Research shows that while these children may experience more pronounced early delays in

expressive and receptive communication, many of them eventually regain lost skills and continue to develop their communication at a rate comparable to children who did not experience linguistic regression (Pickles et al., 2022).

The study also revealed that children with regression had an early early development of motor and speech skills, which may paradoxically be associated with the risk of regression. Despite this, communication developmental trajectories are highly varied and often influenced by preexisting motor and cognitive factors, highlighting the importance of an individualized approach in assessing and supporting these children (Pickles et al., 2022).

Visual preference and social attention are crucial components in the development of human interaction skills, especially during the first years of life. These skills form the basis for children's social, emotional, and cognitive development. When we consider children with Autism Spectrum Disorder (ASD), these areas take on even greater relevance, due to the specific characteristics of the disorder, such as difficulties in social interactions and atypical patterns of visual behavior. Recent studies have investigated how children with ASD process social stimuli compared to non-social ones, revealing fundamental patterns that can help better understand their needs and potentialities (Vacas et al., 2021).

Children with ASD often exhibit atypical visual behavior, which translates into a lower allocation of attention to faces and other social stimuli. Compared to typically developing (TD) children, they tend to direct their gaze to nonsocial objects, such as inanimate items, rather than human faces. This difference in pattern is evident from the first years of life, suggesting that visual behavior may be an important marker for the early diagnosis of ASD. Studies using eye tracking, such as that of Vacas et al. (2021), highlight that children with ASD spend less time on human faces, which is directly related to their difficulties in social engagement and emotional recognition (Vacas et al., 2021).

This atypical behavior in visual attention directly impacts the development of social skills. By spending less time looking at faces, children with ASD have fewer opportunities to learn crucial social cues, such as facial expressions and eye contact. This can make it difficult for them to develop meaningful social interactions and limit their communication skills in the long run (Vacas et al., 2021).

Emotional expressions play an important role in determining visual preference. In the case of children with ASD, the study by Vacas et al. (2021) showed that, although they demonstrate a preference for happy faces, this preference is less pronounced than in children with ASD. In addition, these children exhibit an emotional bias, characterized by a delayed orientation toward angry faces. This reduced sensitivity to negative expressions

can compromise their ability to interpret and respond appropriately to social situations, further complicating their day-to-day interactions (Vacas et al., 2021).

Despite these differences, it is encouraging to note that children with ASD still show some preference for positive emotional stimuli, such as smiling faces. This indicates that they have some level of emotional response that can be amplified and enhanced through therapeutic interventions aimed at increasing sensitivity to social stimuli (Vacas et al., 2021). Circumscribed interests (CIs), which are intense and restricted interests in certain objects or themes, also play a significant role in the visual preference of children with ASD. Vacas et al. (2021) highlight that CIs often compete with the attention that would be directed to social stimuli. For example, instead of fixing their gaze on human faces, these children tend to focus on objects related to their specific interests, even when the faces express clear emotions. This preference can hinder the development of social skills, but it also represents a unique opportunity to create personalized interventions that leverage CIs as a starting point to promote social engagement (Vacas et al., 2021).

Therapeutic strategies that incorporate CI elements into activities can help gradually direct children's attention to social stimuli. This approach not only respects individual preferences but also fosters a more comfortable and motivating environment for learning new skills (Vacas et al., 2021). The identification of atypical patterns of visual attention has significant implications for the diagnosis and treatment of children with ASD. The analysis of visual behavior can provide important indicators that help in the early identification of the disorder, allowing interventions to be initiated at critical stages of development. Vacas et al. (2021) emphasize that therapeutic strategies that increase attention to social stimuli, such as interactive technologies and virtual reality-based games, can considerably improve these children's communication and social interaction skills (Vacas et al., 2021).

Additionally, using tools such as eye tracking to monitor eye attention can help personalize interventions based on each child's specific needs. This ensures more effective support, promoting more balanced development and paving the way for broader social inclusion (Vacas et al., 2021). The patterns of visual preference and social attention in children with ASD are markedly different from those observed in typically developing children, highlighting the importance of understanding these aspects for early diagnosis and intervention. The study by Vacas et al. (2021) provides a solid foundation for exploring how visual behavior can be used to identify early indicators of ASD and to develop effective therapeutic strategies. By integrating this knowledge into clinical and educational practice, it is possible to promote fuller development and more meaningful social engagement for children with ASD, improving their quality of life and future prospects.

Early detection of problems in psychomotor development, either through the identification of warning signs or by monitoring linguistic regression, is vital for the implementation of appropriate interventions. In premature infants, this includes multidisciplinary approaches such as physiotherapy, occupational therapy and speech therapy, which seek to improve motor skills, communication and social interaction. For children with ASD, therapeutic support can include behavioral and educational interventions, tailored to each child's specific needs, helping to maximize their developmental potential (Taczala et al., 2021; Pickles et al., 2022).

The psychomotor development of premature infants is a critical aspect of their health and well-being. Premature babies are those who are born before 37 weeks of gestation and, due to early birth, can face several challenges in neurological development (TACZALA et al., 2021).

An important aspect in the monitoring of these babies are the "warning signs" or "red flags". These warning signs are indicators of possible developmental delays or problems, which can be observed in different spheres, such as gross motor (large movements, such as sitting and walking), fine motor (small movements, such as picking up objects), cognitive (thinking and learning skills), communication (speech and language), and socio-emotional (interaction with other people) (TACZALA et al., 2021).

Careful observation of warning signs in premature infants can help detect serious conditions such as cerebral palsy (CP) and autism spectrum disorders (ASD) early. Cerebral palsy is a condition that affects muscle movement and coordination, while autism spectrum disorders involve challenges in communication and social interaction (TACZALA et al., 2021).

Table (1): Comparison of Specific Developmental Milestones and Possible Warning Signs

Development Area	Warning Signs	Specific Milestones
Gross Motricity (GM-S)	Inability to roll to either side, sit without support, crawl, or walk in the expected time.	At 9 months: Roll over to both sides and sit without support. At 24 months: Run, jump and kick a ball.
Fine Driving (FM-S)	At 9 months: Do not pick up objects with your thumb and fingers, do not touch objects with your index finger.	At 9 months: Pick up small objects with your thumb and fingers, touch objects with your index finger.
	At 24 months: Inability to stack blocks, use a spoon, or help get dressed.	At 24 months: Stack blocks, use a spoon and help get dressed.
Communication (COM)	At 9 months: Absence of vocalizations, lack of reaction to sounds, not using simple words.	At 9 months: Look at familiar objects and vocalize to initiate communication.
	At 24 months: Do not use two-word sentences, incomprehensible speech, do not respond to one's own name.	At 24 months: Use two-word phrases, understandable speech to strangers.
Cognitive (COG)	At 9 months: Not showing object permanence, lack of interest in exploring the environment.	At 9 months: Demonstrate object permanence, look for hidden toys.

	At 24 months: Inability to participate in pretend play or lack of interest in more complex toys.	At 24 months: Symbolically represent and participate in make-believe games.
Social-Emotional (SO-MS)	Lack of interest in the caregiver's face, lack of eye contact, inability to calm down when upset.	At 9 months: Explore the caregiver's face, look for hidden toys.
	At 24 months: Do not show empathy, do not comfort other children, do not participate in side games.	At 24 months: Show empathy, comfort other children, and participate in side games.

Source: The authors.

In short, psychomotor development is a complex and interconnected process, particularly vulnerable in specific populations such as premature infants and children with ASD. Identifying warning signs and understanding phenomena such as linguistic regression are essential steps to ensure that these children receive the support they need to overcome challenges and achieve significant developmental milestones. Studies such as those by Taczala et al. (2021) and Pickles et al. (2022) underline the importance of early and personalized interventions, which can positively transform the life trajectory of these children and their families.

Comorbidities in Autism Spectrum Disorder (ASD) represent an area of growing interest in clinical research, as they bring valuable insights into the heterogeneity of the disorder and its impacts on diagnosis, prognosis, and treatment. The study by Burns et al. (2023) illustrates how medical and neurodevelopmental comorbidities are closely associated with ASD, highlighting the need for personalized and multidisciplinary approaches in the care of affected children.

Comorbidities are often seen in children with ASD, adding a layer of complexity to the diagnosis and management of the disorder. The study by Burns et al. (2023) identified that approximately 29% of children diagnosed with ASD in Manitoba had one or more medical comorbidities. In addition, 23% of these children also had global developmental delay (GDD), a condition that involves significant delays in multiple areas of development, including motor skills, language and cognition. These data reflect how frequent comorbidities can be and, in many cases, determinant in the developmental trajectory of children with ASD (Burns et al., 2023).

The findings also indicated that premature children and those with comorbidity of PDD are more likely to have conditions associated with ASD, such as neurological problems. Neurological comorbidities, including cerebral palsy, seizures, and hypotonia, were the most common, present in 37.1% of the children in the study. In addition, the study revealed that girls were more likely to have neurological and genetic comorbidities than boys, reinforcing the importance of considering gender differences in assessment and intervention (Burns et al., 2023).

Burns et al. (2023) classified comorbidities into several key categories, including:

1. **Neurological Comorbidities**: These include conditions such as cerebral palsy, characterized by motor difficulties, and seizures, which require careful clinical management. Hypotonia, which manifests as reduced muscle tone, is also often seen in children with ASD and can impact fine and gross motor skills.
2. **Genetic Comorbidities**: Some children have specific genetic conditions, such as Klinefelter Syndrome, Trisomy 21 (Down Syndrome), and Tuberous Sclerosis. These genetic conditions are associated with different degrees of impairment in physical, cognitive, and behavioral development, intensifying the need for specialized care.
3. **Allergic and Gastrointestinal Conditions**: Food allergies, asthma, and eczema have been reported to be frequent in children with ASD. Gastrointestinal problems, such as gastroesophageal reflux and feeding difficulties, are also common and can negatively affect nutrition and overall well-being.
4. **ENT Conditions**: These conditions include conductive hearing loss, recurrent otitis media, and procedures such as the insertion of tympanostomy tubes. Such conditions can impact hearing and language skills, highlighting the need for a multidisciplinary approach to care (Burns et al., 2023).

The presence of comorbidities contributes to the heterogeneity of ASD, making the diagnosis and management of the disorder more complex. As highlighted by Burns et al. (2023), some children may be classified as having "primary" ASD, when the disorder is the only condition identified, or "secondary" ASD, when there are associated comorbidities. This distinction can be useful for individualizing treatment and improving the allocation of health resources. In addition, the high prevalence of associated medical conditions underscores the importance of a comprehensive and judicious diagnosis, which considers both the main symptoms of ASD and the secondary conditions that can influence development and prognosis. The integration of multidisciplinary teams in the diagnostic and therapeutic process is essential to ensure that all of the child's needs are addressed in a holistic manner (Burns et al., 2023). Comorbidities in ASD represent a significant challenge, but also an opportunity to deepen the understanding of the disorder and improve therapeutic approaches. The study by Burns et al. (2023) highlights how these associated conditions can influence diagnosis, management, and long-term outcomes, reinforcing the need for personalized, evidence-based interventions. By considering the diversity of comorbidities associated with ASD, health professionals can develop more effective strategies to support the development and well-being of affected children and their families.

CONCLUSION

The analysis highlights the critical importance of early identification and interventions in the management of Autism Spectrum Disorder (ASD). ASD, characterized by its wide clinical heterogeneity, presents manifestations ranging from delays in expressive language and deficits in social interaction to restricted and repetitive behaviors. Recognizing these signs and symptoms early is essential for effective interventions to be applied, maximizing developmental potential and significantly improving the prognosis of diagnosed children.

Tools such as M-CHAT-R/F, eye tracking, and the use of technologies such as machine learning algorithms have proven valuable for early screening, contributing to diagnostic accuracy. At the same time, risk factors, including genetic predispositions, perinatal complications, and environmental influences, also play an essential role in understanding ASD and planning preventive and therapeutic strategies.

Additionally, the integration of innovative therapeutic models, such as multiaxial diagnosis and multidisciplinary approaches based on the D.I.R./Floortime® model, proves to be a promising approach in the treatment of ASD. These interventions, when coupled with the active involvement of families, not only promote significant advances in children's social, communicative, and emotional skills, but also offer essential support for their overall well-being and social inclusion. Therefore, early recognition of signs and symptoms, the application of advanced diagnostic tools, and the implementation of personalized therapeutic models are indispensable pillars for the effective management of ASD. This set of practices represents a valuable opportunity to transform the developmental trajectories of children with ASD, guaranteeing them better prospects for quality of life and full inclusion in society.

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