DOI: 10.2478/dcse-2022-0015

sciendo

Discourse and Communication for Sustainable Education,
vol. 13, no. 2, pp. 13–25, 2022

Early Detection Assessment Tools in Children With Autism Spectrum Disorder: A Literature Study

Muhammad Cahyadi, Thalsa Syahda Aqilah,
Ediyanto Ediyanto and Ahsan Romadlon Junaidi
Universitas Negeri Malang, Malang, Indonesia

Abstract

The high prevalence of Autism Spectrum Disorder (ASD) necessitates acquiring early detection tools that can lead to appropriate interventions for children and assist children in performing as many life functions as possible. In addition, early detection tools for ASD can realize quality early childhood development. This study aims to review various types of assessments for early detection of ASD in children using the literature review method. The following articles are from the website https://eric.ed.gov/ as search engine for scientific articles. Using the keywords "autism spectrum disorder assessment tools" and "early detection for autism," then peer-reviewed only and year filters since 2018, 2,829 articles were found. Then from the identified articles, they are re-elected based on title, abstract, and time of publication to produce 16 articles whose early detection tool was tested on more than 50 participants and began at the earliest possible age. The results show that various screening and diagnostic tools for ASD prioritize areas such as social communication, behavioral problems, emotional problems, sensory regulatory issues, and engagement issues. The instrument's limitations, which include an expensive price, a lengthy process, the need for expert involvement, and cultural differences, create a growing gap that must be bridged immediately.

Key words: autism spectrum disorder, assessment tools, inclusive education

Introduction

Various efforts are being made everywhere in the world, particularly in Indonesia, to support the sustainability of education for all, which is directly related to Sustainable Development Goal 4, namely ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. One of the goals is to ensure that all girls and boys have access to quality early childhood development, care, and pre-primary education by 2030 so that they are prepared for primary school (SDGS 2030; Ferguson et al., 2018). The importance of setting inclusion for all children, both typically developing and children with special needs, is constantly promoted (Ediyanto, Setiawan, Handaka, Rofiah, & Suhendri, 2021). The main realization that can be made is to create an assessment tool that can help direct children's education in the right direction.

Autism is still a significant topic that generates new research every year. The Asian continent, for example, reported an increase, taking into account the prevalence rate found in 2010, which was 0.15 %, and the number in 2020, which was 0.36 % (Qiu et al., 2020). Meanwhile, the United States reported that 2.9 % aged 3–17 years had autism, until 2016 (Xu et al., 2019). In 2016, 0.08 % of school-age children in a South African province were diagnosed with autism (Pillay, Duncan & de Vries, 2021). Every year, the number of children born with this condition rises (Fombonne, 2018; Hodges, Fealko, & Soares, 2020).

Autism spectrum disorderitself is a lifelong neurodevelopmental disorder that occurs in early childhood and is characterized by deficits in communication and social interaction, restricted interests, repetitive behaviors, and sensory problems (Grant, 2019; Lord et al., 2020; Feige, Mattingly, Pitts, & Smith, 2021). This disorder has a significant impact on the quality of personal and family life (Emily & Grace, 2015). In this regard, there is an unwritten agreement that this disorder can be minimized by providing early intervention (Irvan & Jauhari, 2019), which is preceded by early detection (Chakrabarti, Haubus, Dugmore, Orgill, & Devine, 2005; Fuller & Kaiser, 2020; Kurniawan, 2021).

The first step that parents can take to detect their child's condition is to become familiar with the child's developmental and growth milestones (Choo, Argawal, How, & Yeleswarapu, 2019). This must be done meticulously so that any deviations can be identified as soon as possible (Sheldrik et al., 2019). The follow-up to this deviation is early detection so that the child's condition can be correctly defined; autism spectrum disorder is one of the deviations (Baumer & Spence, 2018).

Currently, the gold standard for diagnosing individuals with autism spectrum disorder (ASD) is a complex, time-consuming process that requires a qualified multi-disciplinary team to evaluate behavioral data, history, and parental reports in order to establish a diagnosis (Horlin, Falkmer, Parsons, Albrecht, & Falkmer, 2014). To improve the validity of the resulting assessment, the diagnostic instrument should ideally be sensitive and specific, reliable and valid, simple and concise, and appropriate for all ages and ranges of the autism spectrum (Mayes et al., 2009). There is growing evidence that children with ASD benefit from starting intensive early intervention as soon as possible (Pasco, 2018).

However, in the absence of widely available and evidence-based diagnostic evaluation and screening procedures, access to opportunities for successful early intervention is becoming increasingly difficult. The length of time, lack of parental knowledge of early detection instruments, and reliance on referrals to specialists such as developmental pediatricians are frequently cited as reasons for the failure of early detection of ASD (Dosreis, Weiner, Johnson, & Newschaffer, 2008). Furthermore, universal early detection assessments can be considered successful if there are standardized and reliable screening tools that are culturally adaptable and can be accepted as a critical first step in developing an intervention stage for children with ASD.

Based on the preceding discussion, it is critical to collect the instruments used to detect ASD conditions in children. The article is then analyzed to identify opportunities for parental early detection of autistic children. With this early detection, parents are able to take the necessary steps to ensure their child's development.

Research Method

The use of literature studies is thought to be the best way to investigate how the variance of the types of early detection assessments for autistic children has changed over the

last five years. This study was carried out by selecting previously published scientific articles. Article search area selection, analysis, and categorization are the steps used. 16 articles were chosen that fit the category (focusing on early detection and assessment of autistic children).

Selection of the Articles

The process of selecting articles begins with a visit to the website: eric.ed.gov. The authors then found 8,680 related articles using the keywords "autism spectrum disorder assessment tools" and "early detection for autism" and only using peer-reviewed journals. With the novelty of the article in mind, the search was narrowed by using the year filter from 2018. There were 2,829 related articles found using this filter. Articles appearing in search results will be reviewed for title, abstract, and publication date. These articles were chosen between January and February of 2022.

In the second step, researchers focused on finding articles about early detection assessments for autistic children while excluding articles about assessments of autistic children's needs, assessments of children with special needs in general, and interventions for autistic children's conditions. Articles that discuss the assessment to detect autism in adults are also barred. Based on these criteria, 16 articles that are closely related to the existing research objectives were identified.

Analysis of Studies

Sixteen selected articles met the author's standards, such as the article that provided a complete discussion of the description of the early detection assessment used for autistic children and used more than 50 participants whose age was started as early as possible. This is in line with the study's goal of reviewing early detection assessments for autistic children.

Categorization of the Articles

Each article will be evaluated based on the steps implied in it, beginning with the introduction, and ending with the conclusion. The researcher also ensures that these articles have the potential to discuss supporting assessments. As a result, the study's findings will be based on an assessment for the early detection of ASD conditions in children.

Research Findings

Early detection tools for Autism Spectrum Disorder (ASD) are typically comprised of items capable of detecting social communication (Janvier et al., 2019; Roy, 2019; Lee et al., 2019; Hudry et al., 2021 and Zwaigenbaum et al., 2021; Wetherby et al., 2021; Wu et al., 2020; Pandolfi, Magyar, & Dill, 2017; Hudry et al., 2021; Choueiri et al., 2021). Several other instruments detect them by exploiting behavioral issues (Janvier et al., 2019; Rescorla et al., 2019; Coulter et al., 2021; Roman-Urrestarazu et al., 2021; Razaet al., 2019; Pandolfi, Magyar, & Dill, 2017; Hudry et al., 2021; Au et al., 2020). Meanwhile, emotional problems (Rescorla et al., 2019), sensory regulatory problems (Lee et al., 2019), and engagement problems (Hudry et al., 2021) can also be used for the early detection of children with Autism Spectrum Disorder. Further explanation can be seen in Table 1.

Table 1

Literature Review on Autism

Tools	Description	Author(s)	n*	Age range	Results
The Child Behavior Checklist for Ages 1½–5 (CBCL 1½–5) minutes.	A screening tool that contains a wide range of items related to behavioral and emotional problems in children.	Rescorla et al. (2019)	56	18 Months – 5 Years	The CBCL can identify a variety of other behavioral and emotional problems in young children that may require clinical attention and can be completed by parents in about 5
The Pervasive Developmental Disorder in Mental Retardation Scale (PDD-MRS)	The PDD-MRS assesses an individual's behavior in the previous 2–6 months that is consistent with an ASD diagnosis. It is designed specifically for children and adults with intellectual disabilities aged 2 to 70.	Pandolfi, Magyar, & Dill (2018)	386	3–15 Years	The adaptability of this test makes it simple to collect data (either through a clinical examination or a written report from the child's caregiver). PDD-MRS can be used for initial screening as well as further examination of previous assessment results.
First Year Inventory vers. 2.0 (FYI 2.0)	This is a parent-reported community-standardized screening instrument.	Lee et al. (2019)	121	12 Months and followed up at 36 Months	This assessment takes a long time. FYI 2.0 demonstrated the ability to detect early behavioral markers associated with ASD in a sample of infants who were genetically predisposed to ASD.
The Early Sociocognitive Battery	ESB includes three measures of children's sociocognitive: social responsiveness, shared attention, and symbolic understanding.	Roy & Chiat (2019)	205	2–4 Years	It takes about 15–20 minutes to complete. It entails parents completing a questionnaire. Age-sensitive. Suitable for use with children from a variety of linguistic backgrounds.
GP-MCHAT-R (Gaze Preference combined with the Modified Checklist for Autism in Toddlers-Revised)	This tool combines the first 15 seconds of manually coded gaze preference (GP) video with M-CHAT-R.	Jensen et al. (2021)	101	36–99 Months	Test GP-MCHAT-R (AUC = 0.89 (95 % CI: 0.82-0.95)), performed significantly better than MCHAT-R (AUC = 0.78 (95 % CI: 0.71) -0.85)) and gaze preference (AUC = 0.76 (95 % CI: 0.64-0.88)) alone in screening for ASD in children from low-ability settings.

See next page for continuation of table

Continuation of Table 1

Taiwanese version of the Screening Tool for Autism in Two-Year-Olds (T-STAT)	An interactive Level 2 screening tool for detecting ASD in high-risk individuals in Taiwan consists of 12 activity-based items measuring four social-communicative domains: play, prompting, joint attention, and imitation.	Wu, Chiang, Chu, Iao, & Hou (2021)	168	18–24 Months	It takes about 15–20 minutes to complete. To improve diagnostic accuracy, the T-STAT can be combined with parent-reported interviews or screening tools. Specific use in Taiwan.
The Early Screening for Autism and Communication Disorders (ESAC)	A parent-reported tool with an initial set of 46 items was developed to capture the heterogeneity of delayed social communication skills and early signs of ASD symptoms.	Wetherby et al. (2021)	471	12–36 Months	Maximize the family's role and provide reasonably accurate information about whether to refer for further evaluation. *Sensitivity* is between 0.86 and 0.92; *specificity* is between 0.74 and 0.8.
The Autism Diagnostic Interview-Revised (ADI-R)	This consists of a structured interview with data collected by a caregiver. Responses to items were classified into three domains that reflect the core characteristics of ASD: social interaction, communication, and repetitive behavior.	Samadi, McConkey, & Mahmoodizadeh (2021)	1454	4–11 Years	A revised version required the algorithm used in the ADI-R to identify children with ASD to better reflect the relationships between the items that comprise the identified factors. The ADI-R is given to children who are suspected of having ASD.
The COS Classroom Observation Scale (COS)	COS is made up of structured interviews and data gathered from caregivers. Responses to items were classified into three domains that correspond to the core characteristics of ASD: social interaction, communication, and repetitive behavior.	Au, Shum, Cheng, Tse, Wong, Li, & Au (2021)	304	3–4 Years	Can be conducted for 2 active school days.
The Toddler Autism Symptom Inventory	A semi-structured data-based interview with caregivers of children with ASD to assess the presence and absence of skills and symptoms in children.	Coulter et al. (2021)	294	12–36 Months	TASI is a short, semi-structured questionnaire that provides a clear operationalization of the DSM-5 diagnostic criteria for early childhood and is simple to use for ASD caregivers.

See next page for continuation of table

Continuation of Table 1

The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)	Based on age, developmental level, and language skills, this screening tool can accurately assess and diagnose autism spectrum disorders.	Vermeirsch, Verhaeghe, Casaer, Faes, Oostra, & Roeyers (2021)	55	0–3 Years	ADOS-2, which is fairly specific, identifies all children with ASD. This study backs up the use of ADOS-2 to identify ASD in a group of premature children. It's usually quite pricey.
The Rapid Interactive Screening Test for Autism in Toddlers (RITA-T)	This contains nine interactive activities designed to assess key social communication skills in toddlers at high risk of ASD, such as shared attention, social awareness, and human agency.	Choueiri et al. (2021)	81	18–36 Months	This is a Level-2 test that is affordable, valid, and easy to use.
The Autism Observation Scale for Infants (AOSI)	Brief observation and semi-structured assessment to measure early ASD-related behaviors in early childhood	Hudry et al. (2021) and Zwaigenbaum et al. (2021)	103	6–18 Months	Can be completed in about 15 months – 20 minutes and includes both semi-structured and structured elements designed to elicit a wide range of social communication, engagement, and other behaviors, assessed in 19 operationally defined codes.
The Quantitative Checklist (Q-CHAT 10)	This screening tool is a modification of Q-Chat 25 which is more affordable and easy to use.	Roman-Urresarazu et al. (2021) and Raza et al. (2019)	287	18–30 Months	The sensitivity of Q-CHAT 10 is acceptable, but its specificity is below the level recommended for clinical application.
The DCI Developmental Check-In	This is an ASD screening tool that employs images rather than written descriptions of behavior to reduce literacy requirements while increasing the clarity of target behavior. Visual representations of primary language, social development, and risk behaviors are included.	Janvier, Coffield, Harris, Mandell, & Cidav (2019)	376	24–60 Months	The findings indicate that this pictorial tool can reduce the demand for linguistic literacy and health when screening for autism in vulnerable populations.

* n = number of participants.

Discussion

Autism spectrum disorder is a term used to describe a group of symptoms that include early-onset social communication deficits and repetitive sensory-motor behavior, as well as a strong genetic component and other factors (Djordjević, Memisevic, Potic, & Djuric, 2021). Symptoms of autism spectrum disorder (ASD) usually appear in the first 3 years of life (Raj & Masood, 2020). The prevalence of autistic children is increasing from time to time. Currently, it reaches 1 in 54 children with ASD (Maenner, Shaw, & Baio, 2020). The high incidence of ASD is becoming increasingly serious and requires a revolution in our handling-which is getting better from time to time. Therefore, the form of intervention needs to be preceded by the existence of qualified, affordable, and evidence-based screening and diagnostic tools.

In recent years, there has been widespread acceptance of the importance of early detection and intervention in autistic children (French & Kennedy, 2018). The reason for this is that ASD affects approximately 1 % of the population and is associated with difficulties in life that can place a significant burden on the family, cost of living, medical costs, and education costs (Buescher et al., 2014; Elsabbagh et al., 2012). As a result, early detection and intervention can improve social communication in families with children with ASD (Fuller & Kaiser, 2020). Furthermore, early detection and intervention can reduce negative consequences and lifetime costs to the family and society (Horlin et al., 2014) and can be a benchmark for children's development and growth (Choo et al., 2019).

Early detection of ASD in children can result in early intervention, which has been shown to improve language and cognitive abilities later in life as well as alleviate the main symptoms of ASD (Landa, 2008; Zachor & Curatolo, 2014; Hus & Segal, 2021). For more than a decade, the American Academy of Pediatrics (AAP) has advocated for a generalized early detection assessment of ASD in all children during routine pediatric check-ups with a pediatrician, in this case, a pediatrician who specializes in autism (McCarty & Frye, 2020). Diagnostic tools and screening tools are two types of tools used to support data on the presence of ASD conditions in children. Both serve different functions while achieving the same goal.

The *de facto* ASD early detection assessment is the Modified-Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) (Campbell, Scheil, & Hammond, 2016). According to one study, this single assessment is widely distributed, easy for parents to use in 5–10 minutes, and is usually free (Robins et al., 2014). Therefore, M-CHAT-R/F is a type of early detection assessment level 1 that requires follow-up to get more accurate results (Pop-Jordanova & Zorcec, 2021). The Autism Diagnostic Observation Schedule – Second Edition (ADOS-2), an empirically supported observational assessment tool that can be used to determine the presence and severity of ASD, is another commonly used early detection tool (Marschall, Piehl, & Bernat, 2018). However, the use of ADOS-2 cannot be done by just anyone; it must be done by trained clinical personnel (Rescorla et al., 2019; Jensen et al., 2021). Besides that, The Autism Diagnostic Interview–Revised (ADI-R), a standard interview used in research and clinical diagnostic evaluation when ASD is suspected, is the most widely used and evidence-supported report on interview results with caregivers used to detect ASD (Rutter, Le Couter, & Lord, 2003).

Researchers' efforts to develop an early detection tool for ASD conditions in children from various backgrounds must be recognized. Janvier et al. (2019) present a visual-based

screening tool to eliminate the need for high literacy skills in parents of ASD children, thanks to ADOS-2, which is considered weak for detecting ASD in children whose parents have low educational and economic conditions. Therefore, Jensen et al. (2021) found that combining Gaze Preference with M-CHAT-R can help screen children with ASD in an environment with limited resources. Due to possible cultural differences, the use of screening and diagnostic tools in different countries necessitates further consideration. T-STAT, or the Taiwanese version of the Screening Tool for Autism in Two-Year-Olds developed by Wu, Chiang, Chu, Iao, and Hou (2021), attempts to address this issue.

This, however, does not necessarily bridge the existing chasm. The difficulty of accessing existing screening and diagnostic tools remains an issue in the context of the use of early detection instruments in Indonesia. In a country like Indonesia, the main challenges for caregivers of children suspected of having ASD are the high cost to pay and the requirement for a strong parental educational background. Following this, Sidjaja (2015) created The Indonesian Adaptation of Autism Detection in Early Childhood, which is the Indonesian version of Autism Detection in Early Childhood (ADEC). Nonetheless, the testing in this study only included participants from major cities such as Jakarta, Bogor, Depok, Tangerang, and Bekasi.

Problems in the early detection of ASD individuals typically involve a complex and lengthy process that necessitates the involvement of a qualified multidisciplinary team (Horlin et al., 2014). A diagnostic instrument should ideally be sensitive, specific, reliable, valid, simple, concise, and appropriate for ASD individuals of all ages and ranges (Mayes, 2018). Furthermore, professionals agree that the assessment's primary goal is to obtain an early diagnosis as a foundation for evaluating and planning interventions, as well as educational planning. Another issue that arises in society is the relatively high cost of conducting early detection (Abbas, Garberson, Glover, & Wall, 2018).

Many instruments have been developed to meet the needs of the community in the early detection of ASD children. There are 15 instruments that have been developed, as described in the results section (see Table 1). However, early detection cannot be carried out by the community, particularly by people with limited education and economic resources. It is hoped that in the future, comprehensive instruments that are simple and inexpensive can be developed to provide recommendations for early intervention in ASD children for the larger community. Early detection and diagnosis of autism spectrum disorder (ASD) are critical for connecting children with this condition to interventions and optimizing developmental outcomes.

Conclusions

The growing prevalence of ASD has resulted in various screening and diagnostic tools to detect ASD in children at an early age. Screening and diagnostic tools for ASD need to prioritize the areas of social communication, behavioral problems, emotional problems, sensory regulation issues, and engagement issues. The inclusion of diagnostic tools in screening tools, on the other hand, makes some instruments more difficult to access. Moreover, aside from the requirement for trained implementers, a lengthy process, and high test prices, existing instruments have not achieved good results in detecting ASD conditions in children from specific groups due to differences in culture, educational requirements, and parental economic status. As a result, there is a renewed urgency for developing a valid and evidence-based instrument for the early detection of ASD children

that can be used by parents from diverse cultural, economic, and educational backgrounds, particularly in Indonesia.

The results of this study are very important to realize a good tool for detecting ASD children from an early age so that interventions can be given according to their needs, including education. In addition, of course, it can support the realization of SDG 4.2, namely, by 2030, ensure that all girls and boys have access to quality early childhood development, care, and pre-primary education so that they are ready for primary education.

References

Abbas, H., Garberson, F., Glover, E., & Wall, D. P. (2018). Machine learning approach for early detection of autism by combining questionnaire and home video screening. *Journal of the American Medical Informatics Association*, *25*(8), 1000–1007.

Au, A. H. C., Shum, K. K. M., Cheng, Y., Tse, H. M. Y., Wong, R. M. F., Li, J., & Au, T. K. F. (2021). Autism spectrum disorder screening in preschools. *Autism*, *25*(2), 516–528.

Baumer, N., & Spence, S. J. (2018). Evaluation and management of the child with autism spectrum disorder. *CONTINUUM: Lifelong Learning in Neurology*, *24*(1), 248–275.

Berger, N. I., Wainer, A. L., Kuhn, J., Bearss, K., Attar, S., Carter, A. S., ... & Stone, W. L. (2022). Characterizing available tools for synchronous virtual assessment of toddlers with suspected autism spectrum disorder: A brief report. *Journal of Autism and Developmental Disorders*, *52*(1), 423–434.

Buescher, A. V., Cidav, Z., Knapp, M., & Mandell, D. S. (2014). Costs of autism spectrum disorders in the United Kingdom and the United States. *JAMA Pediatrics*, *168*(8), 721–728. https://doi.org/10.1001/jamapediatrics.2014.210

Campbell, J. M., Scheil, K. A., & Hammond, R. K. (2016). Screening methods. In *Handbook of assessment and diagnosis of autism spectrum disorder* (pp. 65–86). Springer.

Chakrabarti, S., Haubus, C., Dugmore, S., Orgill, G., & Devine, F. (2005). A model of early detection and diagnosis of autism spectrum disorder in young children. *Infants & Young Children*, *18*(3), 200–211.

Choo, Y. Y., Agarwal, P., How, C. H., & Yeleswarapu, S. P. (2019). Developmental delay: Identification and management at primary care level. *Singapore Medical Journal*, *60*(3), 119–123.

Choueiri, R., Lindenbaum, A., Ravi, M., Robsky, W., Flahive, J., & Garrison, W. (2021). Improving early identification and access to diagnosis of autism spectrum disorder in toddlers in a culturally diverse community with the rapid interactive screening test for autism in toddlers. *Journal of Autism and Developmental Disorders*, *51*(11), 3937–3945.

Coulter, K. L., Barton, M. L., Boorstein, H., Cordeaux, C., Dumont-Mathieu, T., Haisley, L., ... & Fein, D. A. (2021). The toddler autism symptom inventory: Use in diagnostic evaluations of toddlers. *Autism*, *25*(8), 2386–2399.

Djordjević, M., Memisevic, H., Potic, S., & Djuric, U. (2021). Exercise-based interventions aimed at improving balance in children with autism spectrum disorder: A meta-analysis. *Perceptual and Motor Skills*, *129*, 90–119, 00315125211060231.

Dosreis, S., Weiner, C. L., Johnson, L., & Newschaffer, C. J. (2006). Autism spectrum disorder screening and management practices among general pediatric providers. *Journal of Developmental & Behavioral Pediatrics*, *27*(2), S88–S94.

Ediyanto, E., Setiawan, A., Handaka, I. B., Rofiah, N. H., & Suhendri, S. (2021). Implementation of inclusive education in learning process at senior high school Malang City, Indonesia. *IJDS: Indonesian Journalof Disability Studies*, *8*(1), 179–189.

Emily, G., & Grace, I. (2015). Family quality of life and ASD: The role of child adaptive functioning and behavior problems. *Autism Research*, *8*(2), 199–213.

Elsabbagh, M., Divan, G., Koh, Y. J., Kim, Y. S., Kauchali, S., Marcin, C., Montiel-Nac, C., Patel, V., Paula, C. S., Yasamy, M. T., & Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research*, *5*(3), 160–179. https://doi.org/10.1002/aur.239

Feige, E., Mattingly, R., Pitts, T., & Smith, A. F. (2021). Autism spectrum disorder: Investigating predictive adaptive behavior skill deficits in young children. *Autism Research and Treatment*, 1–9. https://doi.org/10.1155/2021/8870461

Ferguson, T., Iliško, D., Roofe, C., & Hill, S. (2018). *Concepts of inclusivity and quality education, SDG4 – quality education* (pp. 39–48). Emerald Publishing Limited, Bingley. https://doi.org/10.1108/978-1-78769-423-120181004

Fombonne, E. (2018). The rising prevalence of autism. *Journal of Child Psychology and Psychiatry*, *59*(7), 717–720.

French, L., & Kennedy, E. M. M. (2018). Annual research review: Early intervention for infants and young children with, or at-risk of, autism spectrum disorder: A systematic review. *Journal of Child Psychology and Psychiatry*, *59*(4), 444–456. https://doi.org/10.1111/jcpp.12828

Fuller, E. A., & Kaiser, A. P. (2020). The effects of early intervention on social communication outcomes for children with autism spectrum disorder: A meta-analysis. *Journal of Autism and Developmental Disorders*, *50*, 1683–1700. https://doi.org/10.1007/s10803-019-03927-z

Gedžūne, G., Gedžūne, I., Salīte, I., & Iliško, Dz. (2011). Exploring pre-service teachers' frames of reference and their orientation towards inclusion or exclusion: Educational action research journey. In *Proceeding of the International Conference* (pp. 80–103). Saulai, Saulai University.

Grant, R. J. (2020). Play therapy for children with autism spectrum disorder. In H. G. Kaduson, D. Cangelosi, & C. E. Schaefer (Eds.), *Prescriptive play therapy: Tailoring interventions for specific childhood problems* (pp. 213–230). The Guilford Press.

Hodges, H., Fealko, C., & Soares, N. (2020). Autism spectrum disorder: Definition, epidemiology, causes, and clinical evaluation. *Translational pediatrics*, *9*(1), S55.

Horlin, C., Falkmer, M., Parsons, R., Albrecht, M. A., & Falkmer, T. (2014). The cost of autism spectrum disorders. *PloSOne*, *9*(9), e106552.

Hudry, K., Chetcuti, L., Boutrus, M., Pillar, S., Baker, E. K., Dimov, S., ... & AICES Team. (2021). Performance of the autism observation scale for infants with community-ascertained infants showing early signs of autism. *Autism*, *25*(2), 490–501.

Hus, Y., & Segal, O. (2021). Challenges surrounding the diagnosis of autism in children. *Neuropsychiatric Disease and Treatment*, *17*, 3509.

Iliško, D. (2021). Searching for meaning and identity among young people in an uncertain world: Perspectives from Latvia. In *The Bloomsbury handbook of culture and identity from early childhood to early adulthood* (pp. 306–308), London: Routledge.

Irvan, M., & Jauhari, M. N. (2019). Early intervention for children with autism spectrum disorder using planning matrix. In *The 9th International Conference on Educational Technology of Adi Buana (ICETA 9)*, 140–144.

Janvier, Y. M., Coffield, C. N., Harris, J. F., Mandell, D. S., & Cidav, Z. (2019). The Developmental check-in: Development and initial testing of an autism screening tool targeting young children from underserved communities. *Autism*, *23*(3), 689–698. https://doi.org/10.1177/1362361318770430

Jensen, K., Noazin, S., Bitterfeld, L., Carcelen, A., Vargas-Cuentas, NI, Hidalgo, D., ... & Zimic, M. (2021). Autism detection in children by combined use of gaze preference and the M-CHAT-R in a resource-scarce setting. *Journal of Autism and Developmental Disorders*, *51*(3), 994–1006.

Kurniawan, A. (2021). Early detection of autism children. *Journal of Ortopedagogia*, *7*(1), 57–61.

Landa, R. J. (2008). Diagnosis of autism spectrum disorders in the first 3 years of life. *Nature Clinical Practice Neurology*, *4*(3), 138–147.

Lee, H. Y., Vigen, C., Zwaigenbaum, L., Bryson, S., Smith, I., Brian, J., ... & Baranek, G. T. (2019). The performance of the first-year inventory (FYI) screening on a sample of high-risk 12-month-olds diagnosed with autism spectrum disorder (ASD) at 36 months. *Journal of Autism and Developmental disorders*, *49*(12), 4957–4973.

Lord, C., Brugha, T. S., Charman, T., Cusack, J., Dumas, G., Frazier, T., ... & Veenstra-Vander Weele, J. (2020). Autism spectrum disorder. *Nature Reviews Disease Primers*, *6*(1), 1–23.

Maenner, M. J., Shaw, K. A., & Baio, J. (2020). Prevalence of autism spectrum disorder among children aged 8 years – Autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR Surveillance Summaries*, *69*(4), 1–12.

Marschall, C. E., Piehl, J. J., & Bernat, D. J. (2018). Key aspects of testing in autism spectrum disorder. In M. Wolff, B. Bridges, & T. Dentzek (Eds.), *The complexity of autism spectrum disorders* (pp. 34–53). Routledge.

Mayes, S. D., Calhoun, S. L., Murray, M. J., Morrow, J. D., Yurich, K. K., Mahr, F., ... & Petersen, C. (2009). Comparison of scores on the checklist for autism Spectrum disorder, childhood autism rating scale, and Gilliam Asperger's disorder scale for children with low functioning autism, high functioning autism, Asperger's disorder, ADHD, and typical development. *Journal of Autism and Developmental Disorders*, *39*(12), 1682–1693.

McCarty, P., & Frye, R. E. (2020). Early detection and diagnosis of autism spectrum disorder: Why is it so difficult? *Seminars in Pediatric Neurology*, *35*, 1–7, WB Saunders.

Pandolfi, V., Magyar, C. I., & Dill, C. A. (2018). Screening for autism spectrum disorder in children with Down syndrome: an evaluation of the pervasive developmental disorder in mental retardation scale. *Journal of Intellectual & Developmental Disability*, *43*(1), 61–72.

Pasco, G. (2018). The value of early intervention for children with autism. *Pediatrics and Child Health*, *28*(8), 364–367.

Pillay, S., Duncan, M., & de Vries, P. J. (2021). Autism in the Western Cape province of South Africa: Rates, socio-demographics, disability and educational characteristics in one million school children. *Autism*, *25*(4), 1076–1089.

Pop-Jordanova, N., & Zorcec, T. (2021). Does the M-Chat-R give important information for the diagnosis of the autism spectrum disorder? *Prilozi*, *42*(1), 67–75.

Qiu, S., Lu, Y., Li, Y., Shi, J., Cui, H., Gu, Y., ... & Qiao, Y. (2020). Prevalence of autism spectrum disorder in Asia: A systematic review and meta-analysis. *Psychiatry Research*, *284,* 112679.

Raj, S., & Masood, S. (2020). Analysis and detection of autism spectrum disorder using machine learning techniques. *Procedia Computer Science*, *167*, 994–1004.

Raza, S., Zwaigenbaum, L., Sacrey, LAR, Bryson, S., Brian, J., Smith, I. M., ... & Garon, N. (2019). Brief report: Evaluation of the short quantitative checklist for autism in toddlers (Q-CHAT-10) as a brief screen for autism spectrum disorder in a high-risk sibling cohort. *Journal of Autism and Developmental Disorders*, *49*(5), 2210–2218.

Rescorla, L. A., Winder-Patel, B. M., Paterson, S. J., Pandey, J., Wolff, J. J., Schultz, R. T., & Piven, J. (2019). Autism spectrum disorder screening with the CBCL/1½–5: Findings for young children at high risk for autism spectrum disorder. *Autism*, *23*(1), 29–38.

Robins, D. L., Casagrande, K., Barton, M., Chen, C. M. A., Dumont-Mathieu, T., & Fein, D. (2014). Validation of the modified checklist for autism in toddlers, revised with follow-up (M-CHAT-R/F). *Pediatrics*, *133*(1), 37–45.

Roman-Urrestarazu, A., Yáñez, C., López-Garí, C., Elgueta, C., Allison, C., Brayne, C., ... & Baron-Cohen, S. (2021). Autism screening and conditional cash transfers in Chile: Using the quantitative checklist (Q-CHAT) for early autism detection in a low resource setting. *Autism*, *25*(4), 932–945.

Roy, P., & Chiat, S. (2019). The early sociocognitive battery: A clinical tool for early identification of children at risk for social communication difficulties and ASD? *International Journal of Language & Communication Disorders*, *54*(5), 794–805.

Samadi, S. A., McConkey, R., & Mahmoodizadeh, A. (2021). Identifying children with autism spectrum disorders in Iran using the Autism Diagnostic Interview – Revised. *Autism*, *25*(4), 1009–1019.

Sheldrick, R. C., Schlichting, L. E., Berger, B., Clyne, A., Ni, P., Perrin, E. C., & Vivier, P. M. (2019). Establishing new norms for developmental milestones. *Pediatrics*, *144*(6). doi: 10.1542/peds.2019-0374

Sidjaja, F. F. (2015). Assessment and diagnosis of autism in developing countries: The Indonesian adaptation of autism detection in early childhood (ADEC).

Vermeirsch, J., Verhaeghe, L., Casaer, A., Faes, F., Oostra, A., & Roeyers, H. (2021). Diagnosing autism spectrum disorder in toddlers born very preterm: Estimated prevalence and usefulness of screeners and the autism diagnostic observation schedule (ADOS). *Journal of Autism and Developmental Disorders*, *51*(5), 1508–1527.

Wetherby, A. M., Guthrie, W., Hooker, J. L., Delehanty, A., Day, T. N., Woods, J., ... & Lord, C. (2021). The early screening for autism and communication disorders: Field-testing an autism-specific screening tool for children 12 to 36 months of age. *Autism*, *25*(7), 2112–2123.

Wu, C. C., Chiang, C. H., Chu, C. L., Iao, L. S., & Hou, Y. M. (2021). T-STAT for detecting autism spectrum disorder in toddlers aged 18–24 months. *Autism*, *25*(4), 911–920.

Xu, G., Strathearn, L., Liu, B., O'Brien, M., Kopelman, T. G., Zhu, J., ... & Bao, W. (2019). Prevalence and treatment patterns of autism spectrum disorder in the United States, 2016. *JAMA Pediatrics*, *173*(2), 153–159.

Zachor, D. A., & Curatolo, P. (2014). Recommendations for early diagnosis and intervention in autism spectrum disorders: An Italian–Israeli consensus conference. *European Journal of PediatricNeurology*, *18*(2), 107–118.

Zwaigenbaum, L., Bryson, S. E., Brian, J., Smith, I. M., Sacrey, L., Armstrong, V., ... & Roncadin, C. (2021). Assessment of autism symptoms from 6 to 18 months of age using the autism observation scale for infants in a prospective highrisk cohort. *Child Development*, *92*(3), 1187–1198.

Correspondence concerning this paper should be addressed to corresponding author Ediyanto Ediyanto, Universitas Negeri Malang, Malang, Indonesia. Email: ediyanto.fip@um.ac.id