Evaluation of Autism Diagnostic Tools among Young Children: A Systematic Review

By A.S.M. Sarwar, Khandaker Sabit Bin Razzak, Anika Bushra, Mohammad Nabil Hossain, Dr. Md Moshiur Rahman, Dr. Shirin Tarafder, Sharmin Nahar, Lieutenant Colonel Dr Md. Fakhrul Alam, Razib Chowdhury, Shamima Akter, Sabrina Rahman, Md. Evangel Islam Anik[€], Md. Robiul Islam, Jannatul Ferdous, Ashfa Mahjuba, Paromita Biswas, Farzana Nazmin & Lutfee Alom Brishti

Abstract- Autism is a physical and mental condition that cause significant social, communication, and behavioral challenges. There is often nothing about how people with Autism Spectrum Disorder (ASD) look that sets them apart from other people. Still, people with ASD may communicate, interact, behave, and learn in ways that are different from most other people. The learning, thinking, and problem-solving abilities of people with ASD can range from gifted to severely challenged. Early diagnostic of ASD is very essential because delay detection may cause an increase in severity level. Autism diagnostic tools can play a significant role in the early detection of ASD. There are several diagnostics tools for ASD detection. The main objective of this study was to evaluate autism diagnostic tools among the children and find out the diagnostic outcome of early detection of ASD by systematic review. Some authentic databases like PUBMED, Google Scholar, Scopus were searched using keywords of relevant topics, and a protocol was developed with defined inclusion and exclusion criteria.

Keywords: Autism Spectrum Disorder (ASD), ADI-R, CARS, GARS-2, ASD diagnostic tools.

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Evaluation of Autism Diagnostic Tools among Young Children: A Systematic Review

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Abstract- Autism is a physical and mental condition that cause significant social, communication, and behavioral challenges. There is often nothing about how people with Autism Spectrum Disorder (ASD) look that sets them apart from other people. Still, people with ASD may communicate, interact, behave, and learn in ways that are different from most other people. The learning, thinking, and problem-solving abilities of people with ASD can range from gifted to severely challenged. Early diagnostic of ASD is very essential because delay detection may cause an increase in severity level. Autism diagnostic tools can play a significant role in the early detection of ASD. There are several diagnostics tools for ASD detection. The main objective of this study was to evaluate autism diagnostic tools among the children and find out the diagnostic outcome of early detection of ASD by systematic review. Some authentic databases like PUBMED, Google Scholar, Scopus were searched using keywords of relevant topics, and a protocol was developed with defined inclusion and exclusion criteria. The published study article abstracts were downloaded and screened according to PRISMA criteria. After checking the homogeneity of data, the relevant sources and contents were included, and irrelevant contents were excluded for the study. We have finally considered 40 published article for our study.

After an in-depth study, we found all three diagnostics tools have significantly able to detect ASD. ADI-Ris used in maximum case but effectiveness is slightly low compare to CARS and GARS-2. Geographical and ethnographic socio-cultural differences may cause different impacts on the performance of the ASD diagnostic tools. There is also a scope of improvement of ASD diagnostic tools as per geographical ethnographic, and genetic differences of children.

Keywords: Autism Spectrum Disorder (ASD), ADI-R, CARS, GARS-2, ASD diagnostic tools.

I. Introduction

Autism is a complex condition that affects normal speech and functional behavior. It usually presents with a wide variety of experiences and skills. Autism or Autism Spectrum Disorder (ASD) can be a mild to a moderate issue that doesn't necessarily need the full-time treatment of a special facility. Learning, thinking, and problem-solving can vary greatly from one person with autism to another. Some people with ASD need more assistance than others, depending on the severity of their needs (CDC, 2020).

Diagnosing autism is daunting because there is no medical examination, including a blood test, to detect ASD. Doctors evaluate a child's history and behavior to make a diagnosis. The early diagnosis of children with ASD allows for the initiation of therapies that can enhance social and everyday life skills, resulting in a higher quality of life (Jennifer Harrison Elder, 2017). The American Academy of Pediatrics (AAP) recommends that children be tested for developmental delays at any health checkup. Screening detects developmental delays as early as 18 months of age (Sarabeth Broder-Fingert, 141).

Despite the agreement that ASD diagnoses occur more often today, researchers continue to question if the explanation is because of the rise in cases or a more precise diagnosis, or perhaps both. Regardless, one cannot ignore the fact that ASD is a prevalent disorder, with 1 in 68 children being diagnosed with some sort of ASD (Centers for Disease Control and Prevention, 2020).

Therefore, the clinician's appraisals of the symptoms of ASD remains the current norm for

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42

diagnosis. In 2013 the Diagnostic and Statistical Manual of Mental Disorders was updated to include two main ASD symptoms: chronic social and communication difficulties and an unusual preoccupation with certain habits and interests (American Psychiatric Association, 2013). Additionally, ASD severity has now become part of the diagnostic process, which shows the severity of the patient's symptoms. Research into ASD rejects conventional conceptualizations of ASD as a discrete entity and thus promotes ASD as a spectrum. The validity of objective tests of ASD has been shown across many cultures (Constantino, 2011). The study is now being conducted to promote the use of standardized, percentile-based definitions of ASD symptom manifestation. These percentile-based approaches have proven useful in characterizing other observable health disorders, such as anorexia nervosa and hypertension. At present, specialist professional judgment is needed to signal that someone has severe deficiency to the key symptom areas of ASD.

There are several methods to diagnose autism in a child, but none is to be used specifically. Diagnostic systems use sources from both the parents and guardians of the children, and a professional's evaluation of the children's conduct. Under certain cases, the primary care provider might offer further examination or therapy for a child and family if appropriate. Such advanced medicine encompasses pediatric neurologists, geneticists, developmental-behavioral pediatricians, and early intervention programs that offer assessment services (CDC, 2020).

CDC suggested four Diagnosis tools of Autism Spectrum Disorder for Healthcare Providers:

- Autism Diagnosis Interview-Revised(ADI-R)
- Childhood Autism Rating Scale (CARS)
- Gilliam Autism Rating Scale– Second Edition (GARS-2)
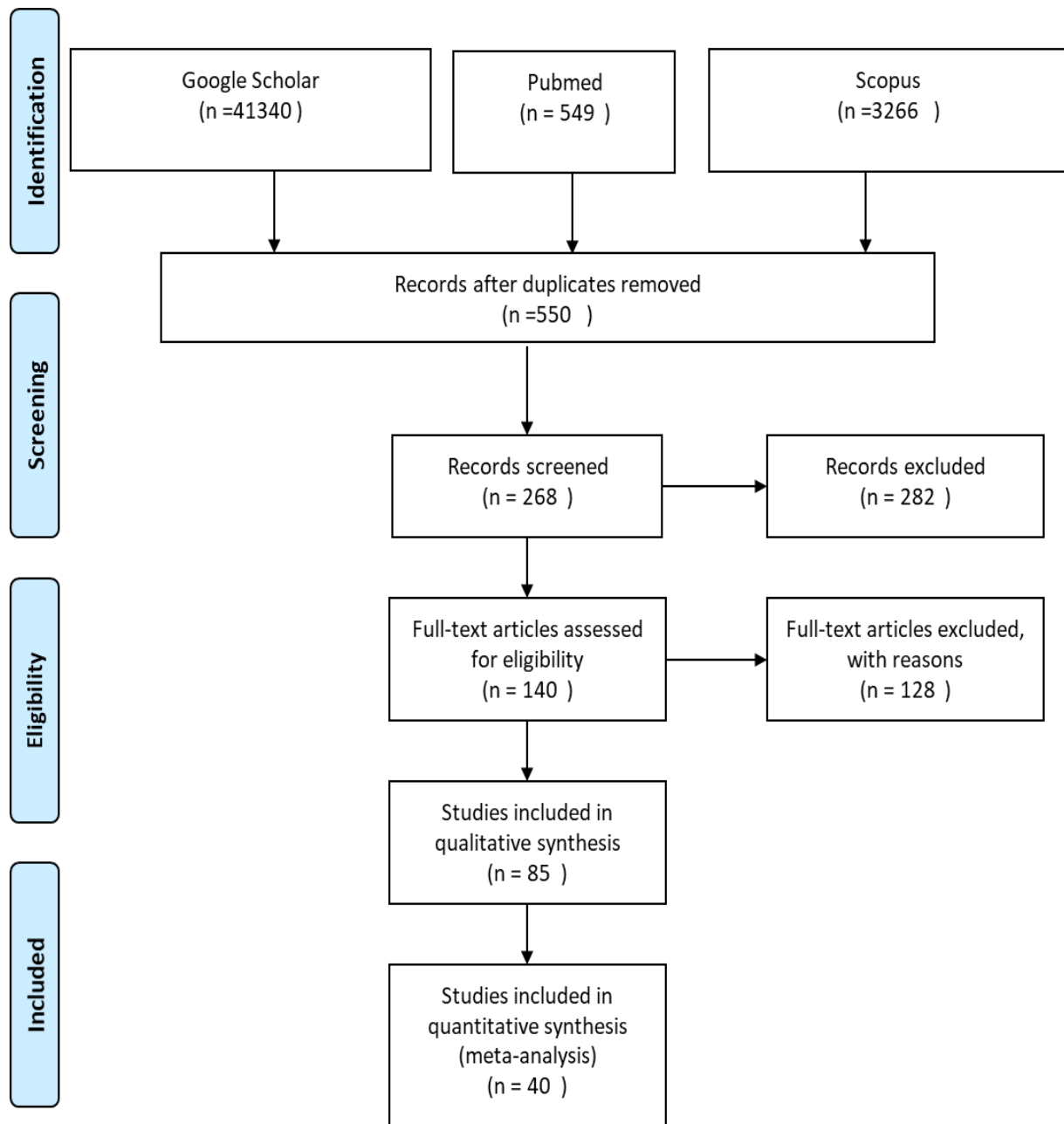- Autism Diagnostic Observation Schedule– Genericexternal icon (ADOS-G)

II. OBJECTIVE OF THE STUDY

The main objective of this study was to evaluate autism diagnostic tools among the children and assess the diagnostic performance of early detection of ASD by systematic review.

III. METHODOLOGY

A state-of-the-art science review was performed, as stated by Grant and Booth, to provide broad and up-to-date information related to the early diagnosis and treatment of ASD. Population, intervention, comparisons, outcome study strategy was used focusing on the evaluation of autism diagnostic tools. A reliable searching database like PUBMED, Google Scholar, Scopus was performed using keywords of a relevant topic. A protocol was developed with defined inclusion and exclusion criteria. The abstracts of publications identified will be screened according to PRISMA criteria. After checking the homogeneity of data, the relevant contents were included, and irrelevant contents were excluded for the study. After screening, all studies finally included 40 studies for our study. The PRISMA model is showing below:

Identification

| Google Scholar (n =41340) | Pubmed (n = 549) | Scopus (n =3266) |

Screening

Records after duplicates removed (n =550)

Records screened (n = 268) → Records excluded (n = 282)

Eligibility

Full-text articles assessed for eligibility (n = 140) → Full-text articles excluded, with reasons (n = 128)

Studies included in qualitative synthesis (n = 85)

Included

Studies included in quantitative synthesis (meta-analysis) (n = 40)

IV.   Results

The table 1 and 2 shows some of the relevant results of three ASD diagnostic tools of selective study:

Table-1: Comparative analysis of autism diagnostic tools

Study	Study Type	Method of study	No of ASD Child	Age range (in Year)	P Value	95% Confidence Interval	
						lower	upper
Autism Diagnosis Interview – Revised (ADI-R)							
(Catherine Lord, 2006)	Original Article	Prospective	67	2-9	0.001	1.6	7.3
(Annelies de Bildt, 2015)	Original Article	Prospective observational	1104	1.75-4	0.002	2.1	8.3
(Eric Zander, 2017)	Original Article	Cross sectional	10	2-17	0.001	0.93	5.8

Childhood Autism Rating Scale (CARS)							
(Colby Chlebowski, 2010)	Original Article	Retro prospective study	606	3.5-5.5	0.001	0.88	4.6
(Alessandra Pereira, 2008)	Original Article	Cross sectional study	60	3-17	0.05	-0.84	0.61
(Tamara Dawkins, 2016)	Original Article	Cross sectional study	183	1-62	0.03	1.2	2.3
Gilliam Autism Rating Scale – Second Edition (GARS-2)							
(Mahboubeh Ghayour, 2018)	Original Article	Case control study	26	2-7	0.001	0.345	1.71
(Martin A. Volker, 2016)	Original Article	Cross Sectional Study	240	3-21	0.001	0.65	1.28
(Linda Sue Jacksona, 2013)	Original Article	Prospective Study	100	4-21	0.02	0.861	1.38

Table-2: Effectiveness of autism diagnostic tools.

Name of diagnostic tools	Number of study review	Effectiveness rate of the tools	Average effectiveness
Autism Diagnosis Interview – Revised (ADI-R)	13	96.5%	97.166%
Childhood Autism Rating Scale (CARS)	14	98%	
Gilliam Autism Rating Scale – Second Edition (GARS-2)	13	97%	
Total Study	40		

Note: We just evaluating top three of the ASD diagnostic tools.

V. DISCUSSION

We considered the four ASD diagnostic tools for discussion here:

a) Autism Diagnosis Interview –Revised (ADI-R)

The ADI-R is a formal interview with the parents of children referred for the diagnosis of potential autism or autism spectrum disorders. An interview with someone with a mental age of at least 24 months and assessing actions in the fields of mutual social interaction, communication and language may be used for diagnostic purposes. A method for diagnosing autism in adults and infants. The instrument assesses actions in three categories: social interaction; communication, and language; and thoughts and desires that are limited and repetitive. One study stated, early childhood ASD and lower language capacity were in the mild-to-moderate range of the ADI-R. Almost half of the older and phrase expression ASD-group fell into the little-to-no concern range (Annelies de Bildt S. S., 2004).

b) Childhood Autism Rating Scale (CARS)

A quick and simple evaluation can be used on any child from 2 years old. The CARS assessment assesses five classification systems for autism and lists the symptoms, skills, and behaviors covered. One frequently used scale for measuring gains achieved in the treatment of autism is the Childhood Autism Assessment Scale (Eric Schopler, 1980). To evaluate symptoms consistent with autism, the CARS evaluates 14 domains, while the 15th domain rates general experiences of autism. Each domain is rated on a scale of one to four; higher scores suggest more difficulty. Scores will vary from 15 and 60; scores below 30 mean that the child is in the non-autistic range, scores between 30 and 36.5 indicate mild to moderate autism, and scores from 37 to 60 indicate extreme autism. The CARS highlights good alignment between DSM-IV criteria and signs of Asperger Syndrome. In a survey of 274 children at preschool (Adrienne Perry, 2005). a strong concordance rate of 88 percent was found between classifications made using the CARS and DSM-IV criteria. An analysis of 54 children diagnosed with autism disability found that the CARS-A and DSM-IV criteria were strongly comparable.

c) Gilliam Autism Rating Scale – Second Edition (GARS-2)

The guide supports students, caregivers, and physicians in recognizing autism in children aged three to twenty-two. It is useful in estimating how bad a child's condition is. The Gilliam Autism Assessment Scale-Second Edition is a diagnostic test for autism spectrum disorders between 3 and 22 years. It was developed to assist diagnosis for people with a type of autism and help discern those with extreme developmental problems from those usually developing. The GARS-2 was developed as a complementary instrument to

facilitate the diagnosis of autism, and it is meant to be used in conjunction with other screening approaches.

d) Autism Diagnostic Observation Schedule – Generic (ADOS-G)

A diagnostic technique for people accused of developing autism that measures social, communication, play, and creative use of materials. The observational plan includes four 30-minute modules that are structured to be delivered in various ways to different people as appropriate. The Autism Diagnostic Observation Schedule, the new version (ADOS-R) contains revised diagnostic algorithms and standardized severity ratings for tests used to test children under ten. This form of autism is characterized by impairments in social-communication and the occurrence of limited, repeated, and stereotyped activities and interests (Association, 2013). Autism used to be conceived of as a disease that affects children. However, reports of young adults with this type of ASD (autism spectrum disorder) show varying results. One study stated, the observational schedule consists of four 30-minute modules, each designed to be administered to different individuals according to their level of expressive language. Psychometric data are presented for 223 children and adults with Autistic Disorder (autism), Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS), or non-spectrum diagnoses. With each particular module, the groups struggle with the same degree of language expression. These test results show significant interrater and test-retest reliability for individual products, excellent interpreter reliability within the medical situations, and excellent internal consistency among the domains.

VI. CONCLUSION

In this study, we found that several studies used different types of diagnostic tools. All the tools have significantly able to determine ASD. ADI-R is used in maximum cases, but effectiveness is slightly low compare to CARS and GARS-2. Geographical and ethnographic socio-cultural differences may cause different impacts on the performance of the ASD diagnostic tools. There is also a scope of improvement of ASD diagnostic tools as per geographical ethnographic, and genetic differences of children. Further study is needed worldwide to assess the effectiveness of ASD diagnostic tools.

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