4 Comprehensive Assessment of Autism Spectrum Disorders

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Overview

The evaluation process for autism spectrum disorder (ASD) can vary drastically in the way it looks due to the wide variety of assessments and domains that are included in a comprehensive evaluation. This chapter attempts to delineate best practices in the autism spectrum disorder diagnostic evaluation process by reviewing the domains of interest in an evaluation, the common assessment tools used in these domains, common comorbid diagnoses, and other diagnostic considerations. Additionally, each of these components will vary based on the child's general developmental category (i.e., infant/toddler, childhood/preadolescence, and adolescence) to ensure that tests and procedures were created and normed with similarly aged children and/or developmentally appropriate.

Every evaluation should begin with an intake interview designed to gather information about the child's presenting concerns, developmental history, family history, medical history, and service history. The intake typically involves the primary caregivers of the child but may include other significant adults such as grandparents and service providers. The information gathered in this initial meeting will directly impact the assessment battery chosen to assess the various areas of concern and interest. Autism-specific behaviors, cognitive ability, adaptive behaviors, speech/language ability, restricted interests and repetitive behaviors, sensory abnormalities, and other psychological comorbidities are the areas typically assessed in a comprehensive autism evaluation.

A comprehensive evaluation process should result not only in a diagnosis but also in individualized recommendations for support and interventions services that often include applied behavioral analysis services. These recommendations should be included in the completed testing report and disseminated to parents and other relevant parties during a feedback session. Lastly, future directions for the field of autism diagnostics will be discussed in this chapter as well.

Diagnostic Domains

Autism-Specific

The heart of evaluation for autism spectrum disorder, regardless of age, is the use of tools designed to assess autism-related symptoms and behaviors. Per the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V; American Psychological Association [APA], 2013), autism spectrum disorders are a collection of neurodevelopmental disorders characterized by differences in social communication, difficulty with social interaction, and restricted and repetitive behaviors and interests. Individuals with autism can present with a vast array of difficulties with social communication and interaction such as a lack of initiation of social interaction, decreased social-emotional reciprocity, infrequent and/or poorly modulated eye contact, failing to integrate verbal and nonverbal communication, difficulty with creating and maintaining relationships with others, a lack of imaginative play, and little interest in their peers. ASD is also characterized by the presence of restricted and repetitive behaviors and interests (RRBIs). For children and adolescents, this can present as repetitive or ritualistic play, difficulties with transitions, insistence on sameness, intense interests in certain objects or subjects, and sensory abnormalities. Comprehensive evaluation of autism spectrum disorder should contain evaluation instruments that assess these domains. Fortunately, there are a number of instruments that can be used to accomplish this goal across childhood and adolescence. Additionally, these instruments are used to obtain evidence for an autism spectrum disorder diagnosis through multiple formats, including parent/caregiver report, teacher report, structured interview procedures, and clinical observation.

Parent/caregiver and teacher report tools are vital to both screening for ASD and to gain an

understanding of an individual's symptoms and behaviors from the perspective of important stakeholders in their lives. Prior to be referred for a comprehensive evaluation for autism spectrum disorder, children are often screened using a measure such as the Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R; Robins et al., 2009). The M-CHAT-R is a brief, parent report screening tool used to assess risk for autism spectrum disorder among toddlers between ages of 16 and 30 months. The M-CHAT-R is a free instrument, often used by primary care and pediatric physicians to provide a quick screener for early signs of autism with minimal training (Sturner et al., 2016). Physicians can use the follow-up interview to further screen children who have been identified as medium-risk, while children that fall in the high-risk range should be bypassed for the follow-up interview and instead be recommended for early intervention services and a diagnostic evaluation. Unfortunately, the M-CHAT-R only covers a small age range. The Gilliam Autism Rating Scale, Third Edition (GARS-3; Gilliam, 2013) is another screening tool with a wider age range of 3–22 years. It is more comprehensive than the M-CHAT-R, with 56 items and six subscales assessing restrictive/repetitive behaviors, social interaction, social communication, emotional responses, cognitive style, and maladaptive speech. The GARS-3, much like any screening tool, should be used with caution as it should not be used in isolation to make a diagnosis. The instrument was revised to reflect the change in diagnostic criteria for ASD in the DSM-V, but may still have low sensitivity for individuals that do not have a comorbid intellectual disability (Nickel & Huang-Storms, 2017). In general, both of these measures should be used as screeners for autism spectrum disorder rather than stand-alone evidence for a diagnostic classification and while these are a few of the most commonly used screeners in our field, there are several other well-validated tools that can be used as part of a comprehensive ASD battery.

A few excellent alternatives to the M-CHAT and GARS include measures such as the Autism Spectrum Rating Scales, the Baby and Infant Screen for Children with aUtIsm Traits, Autism Spectrum Disorders – Child, and the Social Responsiveness Scale-Second Edition. These tools provide a greater breadth of information about the presence and severity of symptoms and can be used both as screeners or as part of a larger comprehensive assessment battery. The Autism Spectrum Rating Scales (ASRS; Goldstein & Naglieri, 2009) are a set of forms created to measure behaviors associated with autism by a child's caregiver or teacher for children between the ages of 2 and 18 years. There are a total of four different forms for the age ranges of 2–5 years and 6–18 years, with options of caregiver or teacher reports for each age range. Additionally, there is a short form for each age range that could be completed by caregivers or teachers; however, this should be used as a screener or for treatment monitoring in the place of the M-CHAT-R or GARS-3 instead of as part of a diagnostic evaluation due to their brevity. Additionally, there is a prorated method of scoring available for individuals with limited or no language that can be used for all forms (Goldstein & Naglieri, 2013).

The Social Responsiveness Scale-Second Edition (SRS-2; Constantino & Gruber, 2012) is another multi-form assessment tool that can be used in autism spectrum disorder evaluations. Like the ASRS, the SRS-2 assesses the social deficits as well as restricted and repetitive behaviors associated with autism for individuals ages 2½ years to adulthood (Constantino & Gruber, 2012). It consists of four different forms that depend on an individual's age: pre-school (2½–4½ years old), school-age (4–18 years old), adult (19 years old and older), and an adult self-report, something that the ASRS does not have. However, it does not contain alternative scoring for those with limited to no language ability like the ASRS. As the ability to use language can significantly impact the interpretation of an individual's social-communicative ability, it is recommended to use a tool like the ASRS that can account for that.

There are also other tools that can be used to gather a parent/caregiver report of symptoms and behaviors that also include measures of comorbid difficulties, like the Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT; Matson et al., 2007) or the Autism Spectrum Disorders—Child assessment battery (ASD-C; Matson & González, 2007a, b, c). The BISCUIT can be used with infant/toddler ages 17–37 months, while the ASD-C is intended for children ages 3 years and older. Each measure is comprised of three parts. Like the ASRS, the first parts of the BISCUIT and ASD-C are intended to measure the presence of symptoms of autism and the level of impairment related to each symptom. What is unique to the BISCUIT and ASD-C are the second and third parts. Part two of the BISCUIT assesses disorders and difficulties that commonly co-occur with autism, including attention deficit/hyperactivity disorder, conduct disorder, obsessive-compulsive disorder, specific phobia, tic disorder, and eating difficulties. Part three assesses the child's impairment related to challenging behaviors like stereotypy, aggression, and self-injury. The ASD-C expands upon the content of the BISCUIT's part two and three by assessing for additionally developmentally relevant difficulties, such as depressive symptoms and other internalizing behavior problems.

In conjunction with parent or caregiver report of an individual's behavior, it is vital to incorporate clinical observation of the child or adolescent into a comprehensive evaluation. This goal is often accomplished with the ADOS-2. The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012), is a semi-structured, standardized observational measure of communication, language, social interactions, repetitive, restricted behaviors and interests, as well as play and imagination. It contains five different modules that could be administered depending on the individual's age and developmental level. It is designed to be used with children from 12 months old to adulthood. Trained individuals select and administer the appropriate module to the child, which often consists of engaging, play-based tasks, and then code the child's behavior following the administration. These codes are then transferred into an algorithm which produces scores with specific autism or autism spectrum cutoffs, with the exception of the Toddler Module in which the algorithm produces ranges of "concern".

The Childhood Autism Rating Scale, Second Edition (CARS-2; Schopler et al., 2010) is a measure of autism symptom severity also based on direct clinical observation. However, the CARS-2 is a questionnaire completed by the clinician after all encounters with the child have occurred, rather than a rating based on one test administration like the ADOS-2. The clinician can also have a caregiver complete an additional CARS-2 questionnaire to provide additional information for their ratings. The CARS has two forms: the Standard Version and the High-Functioning Version. The High Functioning version should be used if the individual in question has average or above cognitive skills, great verbal ability, and fewer social and behavioral difficulties. For both forms, the ratings are summed and transformed to derive a T-score. This resulting T-score for this instrument is interpreted differently than T-scores are typically interpreted. The CARS-2 is based on data from individuals on the spectrum instead of neurotypical children. Instead of an average T-score indicating few to no symptoms of autism spectrum disorder, an average score is indicative of an average level of autism-related symptoms and behaviors. The CARS-2 should not be used in place of the ADOS-2, but it can be helpful to incorporate other behavioral observations from other testing appointments in a standardized fashion in addition to the data gathered by the ADOS-2.

Comprehensive evaluations can also include standardized interview tools, like the Autism Diagnostic Interview-Revised (ADI-R; Rutter et al., 2003) or the Monteiro Interview Guidelines for Diagnosing the Autism Spectrum, Second Edition (MIGDAS-2; Monteiro & Stegall, 2018). The ADI-R is a semi-structured interview that clinicians can use to thoroughly evaluate an individual's developmental history and current behavior. The interview is administered to a parent or caregiver that is familiar with the individual and can provide information about family

history, education, previous diagnoses, medications, developmental history, language, social development and play skills, interests, and other relevant behaviors such as aggression, self-injury, and epilepsy. Parents and caregivers can answer questions about their children across a wide age range as long as the child's cognitive age is at least 2 years. One could also use the MIDGAS-2 as part of a comprehensive evaluation. It differs from the ADI-R in that the individual suspected of having autism is included in the process. The assessment includes guidelines for conducting an interview with parents, caregivers, and teachers about the individual's behavior at home and in school and for conducting a sensory-based interview with the individual. The evaluation results in a comprehensive behavioral profile that can be used in conjunction with other assessment procedures to provide a diagnosis and guide treatment planning.

It is also possible to derive evidence for an autism diagnosis from other measures that do not fall in the realm of parent/caregiver report, observational, or interview measures. One such tool is the Developmental Neuropsychological Assessment (NEPSY-II; Brooks et al., 2009). By itself, the NEPSY-II is a comprehensive neuropsychological assessment for children and adolescents, measuring domains such as attention, executive functioning, memory, learning, sensorimotor ability, and visual processing. It also contains two specific subscales assessing social perception that can indicate difficulties associated with autism spectrum disorder: Theory of Mind and Affect Recognition (Narzisi et al., 2013). While not directly created for ASD evaluations, use of these subtests can provide additional objective information about the individual's ability to recognize different emotions and comprehend others' perspectives, intentions, and beliefs. These subtests can be administered alone or as part of a battery of NEPSY-II subtests, especially if the presenting problems indicate comorbid difficulties with attention, memory, or learning.

Video-based diagnostic tools are becoming more commonplace as the need for diagnostic services, especially those that can be provided remotely, increases. The Vanderbilt Kennedy Center's program TELE-ASD-PEDS is one such telehealth tool designed to assess for autism in children under 36 months (Corona et al., 2020). The provider instructs the parent or caregiver to engage in several tasks with their child, which allows the provider to make important behavioral observations regarding potential autism symptoms. NODA is another remote assessment platform that utilizes video to capture the child's behavior in the home available for clinicians to incorporate in their assessment practices (Nazneen et al., 2015). Other platforms have incorporated machine learning and artificial intelligence (AI) into their diagnostic process that are trained to identify autism based on patient data. COGNOA is one such program that utilizes parent/caregiver report questionnaires, home videos of the child, and other health information to provide early identification of autism (Abbas et al., 2018) Needless to say, the use of technology in screening and diagnosis of autism is a burgeoning area that will continue to grow in the hopes that the process can become more efficient and accessible (Table 4.1).

Cognitive

In addition to the assessment of the core features of ASD, there are multiple other domains related to the presentation of ASD, potential comorbid or differential diagnoses, and overall prognostics that should be included in a comprehensive assessment. Recent estimates suggest that approximately 30% of children diagnosed with autism spectrum disorder also have a comorbid intellectual disability (Maenner et al., 2020). The DSM-V listing for ASD includes a specifier for cognitive impairment for this very reason (APA, 2013). Thus, assessment of cognitive ability is vital to a comprehensive assessment of a child suspected of an autism spectrum disorder. It is also important as an intellectual profile can also delineate a child's strengths that are important to the interpretation of the overall assessment results and can be incorporated into treatment. The best tool for cognitive assessment can vary depending

Table 4.1 Autism-specific measures

Measure	Age range	Format
M-CHAT-R (Robins et al., 2009)	16–30 months	Parent/caregiver report rating form
GARS-3 (Gilliam, 2013)	3–22 years	Parent/caregiver or teacher report rating form
ASRS (Goldstein & Naglieri, 2009)	2–18 years	Parent/caregiver or teacher report rating form
SRS-2 (Constantino & Gruber, 2012)	2.5 years and up	Parent/caregiver, teacher, and self-report rating form
BISCUIT (Matson et al., 2007)	17–37 months	Parent/caregiver report rating form
ASD-C (Matson & González, 2007a, b, c)	3–16 years	Parent/caregiver report rating form
ADOS-2 (Lord et al., 2012)	12 months and up	Clinician ratings based on clinical observation of child's behavior
CARS-2 and CARS-2-HF (Schopler et al., 2010)	2 years and up	Clinician ratings based on clinical observation of child's behavior across testing sessions
ADI-R (Rutter et al., 2003)	2 years and up	Semi-structured interview with parent/caregiver
MIDGAS-2 (Monteiro & Stegall, 2018)	Toddlers, children, adolescents, and adults	Guided interview process with caregiver/parent and sensory-based interview with individual
NEPSY-II Theory of Mind and Affect Recognition Subtests (Brooks et al., 2009)	3–16 years	Structured items administered to the child/adolescent
teleASD PEDS (Corona et al., 2020)	Under 36 months	Remote video-based clinical observation of child's behavior
NODA (Nazneen et al., 2015)	NA	Remote video-based clinical observation of child's behavior
COGNOA (Abbas et al., 2018)	NA	Assessment platform that includes remote assessment and video-based observation

on the child's age and language ability; therefore, multiple options are discussed below.

Comprehensive assessment of cognitive ability can be difficult for younger children, especially for those with developmental delays or limited verbal ability. The Bayley Scales of Infant and Toddler Development, Fourth Edition (Bayley & Aylward, 2019) contains a measure of cognitive development for infants and toddlers ages 16 days to 42 months. The assessment contains play-based tasks designed to evaluate the child's visual preference, attention, memory, sensorimotor exploration and manipulation, and concept formation skills compared to their same-aged peers. Similarly, the Mullen Scales of Early Learning (Mullen, 1995) is an assessment system for infants and toddlers for measuring emerging cognitive, language, and motor development. The age range of the Mullen extends to 68 months. However, it has not been updated since its inception, while the Bayley was recently updated and is considered to be a more comprehensive assessment (which also includes measures of receptive/expressive language, motor, social emotional, and adaptive skills). Overall, the Bayley is the preferred cognitive assessment instrument for estimating cognitive ability in infants and toddlers.

Starting at age two, clinicians can use the Stanford-Binet Intelligence Scales, Fifth Edition (SB-V; Roid, 2003) to obtain a more comprehensive picture of the child's intelligence. Unlike the Bayley and Mullens, which are estimates of cognitive development skills, a standardized administration of the SB-V provides a measure of the child's full-scale intelligent quotient (IQ), verbal IQ, and nonverbal IQ. Having a comparison of verbal versus nonverbal ability can provide additional evidence for an autism diagnosis as signifi-

cant differences between verbal and nonverbal cognitive ability have long been associated with autism spectrum disorder (Ankenman et al., 2014). Additionally, it can provide insight into how the child learns best and what types of activities they will enjoy, which can be helpful for tailoring supportive intervention services after the evaluation.

Regardless of chronological age, some children are unable to complete a verbal cognitive assessment like the SB-V due to verbal language impairments. In these cases, the Leiter International Performance Scale, Third Edition (Roid et al., 2013) can be used to obtain an estimate of nonverbal cognitive ability across the lifespan, starting at age 3. If the child is not old enough to complete the Leiter, the evaluator should instead administer the Bayley scales. The Leiter is a test of nonverbal intelligence and cognitive abilities that was specifically designed for the assessment of individuals with disabilities, such as autism spectrum disorder. Using the Leiter-3 allows the examiner to obtain a measure of an individual's innate intellectual ability regardless of their verbal communication skills. While this assessment does not allow for the examination of a potential fractured IQ profile, it does give the best estimate of intellectual ability in individuals that are nonspeaking or have limited language ability.

There are multiple Wechsler-branded assessments of intelligence that are also commonly used to assess cognitive ability during autism evaluations. The two most commonly used for children and adolescents are the Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition (WPPSI-IV; Wechsler, 2012) and the Wechsler Intelligence Scale for Children, and Fifth Edition (WISC-V; Wechsler, 2014). The WPPSI-IV is intended for children ages 2 years and 6 months to 7 years and 7 months, while the WISC-V is used with children and adolescents ages 6 years to 16 years and 11 months. These assessments contain developmentally appropriate subtests that assess the child's verbal comprehension, visual-spatial ability, fluid reasoning skills, working memory, and processing speed. Like the SB-V, the WPPSI-IV and WISC-V provide a measure of nonverbal ability that can be compared to measures of the child's verbal ability. However, the SB-V does not contain a measure of processing speed, which can significantly influence the interpretation of an individual's overall ability. The Wechsler assessments contain the General Ability Index (GAI) that separates these abilities from the overall full-scale IQ in the case that these abilities are significantly influencing their scores. Additionally, the WPPSI and WISC can be used to derive a Cognitive Proficiency Index, a measure of working memory, and processing speed. This index may be indicative of comorbid attention difficulties, which are discussed later in this chapter. While the SB-V provides a better comparison of verbal versus nonverbal ability, it may be worthwhile to administer a Wechsler test instead if attentional difficulties are a concern. However, if the child has limited to no language ability, the evaluator should instead administer the Leiter-3 and utilize the supplementary attentional and memory subtests that are a part of that instrument.

The Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV; Wechsler, 2008) is normed for ages 16–90, meaning that it technically encompasses part of the adolescent age range. Unlike the WPPSI-IV and WISC-V, the WAIS-IV does not contain measures of nonverbal intelligence or cognitive proficiency and is not recommended. Similarly, some may consider using the Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II; Wechsler, 2011) for this same age range but should considered this measure with even greater caution. The WASI gives a simplified measure of verbal and nonverbal ability comprised of only four subtests. While it can give an estimate of cognitive ability, the WASI-II is unable to provide information about other cognitive areas such as processing speed and working memory that are significant in the interpretation of evidence toward or against a diagnosis of autism spectrum disorder (Table 4.2).

Table 4.2 Cognitive assessment measures

Measure	Age range	Format
Bayley Cognitive Subtest (Bayley & Aylward, 2019)	16 days to 42 months	Structured items administered to the child and caregiver report
Mullen (Mullen, 1995)	1–68 months	Structured items administered to the child
SB-V (Roid, 2003)	2–85+ years	Structured items administered to the child
Leiter-3 (Roid et al., 2013)	3–75+ years	Structured items administered to the child nonverbally
WPPSI-IV (Wechsler, 2012)	2.5–7 years, 7 months	Structured items administered to the child
WISC-V (Wechsler, 2014)	6–16 years, 11 months	Structured items administered to the child
WAIS-IV (Wechsler, 2008)	16–90 years, 11 months	Structured items administered to the adolescent
WASI-II (Wechsler, 2011)	16–90 years, 11 months	Structured items administered to the adolescent

Adaptive

Adaptive behaviors are those behaviors that involve conceptual, social, and practical skills of which enable a person to manage their environment in a way that promotes success. These behaviors may include daily living skills, social skills, communication skills, and motor skills. Those with an autism spectrum disorder may exhibit significant deficits within these areas such that they may struggle to take care of themselves throughout their daily lives. They may also have difficulties interacting with others and maintaining conversation which aligns with deficits in these skills. For comprehensive autism evaluations, information regarding adaptive behavior is typically gather via parent report, teacher report, and self-report measures. Including an assessment of adaptive behaviors can help to identify how the individual engages with others, how well they are able to independently take care of themselves, and how they keep themselves safe.

At present, there are two main assessment tools that are recommended for use in the evaluation of adaptive skills: The Adaptive Behavior Assessment System-Third Edition (ABAS-3; Harrison & Oakland, 2015) and the Vineland Adaptive Behavior Scale- Second Edition (Vineland-3; Sparrow et al., 2016). The ABAS-3 (Harrison & Oakland, 2015) consists of a parent/caregiver report measure, a teacher/day-care report measure, and a self-report measure. This assessment encompasses a wide age range with norms that range from birth up to 89 years old. This measure assesses the conceptual, social, and practical domains of adaptive skills and includes 11 different skill areas such as communication, community use, functional academics, health and safety, home or school living, leisure, motor, self-care, self-direction, social, and work. These items focus on everyday activities required to care for oneself, interact with others effectively and independently, and meet environmental demands, which can be a difficult for individuals on the spectrum.

The Vineland-3 (Sparrow et al., 2016) is similar to the ABAS-3 in both structure and content. Like the ABAS-3, the Vineland-3 assesses the different domains of adaptive behavior including communication, daily living skills, and socialization. The primary differences between these measures are the inclusion of a semi-structured interview form and the exclusion of a self-report form. The interview form is meant to assess the adaptive behaviors of those from birth to 90 years of age where either a parent or caregiver is interviewed regarding the adaptive behaviors of the individual being evaluated. While the Vineland-3 lacks a self-report form, the ABAS-3 self-report is intended for ages 16–89, meaning that it would not likely be helpful to include unless the evaluation was for an older adolescent. Overall, both tools are adequate for the assessment of adaptive behaviors in children and adolescents across multiple raters and multiple settings for the purpose of diagnosis and to delineate target behaviors for intervention services.

While no longer a recommended measure of assessment for adaptive behaviors, it is important to mention the Scales of Independent Behavior-

Table 4.3 Adaptive behavior assessment measures

Measure	Age range	Format
ABAS-3 (Harrison & Oakland, 2015)	Birth to 89 years and 11 months	Parent/caregiver, teacher/daycare provider, and adult self-report rating forms
Vineland Adaptive Behavior Scale (Sparrow et al., 2016)	Birth to 90 years	Semi-structured interview, parent/caregiver rating form, and teacher rating form

Revised (SIB-R; Bruininks et al., 1996) as it has been used historically as an integral part of diagnostic evaluations for autism. This measure was intended to assess functional independence and adaptive functioning across different settings from birth to 80 years old. However, the SIB-R has not been updated since its release in 1996 and includes many outdated adaptive tasks/skills that are not expected of individuals today. Therefore, it is strongly recommended that this measure no longer be used in the field (Table 4.3).

Speech/Language

Impairments in speech, language, and social communication are core features of ASD. The range of verbal abilities is extensive, as are the idiosyncrasies in language differences common to those with ASD. These differences in verbal abilities or characteristics include speech and language delays, echolalia, idiosyncratic speech, and a host of other language differences (Mody & Belliveau, 2013). Many with ASD have limited verbal communication with about 30% being deemed nonverbal after failing to develop phrase speech by 9 years of age (Anderson et al., 2007). While later speech acquisition does occur at higher rates than previously thought (Pickett et al., 2009), speech acquisition after middle childhood is rare and of those that have not developed phrase speech by 4 years of age, higher nonverbal IQ was the biggest indicator of differentiating those that will develop phrase and/or fluent speech later in childhood (Wodka et al., 2013). Other common speech differences include odd intonation or monotone speech, other prosody differences, immediate and delayed echolalia, and articulation issues often related to apraxia and other oral-motor impairments. Some differences observed are within the acquisition of language with some individuals exhibiting deficits in vocabulary and others exhibiting advanced vocabulary, though both tend to have limitations in abstract and social-emotional language (e.g., pronoun reversals, difficulties labeling emotions, relationships, and abstract concepts). While these differences are not specific to ASD and are observed in typical development and other neurodevelopmental disorders (Gernsbacher et al., 2016), the pervasiveness and unique characteristics of these differences can often serve as key indicators of ASD and warrant comprehensive assessment.

The two most common and appropriate tests for this population for a broad comprehensive assessment of speech-language skills are the Preschool Language Scales-fifth edition (PLS-5; Zimmerman et al., 2011) and the Clinical Evaluation of Language Fundamentals-fifth edition (CELF-5, Wiig et al., 2013). Both of these assessments include a broad assessment of receptive and expressive language abilities and are the foundation of a strong comprehensive speech-language assessment. Both tests exhibit sufficient sensitivity and specificity in identifying receptive and expressive language deficits and are further useful in identifying deficits and differences common in ASD.

The PLS-5 can be used with children from birth to 7 years of age and is a play-based assessment. It produces two broad standard scores of receptive auditory comprehension and expressive communication. Additionally, this test provides information that not only includes analysis of semantics and language structure but also provides useful information on attention, use of gestures, social communication, vocal development, play, as well as emergent literacy skills. The test also provides an articulation screener and is available in both English and Spanish. For older children, the CELF-5 has been normed for individuals 5–21 years of age and is a more structured assessment than the PLS-5. The CELF-5

includes 16 individual subtests that can be selected based on the referral question or clinical concerns. Like the PLS-5, it also produces broad standard scores for receptive and expressive communication skills (in addition to a core language score) as well as assessing sentence structure/content and language memory/attention. Additionally, the CELF-5 includes a pragmatics observation checklist that can be used as a screener for pragmatic deficits common in ASD. Lastly, the CELF-5 also includes supplementary tests assessing reading comprehension and a structured writing subtest.

A third option commonly used for infants and toddlers is the Bayley (Bayley & Aylward, 2019) subtests of receptive and expressive language, which is often used when administering the other components of the Bayley (e.g., cognitive subtest). As noted earlier, the Bayley scales can be used with infants as young as days through toddlers up to 42 months of age. These subtests incorporate structured items administered to the child supplemented with behavioral observations of language use during the testing session through play-based interactions and tasks.

Because children with ASD often struggle with the pragmatic and social use of language, oftentimes it is helpful to assess these areas of language development in addition to the broad information provided by the PLS-5 and CELF-5. Two measures commonly used for a deeper assessment of a broad range of language skills, and include good measures of pragmatic language use, are the Comprehensive Assessment of Spoken Language, second edition (CASL-2; Carrow-Woolfolk, 2017) and the Oral and Written Language Scales, second edition (OWLS-II; Carrow-Woolfolk, 2011). Both of these measures assess four scales of language structure (i.e., lexical/semantics, syntax, supralinguistics, and pragmatics) and can be used with individuals aged 3–21 years. The OWLS-II assesses these four languages scales across the areas of listening comprehension, oral expression, reading comprehension, and written expression whereas the CASL-2 is strictly a measure of spoken language. However, the CASL-2 has several subtests that assess areas of language that children with ASD commonly struggle with including non-literal language, pragmatic language, and idiomatic language. Assessment of these language areas can be helpful in identifying needed supports in the social use of language.

More recently developed assessments of pragmatic language, such as the Clinical Assessment of Pragmatics (CAPs; Lavi, 2019) have started to incorporate video-based components to further assess the complex nature of pragmatic language use. Normed for use with children between 7 and 18 years of age, this unique assessment provides a more thorough assessment of pragmatic and social language skills and development including awareness of basic social routines, reading context and nonverbal cues and the use of these same skills, and expressing emotions. While the normative sample does include children with autism, it would not be appropriate for an individual with a comorbid intellectual disability or severe language impairment. The measure provides information that can inform many areas of needed supports and aid in the development of pragmatic goals (Table 4.4).

Restricted and Repetitive Behaviors and Interests

Restricted and repetitive behaviors and interests are one of the hallmark diagnostic criteria of autism spectrum disorder. These behaviors and interests may consist of insistence on sameness, becoming fixated on certain objects, having a heightened or lower sensitivity for different senses, and repetitive movements like spinning or rocking. Although RRBIs are a core feature of autism spectrum disorders, this domain is not specific to autism. There are other disorders such as obsessive-compulsive disorder that also feature RRBIs which makes it critical to assess for differing sensory abnormalities. When assessing restrictive and repetitive behaviors it is also important to consider compensatory behaviors, which are behaviors that allow the individual to mask or hide autism characteristics from others. Compensatory or masking behaviors can make restrictive and repetitive behaviors look different

Table 4.4 Speech/language assessment measures

Measure	Age range	Format
Bayley Receptive/Expressive Language Subtests (Bayley & Aylward, 2019)	16 days to 42 months	Structured items administered to the child, observation, and caregiver report
PLS-5 (Zimmerman et al., 2011)	Birth to 7 years	Structured items administered to the child
CELF-5 (Wiig et al., 2013)	5–21 years	Structured items administered to the child/adolescent
CASL-2 (Carrow-Woolfolk, 2017)	3–21 years	Structured items administered to the child/adolescent
OWLS-II (Carrow-Woolfolk, 2011)	3–21 years	Structured items administered to the child/adolescent
CAPs (Lavi, 2019)	7–18 years	Structured video-based items administer to the child/adolescent

to others and may make them difficult to understand. Because compensatory behaviors could alter how these RRBIs may appear, it is best to use a self- or parent report and interviews to accurately capture how they may exist. When assessing for repetitive and restrictive behaviors and interests, it can be helpful to use a multimethod technique, meaning that the clinician should use both observation and other sources of information whether it be self- or parent reports. This may be especially relevant when assessing adults as the measures specific to adulthood are limited.

There are few different tools that can be used to assess RRBIs in both children and adolescents. One such tool used to measure repetitive and restrictive behaviors is the Repetitive Behavior Scale for Early Childhood (RBS-EC; Wolff et al., 2016). This report measure is designed for children from 17 months to 7 years of age and can be completed by parents, caregivers, and teachers. The RBS-EC is intended to understand differences across a broad range of repetitive and restrictive behaviors while focusing on quantifying the dimensions of these behaviors. A recent psychometric study by Lachance et al. (2021) has provided additional normative data regarding age and gender which can be used for comparison during the evaluation process. The Repetitive Behaviors Scale-Revised (RBS-R; Bodfish et al., 1999) is a similar measure suited for individuals from 6 to 17 years of age. This measure assesses stereotyped behavior, self-injurious behaviors, compulsive behaviors, routine behavior, sameness behaviors, and restricted behaviors and is also typically completed by parents or caregivers of the child. Individuals answer questions about repetitive movements, special interests, and insistence on sameness. These questions help to highlight the different behaviors that individuals engage in that they may be masking when in the presence of others.

It is important to recognize that the RBS-EC and RBS-R are strictly meant to assess restrictive and repetitive behaviors and are not autism-specific. While these measures may capture important information, it is essential to understand sensory abnormalities as well to truly understand RRBIs. Thus, it is vital to measure for differences in sensory processing when considering a diagnosis of ASD.

Sensory Abnormalities

Similar to RRBIs**,** sensory abnormalities are a core feature of autism spectrum disorder but are not limited to an ASD diagnosis. While many of the measures discussed include some component assessing sensory abnormalities (usually as an ASD specific diagnostic symptom), few measures have been developed specifically for the aim of assessing sensory abnormalities. One such measure is the Sensory Profile 2 (Dunn, 2014). This caregiver/teacher report measure can be used with children from birth through 14 years of age and assesses sensory abnormalities across sensory processing modalities (i.e., auditory, visual, touch, movement, body position, and oral sensory) and behavior (i.e., conduct, social-

emotional, and attentional) and categorizes these behaviors according to "quadrants", which assess the degree to which their sensory behaviors fall under one of four categories. These quadrants include seeking/seeker, avoiding/avoider, sensitivity/sensory, and registration/bystander which are based on two factors; the degree to which individuals actively self-regulate (with seekers and avoiders engaging in active self-regulation) and the threshold for which individuals notice sensory stimuli (with sensors and avoiders having a low threshold for noticing sensory stimuli). The scores produced by the Sensory Profile 2 are percentile ranges and a 5-point Likert scale ranging from much less than others to much more than others. Unfortunately, the measure does not provide scaled or standard scores and exhibits weak psychometric properties; however, the qualitative information gathered from this measure can be helpful in better characterizing the sensory abnormalities of the assessed individual to aid in the development of recommendations and intervention planning.

Psychological Comorbidities

Attention

One comorbidity with autism is difficulties with attention. Particularly, those with autism can have comorbid attention-deficit/hyperactivity disorder (ADHD). This disorder is defined by symptoms of inattention, hyperactivity, and/or impulsivity. In order to assess for ADHD within autistic individuals, caregiver and teacher report measures are available, such as the Behavior Assessment System for Children, 3rd Edition (BASC-3; Reynolds & Kamphaus, 2015) and the Conners-3 (Conners, 2008), for understanding these symptoms within an individual better. Measures can also be administered to the child, depending on their age. The primary behavioral measures that can be used with children for attention include the Conners Continuous Performance Test, 3rd Edition (Conners CPT-3; Conners, 2014), Conners Continuous Auditory Test of Attention (Conners CATA; Conners, 2014), Conners Kiddie Continuous Performance Test 2nd Edition (Conners K-CPT 2; Conners, 2006). The Conners CPT-3 and Conners CATA are for individuals 8 years old and older while the Conners K-CPT-2 is for children between the ages of 4 years and 7 years 11 months. In previous research, caregiver report measures such as the BASC-3 and Conners-3 have been able to differentiate between symptoms of ASD and ADHD while the Conners CPT-3 had more difficulty differentiating between these symptoms (Braconnier & Siper, 2021).

Feeding Problems

Children with autism have significantly more feeding problems than those without autism. Feeding problems that children can have include food selectivity, rapid eating, chewing difficulties, and food refusal. In order to understand these difficulties more, several measures exist to assess for them including the Brief Autism Mealtime Behavior Inventory (BAMBI; Lukens & Linscheid, 2008) and the Screening Tool of feeding Problems (STEP; Matson & Kuhn, 2001) that has been modified for use with children (STEP-CHILD; Seiverling et al., 2011). The BAMBI has been used with children 3–8 years old while the STEP-CHILD has been used with children 2–18 years old. Both of these measures are caregiver reports and provide clarity to the child's specific difficulties regarding feeding.

Sleeping Problems

Many autistic children have difficulties with sleep. This can include difficulty falling asleep, difficulty staying asleep, early waking, parasomnias, and daytime sleepiness. One way to measure sleep problems in children with autism is keeping a sleep diary in which antecedents, behavior, and consequences surrounding sleep difficulties are recorded. Through this, one would be able to better understand possible causes in the child's environment. Additional quantitative measures of sleep have been previously used to understand sleep difficulties within autistic children. These include the Children's Sleep Habits Questionnaire (CSHQ; Owens et al., 2000), the Behavioral Evaluation of Disorders of Sleep (BEDS; Schreck, 1998; Schreck et al., 2003) the

Family Inventory of Sleep Habits (FISH; Malow et al., 2009). The CSHQ has been used with children with autism from 2 to 18 years old. The BEDS has been used with 5- to 12-year-olds with autism. The FISH has been used with autistic children between the ages of 4–10 years.

Executive Functioning

Another common concern for autistic children is difficulties with executive functioning, which is broadly defined as inhibition, cognitive flexibility, impulse control, working memory, and planning. Executive functioning deficits are thought to be associated with difficulty with behavior regulation, affective regulation, and meta-cognition which negatively impacts one's ability to cognitively manage and execute tasks (Berenguer et al., 2018). Several measures exist that can examine these different aspects of executive functioning within autistic individuals. One such measure is the Delis-Kaplan Executive Functioning System (D-KEFS; Delis et al., 2001). The D-KEFS, used for ages 16 years old to 89 years old, has various tests that can be used to measure different aspects of executive functioning, such as cognitive flexibility, response inhibition, and planning. Another measure for executive functioning is the previously mentioned NEPSY-II, which can be administered to children aged 3–16 years old. The NEPSY-II measures six different domains, one of which is executive functioning.

Challenging/Disruptive Behaviors

Challenging and disruptive behaviors occur in children with autism at a higher rate than neurotypical children. These behaviors can include aggression, self-injury, and disruption to their environment. Often these behaviors are considered to be behaviors that can cause harm to the child or others, are not culturally or socially acceptable, and/or negatively affect their life or education. One measure of these behaviors is the Behavior Problems Inventory (BPI-01; Rojahn et al., 2001) which has been used with children aged 14 years and above. Another measure is the PDD Behavior Inventory (Cohen et al., 2003). This has been used with children with autism between the ages of 2–12 years. One other way to assess challenging and disruptive behaviors that can be used with children of any age is conducting a functional behavior assessment (FBA). An FBA involves gathering information about the antecedents of a behavior, details about the behavior itself, and consequences for the behavior. Additionally, challenging behaviors can also be assessed through the BISCUIT and ASD-C measures which were previously discussed.

Diagnostic Considerations

In addition to evaluation of the previous domains, there are other common areas that are important to consider during evaluation and the interpretation of results from the evaluation.

Regression of Skills

There are generally four patterns of development that have been identified in children that are identified as autistic (Pearson et al., 2018). Some children exhibit autism symptoms within the first year of life. Others make developmental progress, but later experience a significant plateau in their development. Unfortunately, some children will attain developmental milestones but later regress or lose those skills. Other children that experience delays in their abilities from the beginning may also exhibit regression in certain skill areas. Previous research reports that the latter two patterns typically occur around 21 months of age, ranging from 15 to 30 months (Barger et al., 2013). Parents may report regression of their child's language skills, social skills, or a mixture of both. Documenting this regression is key as it provides context to the child's current delays and areas of impairment as well as important targets for intervention. For older children and adolescents, it also provides additional historical evidence for an autism spectrum disorder diagnosis.

Age Milestone Transitions

Individuals on the spectrum sometimes have difficulties with age-related transitions, such as entering kindergarten, transitioning to middle school, or transitioning to high school. Distress and impairment related to their ASD and other behaviors may worsen during these transitional periods. Evaluations of children undergoing these important transitions should include recommendations for better management of these transitions, such as providing increased occupational therapy support and school-based interventions (Davis, 2009; Marsh et al., 2017).

Compensatory Behaviors

One challenge of evaluating for autism, especially in older children, is the development of compensatory behaviors that hide or mask symptoms of autism. Compensatory behaviors, as it pertains to autism, is when an individual learns, whether consciously or subconsciously, to hide behaviors that may be considered socially unacceptable and compensate with behaviors that are viewed as socially acceptable; this is also often referred to as masking or camouflaging behaviors. For example, an individual with autism may learn to make eye contact, imitate facial expressions, or have phrases or jokes that are prepared for social conversations. These behaviors aid the individual in appearing socially competent. However, these compensatory behaviors can be taxing on the individual, potentially leading to diminished well-being, possibly due to stress associated with performing behaviors that do not come naturally to the person or from attempting to determine what behavior is appropriate to a situation. Individuals with compensatory behaviors tend to still have social issues, particularly with maintaining friendships, despite their own compensatory behaviors. Compensatory behaviors have also been found to be more prevalent in females than males, which can contribute to the disparate diagnostic rates (Ratto et al., 2018). Taken together, individuals with autism, especially females, may develop compensatory behaviors that could result in them resting below the diagnostic threshold for autism but still experiencing autism-related difficulties (Livingston et al., 2019).

Barriers to Diagnosis

It is believed that ASD is equally distributed across all races, ethnicities, and socioeconomic statuses. However, the actual reported prevalence rates have been found to differ across races. More specifically, communities of color typically have a lower prevalence rate of ASD than other communities (Baio et al., 2018; Center for Disease Control and Prevention, 2016; Tek & Landa, 2012). It is suggested that this is due to a lack of knowledge about autism and less access to healthcare resources within minority communities leading to fewer diagnoses (Tek & Landa, 2012). It has been found that socioeconomic status plays a role in these differences in prevalence rates as well (Durkin et al., 2017). This finding suggests that ASD is frequently underreported in racial and ethnic minorities from a lower socioeconomic status. Additionally, unique barriers exist for families that are of low income and/or minority backgrounds that create difficulties in receiving a full diagnostic evaluation. These barriers include having limited follow-ups scheduled after a positive screening for ASD due to lack of access to phones or higher levels of stigma associated with a diagnosis of autism (Khowaja et al., 2015). In addition to these barriers, it is often quite costly to obtain a diagnostic evaluation for autism, not only for the cost of the evaluation itself but for all costs associated with receiving that diagnosis (e.g., transportation to get the diagnosis, childcare for siblings, caregivers having to take time off work). Living in a rural area can also limit accessibility for diagnostic evaluation services. Not only are there fewer available options for families to receive these services, but the distance needed to travel to obtain these services is substantially higher and more costly. When there is limited access to proper resources, a diagnosis for autism may be missed or delayed. These barriers for an early diagnosis

of autism are then further compounded and complicated by challenges when attempting to diagnose autism later in childhood or later in life.

Comorbidities

An additional factor to consider when diagnosing autism is the high occurrence of co-morbid disorders (i.e., two or more disorders that co-occur within an individual). Individuals with autism tend to present with high rates of co-occurring disorders, including psychiatric disorders like anxiety, depression, social anxiety, and obsessive-compulsive disorder as well as medical conditions, such as sleep disorders, gastrointestinal disorders, and epilepsy (Ming et al., 2008). These high rates of co-morbidities can contribute to the difficulty of parsing apart what is autism and what is another disorder. A particularly noteworthy co-occurring disorder is social anxiety disorder, as both autism and social anxiety disorder tend to present similarly (e.g., aversion to social situations and lack of eye contact). While these behaviors may be present in both disorders, it is possible for a child to be diagnosed with either of these disorders, both, or neither. In order to differentiate between autism and another disorder, a clinician must understand the reasons behind the symptoms presented as well as have a thorough understanding of the criteria for these disorders and how they could present within an individual.

Recommendations and Treatment Planning

Once the results of the evaluation have been aggregated and interpreted, the clinician should utilize this information for the creation of tailored recommendations and treatment planning. There are several types of recommendations that are common to comprehensive testing reports for autism, including in-home supports, speech therapy, occupational therapy, ABA services, school-based recommendations, and even more depending on the child's needs. However, it is important to incorporate not only the data regarding the child's weaknesses but also the available information of their strengths when recommending these services. The individual's strengths can be leveraged to address their weaknesses in a more empowering and efficient way. For example, a child that struggles with language but excels in visual processing, as determined by cognitive and language assessment can be supported with the use of visual schedules to aid transitions at home and in school.

Feedback

Upon the completion of a diagnostic evaluation for autism, a feedback session is typically conducted. How this feedback process is completed can vary across settings, but there are key parts of the feedback session that should be included. During the feedback, a clinician should, at minimum, discuss the findings of the assessments, the diagnoses, and recommendations for the child and their family (Austin et al., 2012). However, feedback should not be limited to just this final session and should extend beyond. Providers should be continuously providing feedback to the caregiver throughout the evaluation session(s), such as information about the evaluation process and their observations of the child's behavior. Doing so can help prepare a family for this final feedback session. Withholding information about a potential diagnosis during the evaluation process, even if a diagnosis is not yet fully established, can be harmful to the final feedback session. It is important to consider the family's cultural background when providing feedback as this may contribute to their understanding and acceptance of the diagnosis and recommendations. Before the final session that is devoted to providing feedback, consider with the caregivers who should attend. It may or may not be helpful to have family members or other providers of the child present, depending on each family's situation. Also, the presence of young children during a feedback session has the potential to be disruptive or take the caregiver's focus away from the feedback session. During the feedback session, the clinician should inquire about any changes

that have occurred with the child since their last session, acknowledge how the family contributed to the evaluation process, and provide them with an overview of the feedback process (Austin et al., 2012). Providing caregivers who attend the feedback session with written material, such as an evaluation report, and focusing on the child's strengths are recommended. Always using clear language and allowing families time to process a diagnosis is helpful, as an autism diagnosis can be overwhelming for many families. For more information about conducting feedback sessions for autism diagnostic evaluations, we recommend the video series, handbook, and other resources created by Autism Speaks regarding the subject. These videos can be found at https://www.autismspeaks.org/tool-kit/atnair-p-guide-providing-feedback-families-affected-autism (Autism Speaks, n.d.).

Future Directions

While there have been great strides made in the field of diagnostics for autism spectrum disorders, there is always more work to be done. Clinicians and researchers have noted several areas in which current assessment literature and practices need to focus their efforts. For example, the field of diagnostics continues to search for new ways to increase the accessibility and efficacy of autism evaluations. As discussed earlier, multiple efforts are being made to incorporate video observation tools and telehealth in the diagnostic process. There is also interest in potential biomarkers that can be used to identify autism (Frye et al., 2019). While the current diagnostic process is heavily based on clinical observation of behaviors and caregiver report, biomarkers could provide biological evidence for autism and improve rates of early diagnosis. However, this research is in its infancy and will require continued research efforts in order to be integrated into evaluation procedures.

For current assessment methods, there is a need for the development of better tools for the diagnostic domains mentioned previously in the chapter. Assessment of RRBIs and sensory abnormalities in particular are lacking. The tools that do exist are often limited in their psychometric utility, age range, or format. In general, many autism assessments are limited to parent/caregiver report due to the inability of children and adolescents to report on their own developmental history and some behaviors. Current evaluative tools and those to be developed in the future should continue to expand their utility to older children and adolescents, increase their psychometric properties, and integrate multiple formats of assessment data to provide a comprehensive picture of the individual's symptoms and behaviors.

There is also important work to be done concerning autism and gender. The DSM-V criteria for autism spectrum disorder drive the creation of diagnostic instruments for evaluation; however, these criteria may not capture the presentation of ASD symptoms spanning the entire spectrum of gender. Historically, autism has been thought to be present more often in individuals assigned male at birth than those assigned female at birth, with a 4–1 ratio of boys to girls (Maenner et al., 2020). While this difference in diagnostic rates has remained stable over time, there are questions as to why there continues to be such a robust sex difference. The DSM criteria at present are not sex- or gender-specific despite potential differences in development for boys and girls on the spectrum (Rivet & Matson, 2011). Future research delineating these differences may provide evaluators with sex- and gender-specific consideration when evaluating for autism spectrum disorders. Additionally, a number of individuals on the spectrum are gender diverse, meaning that they identify outside of the gender binary (George & Stokes, 2018; de Vries et al., 2010). The field is just beginning to address this cooccurrence and what it means for the presentation of ASD symptoms and the evaluation process.

While this chapter is focused on the assessment of children and adolescents with autism spectrum disorder, there is burgeoning interest in increasing diagnostic efficacy for adults. Many adults with autism may go undiagnosed for a number of reasons including the barriers to diagnosis previously mentioned, not meeting criteria for previous conceptions of autism, less concern from parents about developmental issues, com-

pensatory behaviors, and more (Cage & Troxell-Whitman, 2019; Davidovitch et al., 2015; Durkin et al., 2017; Lai & Baron-Cohen, 2015; Maenner et al., 2020). As such, the field will need to continue its efforts to improve the evaluation process beyond childhood and adolescence.

Conclusion

As we conclude this chapter, we hope it has become clear that the evaluation process for autism spectrum disorder can and should be comprehensive. Assessment batteries should incorporate a multi-modal assessment approach, including parent/caregiver reports, teacher report if applicable, clinical observation measures, and standardized assessment measures. Of these methods, an evaluator should assess autism-specific symptoms and behavior, cognitive ability, adaptive behavior, speech and language ability, RRBIs, sensory abnormalities, and other potential comorbid disorders or difficulties. These domains and additional diagnostic considerations will give the evaluator an overall picture of whether the individual being evaluated meets criteria for an autism spectrum disorder and receive the support services they need.

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