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A Systematic Review of the Literature on the Assessments Used For Social Communication in the Diagnosis of Autism Spectrum Disorder

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A SYSTEMATIC REVIEW OF THE LITERATURE ON THE
ASSESSMENTS USED FOR SOCIAL COMMUNICATION
IN THE DIAGNOSIS OF AUTISM
SPECTRUM DISORDER

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This review of the literature aims to analyze the current assessments available for clinicians, parents, and other professionals to use during the diagnosis of Autism Spectrum Disorder (ASD) that specifically addresses social communication. Although ASD can be diagnosed as early as the age of 2, children are often not diagnosed until the age of 4-5 years old. Especially for children who would be diagnosed with ASD and require Level 2 and/or Level 3 supports, early diagnosis can lead to early intervention which can help to provide the necessary support for both the child and family. Early intervention can help to reduce difficulties associated with ASD that the child may experience. Aspects of social communication can be observed in children as early as the age of 2 and before other modes of communication are demonstrated by the child. Although there are many popular assessments, such as the ADOS-2 and ADI-R, these assessments do not specifically examine nor provide in-depth information about the social communication abilities of the child being assessed. Thus, there is a need for assessments that specifically test social communication in order to help aid in identifying children who may be at more risk of ASD, assisting in accurately differentially diagnosing ASD in children, and providing in-depth information to aid in intervention.

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Introduction

      Pragmatic language is the ability to use one's knowledge of semantics (language meaning) and syntax (language structure) in effective ways across different social contexts. Pragmatic language skills are influenced by historical social practices essential for learning and using cultural knowledge to engage multiple contexts and with a variety of interlocutors (Hyter, 2007; Hyter et al., 2017; Rivers et al., 2012). These skills not only affect how an individual engages with others during conversation and/or in social situations, but it also affects how others react to the individual (Loukusa et al., 2018). Pragmatic language has been conceptualized as including at least three different components: discourse management, communication functions, and sociolinguistic skills that require social cognition and supports one's ability to infer intentions of others (Hyter, 2017; Landa, 2005). Individuals who struggle with pragmatic language may present with difficulties organizing discourse, understanding literal use of language and social inferencing, employing social use and understanding of language, and using social cognitive skills (Adams et al., 2005; Volden et al., 2009). Although these individuals may have intact formal linguistic abilities, they have limited social communication abilities, and can be seen as an intermediate group between individuals who have a diagnosis of ASD or other specific language impairments.

      Social communication is the ability to be able to assess one's social situation and then engage in behaviors consistent with the expectations in those social situations (Wetherby et al., 2007; Olswang et al., 2001). Social communication consists of pragmatic language (i.e., communicative intention, presupposition, and discourse management) and concepts such as joint attention, social interaction, social cognition, language processing, and integration of affect and gesture with communication (Adams et al., 2005; Hyter, 2012; Landa, 2005). Individuals with

competent social communication skills are able to express their own needs and perspectives and can infer the perspectives and implicit thoughts of others (Aldred et al., 2008). Although these concepts are important to the development of social communication in individuals and can impact a child's success in social interactions with peers, they are often overlooked in formal assessments and hard to objectively measure in standardized assessments due to fact that aspects of social communication are highly dynamic in different contexts (Landa, 2005; Norbury, 2014).

Early Development of Social Pragmatic Communication

Children engage in social pragmatic communication as infants long before they begin to use verbal forms of communication. One of the earliest developing forms of communication that infants engage in is joint attention, which is an essential component for successful communication between parties and an indicator for social competency at any age (Petinou & Minaidou, 2017; Parlade et al., 2009). Even before they are able to verbally express their wants and needs in a social context, infants will utilize fine-tuned interactions in order to communicate with those around them.

Social cognition refers to an individual's ability to use cognitive mechanisms and processes in order to understand and interact with the world around them. Social cognition can be observed in concepts such as theory of mind, imitation, and face and gaze processing. All of these aspects can be observed during the early stages of infancy although it can continue to develop throughout adolescence and adulthood (Kilford et al., 2016). Impairments and atypical development in social cognition often lead to impairments in social interactions and communication with peers (Senju, 2013). Because social interaction is often facilitated by information given through eye contact, any atypical impairments in eye gaze can be an indication of deeper social cognition difficulties (Vogindroukas et al., 2014). Atypical joint attention and

eye gaze in some cultures is often an early indication that an individual may have impairments in social cognition (Hanley et al., 2014). Although typically developing children will focus on all aspects of the face (e.g., mouths, eyes, eyebrows), individuals who have atypical development in gaze and joint attention may put atypical focus on another individual's lips, as they will need a higher focus on speech and language rather than facial cues.

Based on an individual's ability to read others can also affect how they play and interact with same-aged peers. An individual's play and interactions tendencies can be indicators and physical manifestations of an individual's understanding of others. Children typically engage in spontaneous play (i.e. treating and using an object for something that it isn't) around 24 months; however, children who have impairments in social aspects of spontaneous play may not be able to engage in such behavior (Lam & Yeung, 2012; Kasari et al., 2006).

Diagnosis of Autism Spectrum Disorder

Children diagnosed with Autism Spectrum Disorder (ASD) often struggle with the principles associated with social pragmatic communication. According to the DSM-5 definition, children diagnosed with ASD often struggle with social interaction, verbal and nonverbal communication, and exhibit repetitive, restricted behavior (Woods & Wetherby, 2003; American Psychiatric Association [APA], 2013). Compared to typically developing children and children diagnosed with disabilities, children diagnosed with ASD perform significantly lower in the areas of social pragmatic communication (Jeans et al., 2013; Anagnostou et al., 2015). Recent changes in the DSM-5 have also differentiated Social Communication Disorder (SCD) from ASD. Although both diagnoses exhibit difficulties in social pragmatic communication, only the latter includes the repetitive and restricted behaviors (APA, 2013).

Difficulties with social communication for individuals who would be diagnosed with ASD and require Level 2 and/or Level 3 support is a key characteristic for the mentioned demographic (Loukusa et al, 2018). Additionally, elements of social communication may be present, even if elements of verbal communication have not fully developed. Especially at younger ages, when verbal communication has not developed, professionals may be able to observe and assess an individual's social communication capabilities in order to determine if further additional testing is needed or if a diagnosis can be made. Children who would later be diagnosed with ASD often exhibit significant differences in their social interaction and social communication skills at or around the age of 2 when compared to typically developing children or children diagnosed with disabilities (Barton et al., 2016; Jeans et al., 2013; Landa et al., 2007). Specifically, children diagnosed with ASD may exhibit reduced joint attention, reduced engagement with peers, and/or impairments to social reciprocity (Landa et al., 2007; Maenner et al., 2013; Nagai et al., 2017). There is research that suggests that children with ASD exhibit difficulties in social communication with peers and those around them due to the possibility of feeling overwhelmed in social situations (Clark et al., 2017). Additionally, individuals diagnosed with ASD often have difficulties generalizing learned skills and behaviors in the presence of novel settings and individuals (Owen-DeSchryver et al., 2008).

Although formal assessment for ASD is not recommended until the age of 18 months, some developmental and social pragmatic communication behaviors can be assessed during infancy (Cangialose & Allen, 2014). Reduced levels of social attention and social communication is one behavior that can be observed between 12 and 24 months of age that may be an early indicator if a child presents with ASD (Zwaigenbaum et al., 2015). Deficits in social

attention and social communication, specifically in social orientation tasks, such as responding to their name, can help clinicians differentiate a child who presents with ASD from typically developing children and also children who are diagnosed with other disorders/disabilities. Difficulties in verbal and nonverbal language development may also serve to be an early indicator of ASD (Anagnostou et al., 2015). Zwaigenbaum et al. (2015) also found that infants from 24 months and up had a declining trajectory in social communication abilities compared to that of typically developing children.

These behaviors manifest in children at a young age and clinicians are reliably able to formally assess and diagnose children with ASD as young as the age of 2 (Moulton et al., 2019). However, children are often not formally assessed and diagnosed with ASD until 4 to 5 years of age, at the earliest (Anagnostou et al., 2015; Shattuck et al., 2009; Gillon et al., 2017). Later identification and diagnosis of ASD may be due to multiple factors. One factor may be that clinicians feel uncomfortable in relaying the information of a child's development to parents and also due to the varying requirements and regulation of different states regarding the identifying process of ASD (Barton et al., 2016; Nagai et al. 2017). Another underlying reason for the later diagnosis of ASD may be due to the fact that ASD is a diagnosis based on a spectrum, in that some behaviors associated with ASD may be present in typically-developing children at or around the age of 2 and that the severity and occurrence of a behavior may not be the same from one child to another. A third factor may be due to the fact that not all individuals who would later be diagnosed with ASD present with mild to severe atypical social communication characteristics and behaviors before the age of 2. Some individuals diagnosed with ASD may not have presented with atypical behaviors until around the age of 2 and/or may have presented with mild concerns that gradually worsened over time (Landa et al., 2007).

There is evidence suggesting that identification and intervention before the age of 3 may improve the development of a child diagnosed with ASD and minimize the behaviors and symptoms associated with ASD (Jeans et al., 2013). Additionally, parents have reported that they prefer to be given information and recommendations for their child's development as early as possible. Earlier identification of ASD within children may also provide the opportunity for the child(ren) and families to have access to resources and services at a younger age. Earlier identification of ASD also gives the child maximize time in which they can have more learning experiences while neural plasticity is at its highest (Clark et al., 2017).

Diagnosis for ASD can be very difficult because ASD encompasses multiple modalities of communication, of which can vary drastically from child to child. Additionally, behaviors associated with ASD can also fall under the symptoms and behavior of other developmental, language, or cognitive disorders (Huerta & Lord, 2012). Because of the difficulty in the presence of unique behaviors and characteristics in ASD, diagnosis for ASD relies on the use of "multidisciplinary" observation, assessment, and the integration of the information gathered in order to generate an accurate diagnosis (Huerta & Lord, 2012; Risi et al., 2006). Although the term "multidisciplinary" has often meant a multi-member team of professionals and has long been considered the best practice for the diagnosis of ASD, it is often difficult to consistently put together such a team and can be overwhelming for parents who are not familiar with the process. Instead, "multidisciplinary" should be reconceptualized to mean that a diagnosis for ASD needs to address multiple aspects of functioning (Huerta & Lord, 2012). That is why evaluations consist of both formal assessments and informal observations and interviews in order to produce the most accurate diagnosis.

Current Assessments

Currently, there are many assessments that clinicians may use in order to formally and informally assess and to help diagnose a child with ASD (Gillon et al., 2017; Rutter et al., 2003; Luyster et al., 2008; Ozonoff et al., 2010). These assessments are a collection of questionnaire-based, rating scale, and observation-based assessments, many of which rely more on the parents' observations of their child's behavior (Cangialose & Allen, 2014).

Popular assessments that clinicians and health professionals often use during the evaluation and diagnosis of ASD are the *Autism Diagnosis Observation Schedule, 2nd Edition (ADOS-2;* Lord et al., 2000*)*, the *Autism Diagnostic Interview - Revised* (ADI-R; Lord et al., 1994), the *Childhood Autism Rating Scale -* Second Edition (CARS-2; Van Bourgondien et al., 1992), the *Gilliam Autism Rating Scales -* Second Edition (GARS-2; Gilliam, 1995) and the official definition and standardized criteria stated in the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth Edition (DSM-5; American Psychiatric Association [APA], 2013; Center for Disease Control and Prevention [CDC], 2020).

Autism Diagnosis Observation Schedule, 2nd Edition (ADOS-2)

The most common of these assessments for clinicians to use in observing behaviors in children suspected of having ASD is the *Autism Diagnosis Observation Schedule,* 2nd edition (ADOS-2). The ADOS is one of few standardized assessments that utilizes direct observation of a child's interactions that accounts for both the developmental level and age of the child (Akshoomoff et al., 2007). Although originally, the ADOS was standardized for children from the ages 5 to 12, over the years as referrals for ASD have increasingly been composed of children younger than 5, the ADOS has been adjusted and revised for younger and nonverbal children (Lord et al., 2000). The ADOS-2, the most recent edition of the ADOS, is a play-based

assessment in which the clinician can prompt specific scenarios in play in order to observe and

analyze the child's speech and social abilities in the context (Kover et al., 2014).

Autism Diagnostic Interview - Revised (ADI-R)

The ADI-R is a standardized assessment that utilizes a semi-structured interview of

parents in order to obtain more information about the child's behaviors. Originally, the ADI-R

was known to be reliable for older children. However, new algorithms were developed so that

the ADI-R could also be reliable and valid in younger children, aged 12-47 months (de Bildt et

al., 2015). The ADI-R consists of five sections (i.e., opening questions, questions about

communication, questions about social development and play, questions about repetitive and

restricted behaviors, and questions about general behavior problems). Depending on the age and

severity of difficulties the child represents, the time it takes to complete the interview can range

widely from 1.5 - 2.5 hours (Lord et al., 1994).

The Childhood Autism Rating Scale, 2nd Edition (CARS-2)

The CARS-2 utilizes a rating scale in order to describe the severity of ASD in a child

based on the observations of a clinical professional. Over the years, the CARS has been adapted

and revised in order to account for different aspects and placement on the spectrum of ASD and

help to differentiate a diagnosis of ASD from other developmental delays that may share some

presenting aspects and symptoms with ASD (Moulton et al., 2019). Although the CARS-2

mostly utilizes making a severity diagnosis based on a clinical professionals' direct observation

of the child, additional information can also be scored depending on the answers provided by

parents on the CARS-QPC (CARS - Questions for Parent Concerns) form (Van Bourgondien et

al., 1992). The CARS-2 also utilizes cut-off scores which indicate whether an individual is

considered "non-ASD" (scores < 30), "mild/moderate ASD" (scores 30 - 36.5), or "severe ASD" (scores 37 - 60) (Moulton et al., 2019).

The Gilliam Autism Rating Scales, 2nd Edition (GARS-2)

The GARS-2 is another rating scale-based assessment that focuses on the severity of presenting symptoms and behaviors in the areas of stereotyped behavior (compared to that of individuals with ASD), communication, and social interaction. Many of the items in this assessment are based on the definitions and standardized criteria stated in the DSM-4. This assessment utilizes both clinical observations and also supplemental information gathered from parents (Gilliam, 1995).

Although the mentioned assessments assess the areas of social interaction, communication, and play behaviors in children, very few of these assessments provide a comprehensive evaluation of social pragmatic communication skills in young children with ASD, specifically in the areas of social language and social behaviors supported by cognitive skills such as executive functions and perspective taking (Landa, 2005; Adams, 2002). Many of these assessments focus on the receptive and expressive language abilities of the child and often compare the child's language abilities to their social abilities (Kover et al., 2014). A significant need exists for the development of reliable measurement tools in regard to social communication for the diagnosis of ASD, appropriate for young children, that can guide identification, intervention and/or classroom instruction (Dietz et al., 2006; Landa & Kalb, 2012; Loukusa et al., 2018; Woods & Wetherby, 2003). Some studies suggest that earlier identification and implementation of early intervention could yield "more optimal outcomes" in the areas associated with ASD, such as social communication abilities (Clark et al., 2017).

The purpose of this study is to assess what assessments are currently used during the diagnostic process of ASD in young children. This study will aim to analyze and consider these assessments and how they may or may not provide sufficient information about social communication in individuals being assessed for ASD. Although clinicians and other health care professionals use a variety of assessments, very few, if any, focus on the social communication aspects and characteristics of children with ASD.

Methodology

Peer-reviewed publications from PubMed, SpringerLink, ASHA, and JSTOR were gathered using combinations of one term from four different groups of search terms, which would yield a total of 108 combinations per publishing website. The groups are as follows: Group 1 ("ASD", "Autism Spectrum Disorder", and "Autism"), Group 2 ("Level 2 Support(s)", "Level 3 Support(s)", and "Low-Functioning"), Group 3 ("Social Pragmatic Communication", "Social Communication Disorder", "Social Communication Impairment", and "Social Communication"), and Group 4 ("Assessment", "Tool", and "Measurement"). Figure 1, see below, illustrates the search terms and grouping used for the article search.

Inclusionary and Exclusionary Criteria

Publications were included if they were published between 2013 to the present day. The year 2013 was when the DSM-5 manual (APA, 2013) altered the criteria of diagnosis for ASD and included the levels of severity and support required for individuals with ASD. Included publications must also have been written and published in English as the primary language. Publications must also have included information about the diagnostic process of ASD and be relevant to school-age children (6;11 years or younger). Publications must also be relevant to children who would receive Level 2 and/or Level 3 support.

Publications were not included if they were published before 2013, were initially written and published in a language other than English, did not include information about the diagnostic process of ASD, were not relevant to school-age children (6;11 years or younger), and/or did not pertain to individuals who receive Level 2 and/or 3 support (i.e., individuals who were considered "high-functioning" in the older definition of ASD and who would receive Level 1 supports).

The initial search yielded 8,342,939 total publications. After duplicate publications were removed, a total of 114,591 publications remained. Then, the titles of the remaining publications were read and analyzed in order to filter out any irrelevant articles. The titles of the publications needed to include at least one of the asterisked terms in Figure 1 in order to be included in further evaluation. After screening the titles of publications, 87 publications remained.

From the publications with accepted titles, the abstracts were read in order to filter out additional irrelevant publications. Publications were submitted to further evaluation if the abstract indicated that the study contained information about assessments that are used to aid in the diagnostic process of ASD in school-age children, aged 6;11 years or younger. Publications may also be submitted to further evaluations if the abstract indicates that the publication includes information about the social communication impairment domain of ASD. After reading the abstracts of included publications, 6 publications remained to be used for further evaluation.

Bibliographies of the last remaining publications will also be reviewed in order to identify any additional publications that may have been missed in the initial searches. The same protocol will be followed, in that the titles must contain the key words mentioned and any included publications' abstracts will be read in order to determine if it is eligible for being

included in the review. This added 3 publications to be used in the review, totaling 9

publications.

Reliability of Rating

To ensure that the information from the eligible articles were represented in the Article

Analysis accurately, a second rater analyzed a portion of the eligible articles. The second rater

was a Master's degree student from the Speech, Language, and Hearing Sciences department at

Western Michigan University. The second rater was trained by the author to ensure that data and

information from eligible articles would be as accurate to the intentions of the author of this

review. For training, the author took one eligible article to use as an example to explain to the

second rater the intentions of each item and subsection of the Article Analysis form. This is

especially important for the item "If YES, what information is provided?" (subsection: Analysis),

in regard to what information about social communication is provided by a certain assessment.

During the training session, the second rater had the opportunity to ask any clarifying questions

for any of the sections (e.g., "What should I do if not all ethnicities listed in the Article Analysis

is not mentioned in the article?")

Once the eligible articles were confirmed, the author randomly chose 3 articles to send to

the second rater. After the second rater finished rating the randomly selected articles, reliability

was calculated by taking the number of matching entries divided by the number of possible

matching entries provided in the Article Analysis forms. The last subsection ("Results and

Discussion") will not be included in tallying the similarities and differences of the author's and

second rater's completed Article Analyses forms. This is due to the high subjectivity of the

sections and because the information provided in this subsection will not directly influence the results of this review.

Results and Discussion

Assessments Mentioned in Articles

Assessments mentioned and used in the eligible articles were recorded and analyzed using the Article Analysis form (Form 1), see below, created for this study. From the literature search, 9 articles were identified that satisfied all the inclusionary criteria. Of these 9 articles, only 1 article included information about an assessment with a specified sub-section pertaining to social communication. The other 8 articles included information about assessments that had items and questions pertaining to social communication but did not provide any specific details about the social communication information obtained from the assessments. Many of the assessments were "Questionnaire" and/or "Check-List" type screening instruments that gave a score to individuals that could indicate whether a child should get additional testing done.

Many of the assessments mentioned in the included articles also mentioned other notable assessments that they used to compare the validity and the results of their assessment. According to Table 2, the assessments that were used the most often were the ADOS-2, ADI-R, and the CARS-2, respectively. This information indicates that these three assessments are the most commonly used assessments typically used in the diagnostic process of ASD, however, these assessments do not yield specific and detailed information about the social communication abilities of individuals who are tested.

Reliability

Reliability of the Article Analysis form was calculated by dividing the number of entries that were the same between the author and rater by the total number of entries available in the form. Reliability was calculated to be approximately 92% - 110 out of 120 possible entries matched between the author and rater.

Limitations

This review of the literature focused on the assessment and diagnosis of ASD in younger children. The search terms and eligible criteria for articles to be included in this review did not include all populations in which a diagnosis ASD was present. Articles that contained assessments and information on individuals who had concurrent disabilities (e.g., ADHD, Fragile X Syndrome) and/or other medical diagnoses (e.g., Deaf or Hard-of-Hearing individuals) were not included in this review. Thus, there is a possibility that assessments that may focus on individuals with multiple diagnosis and/or conditions along with ASD may have been overlooked during this review.

This study also did not focus on older age groups and the adult population. Articles that contained information about assessments used to diagnose ASD in older age groups and the adult population may have been overlooked during this study.

During the systematic search of terms, the terms "questionnaire" and "test" were omitted in Group 4 of the possible search terms. Due to this oversight, articles that may have discussed assessments that utilize the terms "questionnaire" and/or "test" and not the terms within the parameters set for this systematic search, may have been omitted.

Implications and Future Work

Although many of the assessments included in this review indicate that they address social communication in some way, the information provided on these assessments was lacking. Many of the assessments do not provide a specific subsection to provide in-depth and/or specific information about the social communication capabilities of the individual being tested. Out of the 9 identified articles, only one article included information about an assessment, the *Autism Behavior Inventory*, with a specific subsection dedicated to "social communication". However, upon further reading, none of the assessments mentioned in the eligible articles provided in-depth analysis and information about the social communication abilities the individual may have at the time of their evaluation.

As many individuals can develop and display aspects of social communication at relatively younger ages than other modes of communication and interaction (e.g., verbal communication and play), there is a need for assessments that focus on social communication. Assessments that focus on social communication can help to provide in-depth information that can help assist in providing an accurate diagnosis and guide intervention, if needed.

The *Developmental Profile of Social Communication* (DPSC; Vogindroukas et al., 2020) is one such assessment that heavily focuses on the social communications skills and capabilities with which an individual presents. The DPSC is a questionnaire assessment that is based on the Circle Theory and focuses on seven components of social communication - socialization, communication, play, language, speech, writing, and sociability. Administered by a trained clinician, parents provide answers ("Yes", "Emerging", or "No") about skills relating to each aspect of social communication addressed in this assessment. Upon completion of the

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assessment, parent(s) and the administering clinician can get an in-depth understanding and

outlook on the emerging and/or present strengths and weaknesses in regard to social

communication compared to that of typically-developing children. Since social communication

skills and characteristics can develop at very early ages, this assessment can be used to screen

and/or assess young children and provide information as to whether an individual may or may

not need further testing and/or continued monitoring at earlier ages. Additionally, because ASD

presents on a continuum, the DPSC is an excellent example of an assessment that can provide

in-depth information about the social communication skills an individual may have in

comparison to typically-developing peers and guide clinical decision making in terms of further

assessment and/or intervention. The DPSC can also be utilized for children who may have a

diagnosis of ASD along with another disorder and/or diagnosis. The DPSC deeply analyzes the

social communication abilities a child may have rather than physical characteristics, abilities, and

behaviors they may have due to their diagnoses. Although children who have multiple diagnoses

may present with some similar difficulties in social communication as a child with a sole

diagnosis of ASD, the DPSC can provide in-depth strengths and weaknesses that may provide

more information on how a diagnosis of ASD may interact and/or be affected by other disorders

and/or diagnoses.

The *Assessment of Pragmatic Language and Social Communication* (APLSC; Hyter &

Applegate, 2012) is another example of an assessment that focuses heavily on the social

communication skills of the individual being tested. Compared to the DPSC, which is a

lengthier, more in-depth assessment, the APLSC was designed to be a Response to Intervention

(RTI) Tier 1 instrument with which professionals and parents could quickly describe the

strengths and weaknesses an individual may present within different settings. Responses on the APLSC can be given on a continuum ("Hardly Ever" to "Almost Always") in order to account for the fact that skills in regard to social communication may be emerging and/or a weak skill present in an individual. Using the APLSC, clinicians and professionals can quickly see what skills an individual may struggle and/or excel at based on the design of the assessment. Thus, more personalized intervention can be created so that clinicians and professionals are providing the best type and level of care a child may need during intervention. Assessments like the DPSC and the APLSC that heavily focus on social communication can be crucial in helping to identify the appropriate social communication difficulties and deficits in children so that they may get an earlier and more accurate diagnosis of ASD, as appropriate.

Other future work may also include researching and developing a more refined list of possible social communication difficulties and/or characteristics of children who would be diagnosed with ASD who would receive Level 2 and/or Level 3 support throughout the age range as a younger child (i.e., 6;11 or younger). By analyzing and curating such a list, parents and professionals may be able to identify children who may be at higher risk of having a diagnosis of ASD so that proper support can be provided as early as possible. Additionally, having such a list of characteristics may be useful in reducing the number of false positives and negatives so that individuals who have a higher-risk of having ASD are correctly identified as early as possible and individuals who are less likely to have ASD are not misdiagnosed when another diagnosis may be more appropriate. It is also important to remember that because ASD presents on a wide spectrum of both displayed behaviors and abilities in regard to communication and interaction, that such a list would not be considered a sole diagnosis tool for

professionals and parents to use. Instead, it should be considered an item for education and

awareness of the possible behaviors that are often closely associated with ASD.

However, because this review did not include assessments that accounted for other

diagnoses and disorders were not included, future research may be needed to more closely

analyze the social communication characteristics and testing performances of individuals with an

individual diagnosis of ASD to that of individuals with a diagnosis of ASD and additional

disorders and/or diagnoses. This type of research would also provide crucial information on

social communication difficulties and characteristics of purely ASD and also how other

diagnoses and disorders may interact and affect the social communication capabilities of an

individual with ASD.

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Appendix A

Summary of Assessments Used to Assess Social Communication During the Diagnosis of Autism Spectrum Disorder

Table 1

Summary of Assessments Used to Assess Social Communication During the Diagnosis of Autism Spectrum Disorder

Article Reference	Assessment Name	Age Range	Type of Assessment	Addresses Social Communication?	Social Communication Component(s) Addressed
Bangerter et al. (2017)	Autism Behavior Inventory	3yrs - Adult	Rating Scale	Yes	Reciprocity, nonverbal communication, verbal communication
Nah et al. (2014); Young & Nah (2016)	Autism Detection in Early Childhood (ADEC)[a]	12mo - 36mo	Observation/ Check-List	Yes	Joint attention and social referencing, eye contact, reciprocity of smile, gaze monitoring, anticipation of social advances, use of gestures
Meng et al. (2018)	Beijing Autism Subtyping Questionnaire[b]	2yrs - 10yrs	Questionnaire	Yes	Not specified
Morales-Hidalgo et al. (2017)	EDUTEA	3yrs - 5yrs; 10yrs - 12yrs	Questionnaire	Yes	Social interaction, social behaviors
Robins et al. (2014)	M-CHAT-R/F	16mo - 30mo	Questionnaire/ Check-List	Yes	Joint attention, smile reciprocity

Barbaro & Dissanayake (2013)	Social Attention and Communication Surveillance (SACS)[c]	12mo - 24mo	Observation	Yes	Social attention and communication
Wagner et al. (2020)	TELE-ASD-PEDS	< 36 months	Observation	Yes	Socially directed speech sounds
Davis et al. (2015)	Toddlers at Risk of Autism Clinic Model (SACS + ADEC)	12mo - 24mo[d]	Observation/ Check-List	Yes	Social attention and communication, Joint attention and social referencing, eye contact, reciprocity of smile, gaze monitoring, anticipation of social advances, use of gestures

Note. This table summarizes the assessments mentioned in eligible articles discussing assessments used to assist in diagnosing a child with Autism Spectrum Disorder (ASD).

[a]This assessment was used in Australia

[b]This assessment was translated from the Wing Subgroups Questionnaire (WASQ) into Chinese and then re-translated into English.

[c]This assessment was also used in Tianjian, China (SACS-C)

[d]Age range is lower than that of the ADEC due to the fact that the age range of the SACS is 12mo - 24mo

Appendix B

Summary of Other Mentioned Assessments Used to Compare ASD Diagnoses

Table 2

Summary of Other Mentioned Assessments Used to Compare ASD Diagnoses

Article Name	Frequency of Mentions In Eligible Articles
Autism Behavior Checklist (ABC)	xx
Autism Diagnostic Interview Revised (ADI-R)	xxx
Autism Detection in Early Childhood Manual (ADEC)	x
Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)	xxxxxx
Baby and Infant Screen for Children with Autism Traits (BISCUIT)	x
Checklist for Autism in Toddlers (CHAT)	x
Clancy Autism Behavior Scale (CABS)	x
Caregiver Strain Questionnaire	x
CASI-5-ANX	x
Child Behavior Checklist	x
Childhood Autism Rating Scales (CARS-2)	xxx

|	
Objective Language Criteria Test-Screening Revised	x
Modified Checklist for Autism in Toddlers (M-CHAT)	xx
Mullen Scales of Early Learning (MSEL)	x
RBS-R	x
Screening Tool for Autism in Two-Year Olds (STAT)	x
Social Attention and Communication Study (SACS)	x
Social Communication Questionnaire (SCQ)	xx
Social Responsiveness Scale (SRS) (Parent)	xx
Vineland Adaptive Behavior Scales, Second Edition (VABS-2)	x
Wings Subgroups Questionnaire (WSQ)	x

Note. This table lists the assessments used in the eligible articles for comparison of validity and reliability in identifying and/or

diagnosing ASD in young children.

Appendix C

Search Term Flow Chart

Figure 1
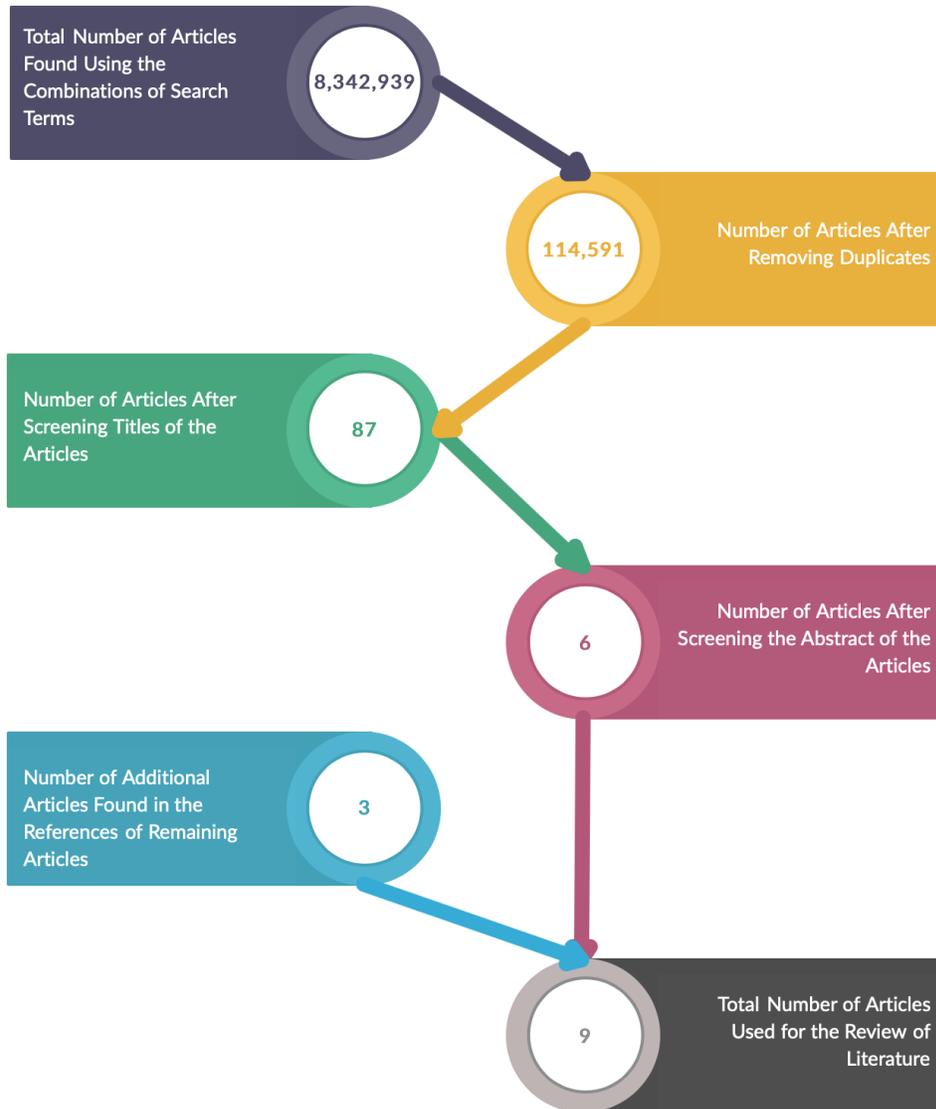
Search Term Flow Chart
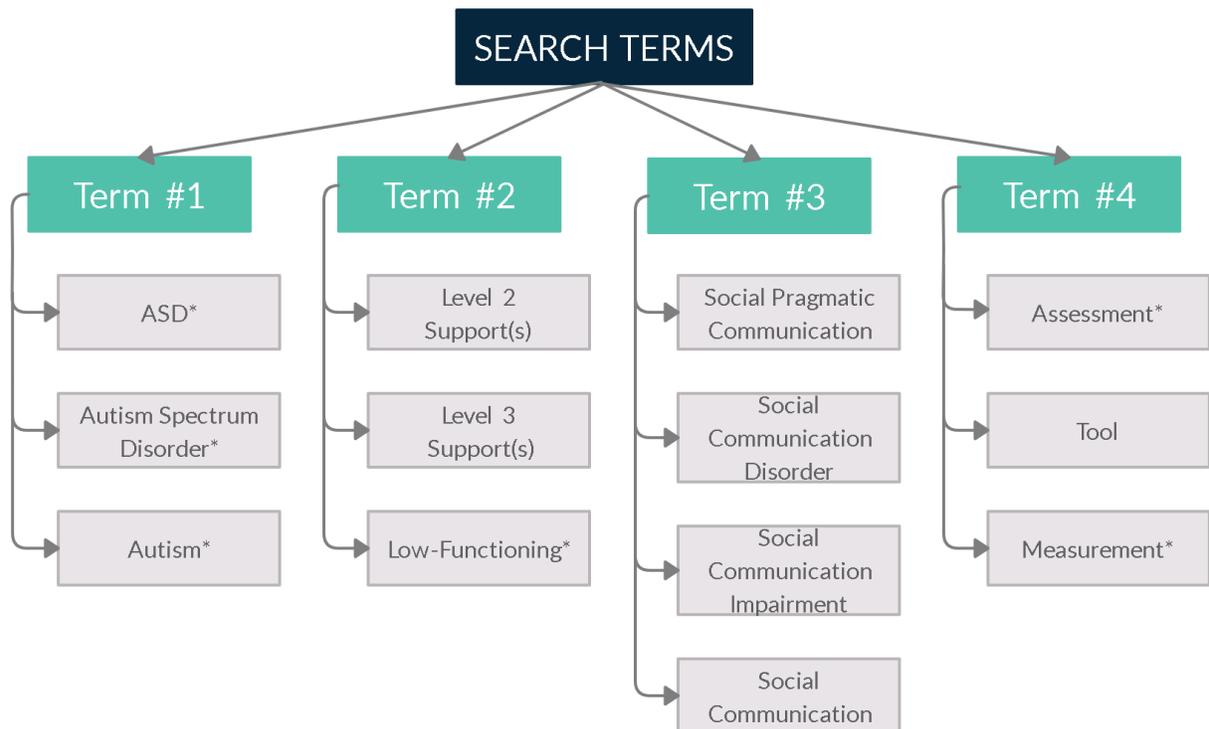
Note. Terms marked with an asterisk (*) indicate terms that had to be in the title in order to pass

the title screening during the eligibility process.

Flow Chart of Article Eligibility

Figure 2

F*low Chart of Article Eligibility*

Note. This flowchart demonstrates the process and quantity of articles left after applying the

inclusionary and exclusionary criteria for the steps listed in the Methodology.

Article Analysis Form

Article Identifying Information

Article Reference:

Full Abstract:

Methodology (Highlight Answers Where Applicable)

Number of Participants		
Range of Age of Participants (Include year;months if Applicable)		
Ethnic/Racial Composition of Participants (Select All That Apply)	White/Caucasian	Native American
	African American	Asian
	Latinx	Other (specify):
Gender of Participants (List Number of Each Gender)	Male:	Female:
Languages Known (Select One)	Monolingual	
	Bilingual (list languages known):	
	Multilingual (list languages known):	
	Not Reported	
Socioeconomic Status (Select One)	High	
	Middle	

	Low
	Not Reported
Randomization of Participants, if applicable (Select One)	YES
	NO
	Not Reported

Assessments Used (list all that are mentioned):

1.

Analysis (list all that are applicable):

ASSESSMENT #1: [Insert Assessment Name]

Formal or Informal?	FORMAL	INFORMAL
Type of Assessment (Select All That Apply)	Observation	Questionnaire
	Check-List	Other (specify):
Who can administer the assessment?	Licensed Clinician/Health Professional	Parent/Caregiver
	Teacher/Educator	Other (specify):
Does the assessment provide information about the individual's social communication? (Select One)	YES	NO
If YES, does the assessment have a section specifically for social communication? Or is the information obtained throughout the assessment? (Select One)	SPECIFIC SECTION/SUBSECTION	OBTAINED THROUGHOUT
If YES, what information is provided?		
Validity noted?	YES	NO

(Select One)		
Reliability noted? (Select One)	YES	NO

Results and Discussion

Summary of Major Findings:

Implications of Major Findings:

Further Studies Suggested:

References

This article analysis tool is NOT a standardized tool for analyzing articles. This article analysis tool was created for specific use for this review of the literature. It was adapted from the Primary Research Appraisal Tool (PRAT) developed by DeJarnette, et al. (2012).

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