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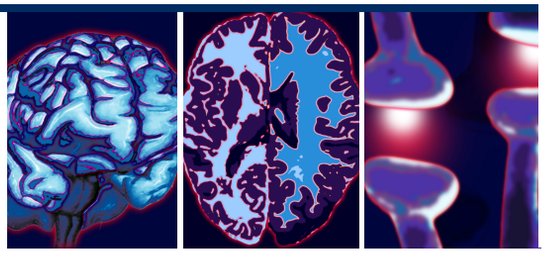

Differential diagnosis and comorbidity: distinguishing autism from other mental health issues

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Practice points

- Considerable overlap exists between autism spectrum disorder (ASD) and mental health disorders.
- High rates of overlap are significant because they affect the nature and type of problems displayed by persons with ASD and how the disorders are assessed.
- ADHD, anxiety disorders and depression are among the disorders most commonly associated with ASD.
- Symptom presentation is similar whether ASD occurs alone or with other conditions.
- Multiple assessments after initial diagnosis of ASD are frequently necessary.
- ASD can be diagnosed very early, while symptoms of other disorders emerge at different points in human development.

SUMMARY Comorbid autism spectrum disorder (ASD) and other mental health conditions are common. However, the recognition and study of this clinical issue is of recent origin. It has recently emerged that certain disorders are more likely to occur with ASD, such as ADHD, depression, anxiety and conduct disorder/challenging behaviors. Developmental factors are significant in that, while ASD presents at a very early age, this is not often the case with the co-occurring disorders noted above. The clinician should be aware of and plan for these potential concerns. Tests that are specifically designed to assess for comorbid mental health issues among persons with ASD are being developed. These methods are recommended given what we know about high rates of comorbidity in this emerging field.

Scope of the problem

Symptom presentation and how autism spectrum disorder (ASD) is conceptualized and diagnosed has been a source of great interest to clinicians [1,2]. Until recently, ASD was believed to be environmentally caused and occurring only in a subset of children whose parents were cold and aloof. Additionally, ASD was seen as a singular condition that did not overlap with other mental health disorders, as codified in DSM-IV. As more research information has become available, these views and diagnostic practices that apply to ASD have evolved substantially [3–5].

ASD is now considered to be neurodevelopmental and lifelong [6]. Equally important, emerging research is demonstrating high

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rates of comorbidity between ASD and other mental health disorders [7–10]. As early intervention has become popular, early diagnosis of ASD has become a key focus. As a result, the challenge now for the clinician is not only to determine if ASD is present, but also whether other forms of psychopathology are also present **(Box 1)** [11–13].

Lugnegard *et al.* assessed comorbidity of psychopathology in young adults with Asperger's syndrome. They reported comorbid depression in 70% and anxiety in 50% of persons who were assessed [14]. Overlap between autism and ADHD is also common [15]. Kochhar *et al.* found ADHD to be more common in persons with ASD than the general population [16]. Murray reported that over half of individuals with ASD also met criteria for ADHD [17].

Comorbid mental health conditions are especially high in individuals with ASD. In one study of 84 adolescents and young adults with ASD, a comorbid mental health disorder was reported in 42% of the sample, which is a rate two- to four-times that found among typically developing peers [18]. Skokauskas and Gallagher studied 68 children with ASD and reported that 45% met diagnostic criteria for ADHD and 46% met criteria for an anxiety disorder, with many of the children meeting criteria for all three conditions [19]. This phenomenon is international in scope. Researchers in Saudi Arabia, for example, report comorbid disorders in 63% of the 60 children they examined who had diagnoses of ASD [20]. Anxiety disorders were reported in 58% of their sample. ADHD co-occurred in 32% of the children and conduct disorder was noted in 23% of their sample. These figures replicate other studies and point to the presence of multiple conditions in children with ASD. Similarly, high prevalence rates of comorbidity were reported in a Danish sample [21].

A study of youth with ASD found three or more comorbid disorders in 95% of their sample, who were seen through a pediatric psychopharmacology program [22]. Since this sample was biased toward more severe symptomatology, these numbers are probably higher than average, and are thus not representative of ASD in general. However, this study does underscore the high likelihood of overlapping disorders. Mattila *et al.* reported on a sample of 50 children aged 9–16 years with Asperger's syndrome or high-functioning autism [23]. They reported a 74% prevalence of psychiatric disorders in the sample. In this sample, 44% of participants evinced behavioral disorders, 42% evinced anxiety disorders and 26% displayed tic disorders, with many individuals experiencing multiple disorders. Phobias, mood disorders and psychoses are also problems that have been reported in the ASD population [7].

Diagnostic considerations

Historically, many clinicians thought that individuals with intellectual disability (ID) or ASD were not able to also develop other mental disorders, and symptoms such as self-injurious or destructive behaviors that may have been due to underlying comorbid problems were instead attributed to intellectual impairment [9]. As it was believed that ASD or intellectual impairments precluded the presence of psychiatric disorders, diagnostic overshadowing prevented further evaluation of other disorders as possible causes for the symptoms. While it is now widely accepted that psychiatric disorders occur at high rates among those with ID or ASD, clinicians and researchers must take care to accurately assess and determine the underlying causes of symptoms.

Differential diagnosis is a familiar process for clinicians. However, differential diagnosis becomes increasingly complex in the case of comorbid disorders, and even more so when comorbid disorders have overlapping symptomatology. For example, problems with both attention and social skills are common in children with ASD and those with ADHD, and it is not uncommon for children with an ASD to first be diagnosed with ADHD. However, although attention problems are common in each disorder, the nature of attention deficits in those with ASD alone may be qualitatively different from deficits common to children with ADHD [24]. Hypervigilant attention and internal distractibility are more common to ASD, while ADHD is generally marked by a lack of focus and distractibility by external stimuli. If symptoms are accurately identified and both disorders are in fact present, treatments for ADHD can be effective additions to interventions for ASD [25]. Differential diagnosis and accurately diagnosing similar but distinct comorbid disorders are critical in developing and implementing effective treatments for affected individuals.

Just as in typically developing individuals, a family history of mood, anxiety or ADHD disorders increased the risk of these disorders in persons with ASD; and having an ASD diagnosis on top of a family history of psychiatric

disorders further raises the risk of developing these disorders. Researchers have suggested shared familial and genetic factors between ADHD and ASD, noting a high co-occurrence and frequently shared biochemical markers [26]. The frequency of major depression in first-degree relatives of children with ASD has been found to be much more common than in the general population or relatives of children with other developmental disorders, and a family history of psychiatric problems has been found to be a significant predictor of psychiatric symptoms in individuals with ASD [27]. Obtaining a family history of psychiatric disorders can help inform assessment and contribute to future research into the risk factors for psychiatric disorders concurrent with an ASD diagnosis.

Box 1. Definition of key terms.

Diagnostic overshadowing

- Occurs when the salience of one disorder (e.g., intellectual disability) 'overshadows' consideration or recognition of another disorder, with all symptoms being attributed to the primary disorder

Differential diagnosis

- The process by which the clinician determines which of two or more distinct disorders with similar symptoms is the one by which an individual is affected

Comorbidity

- When the individual is affected by two distinct but concomitant disorders

Overlapping symptoms

- Symptoms that commonly occur during the course of two or more distinct disorders; for example, while depression and anxiety have distinct clinical features, irritability, decreased concentration and impaired sleep are symptoms common to both

Developmental issues

Two primarily developmental issues should be factored into the differential diagnosis of comorbid psychopathology among persons with ASD. One of these variables is ID. Estimates are that 70% of persons with ASD also have ID; conversely, 40% of the ID population also has an ASD [28]. These high rates of overlap are significant due to the effect of the nature and type of comorbid mental health problems displayed by persons with ASD and how the disorders are assessed [29]. Persons with ASD and an IQ below 70 have been found to present with oppositional defiant disorder, while individuals with ASD and an IQ above 70 were more likely to present with generalized anxiety [30].

There are specific timelines when different mental health concerns are likely to appear. Anxiety and depression emerge later in childhood. However, some comorbid symptoms of psychopathology, such as ADHD, occur in children as young as 12–39 months of age [31]. The persistent nature of these problems over time means there is no time to waste in treating these disorders. Bradley and Bolton underscore this point, noting that teenagers with ASD and ID had more lifelong emotional problems than persons with ID only [32].

Diagnosing common co-occurring disorders & symptoms: instruments & methods

In the past, ASD was often seen as a singular diagnosis. However, there is no reason to assume that an ASD diagnosis makes that person immune to other mental health conditions. Symptom presentation will probably differ by subtype of ASD, given the heterogeneity of the condition [33]. Close *et al.* have also noted that persons with a past diagnosis of ASD resulted in different comorbidity rates than persons with a current diagnosis [34]. These findings led the authors to conclude that changes in ASD symptoms effects prevalence rates of co-occurring problems. What is known at this point is that a few disorders, in particular, are the most commonly co-occurring in individuals with ASD. Among these are ADHD, anxiety, depression and conduct disorder/challenging behaviors (CBs).

Presently, differential diagnosis of ASD relies exclusively on testing methods that involve an interview carried out by one or more caregivers. Standardized observations are also employed, and historical data are often evaluated when present. These methods are normed according to the age group of persons with suspected ASD. The upcoming DSM-5 is attempting to move towards a physical medicine model. However, while currently under study, there are no established biomarkers for ASD [35]. Emerging research demonstrates anomalies in brain structure suggesting the potential utility of functional MRI, single-photon emission computed tomography and similar brain imaging technologies in the future [36]. Scans measuring gray and white matter also show promise [37]. More studies on the linkage of specific genes to ASD are also appearing. In the future, these methods should be available to complement existing methods.

It is likely that biomarkers will eventually be part of the equation when diagnosing ASD. However, expense will play a role in how often these methods are used. More importantly, symptom presentation is so varied and complex

that behavior-based tests and observations will most likely always be part of the equation. Down's syndrome is a perfect example. While an established biomarker exists, paper and pencil measures still present a good deal of variability in type and severity of symptoms. Thus, these measures remain invaluable. A brief review of commonly co-occurring disorders and methods for assessing each in the context of ASD follows.

ADHD

According to the DSM-IV-TR an individual cannot be diagnosed with ADHD if the symptoms occur during the course of a pervasive developmental disorder. However, in clinical practice, comorbid diagnoses are often made, in part because when impairing attention deficits are not improved by standard ASD treatments they can often be effectively improved with ADHD treatments [25]. Symptoms of comorbid ADHD may occur in children as young as 12–39 months of age [31]. Researchers have noted a high rate of ADHD symptoms severe enough to consider an ADHD diagnosis in addition to ASD. In a study that used DSM-IV-based rating scales (the Early Childhood Inventory-4 and the Child Symptom Inventory-4) to assess a clinically referred sample of children with ASD, researchers found that 40% of 3–5-year-old and over 50% of 6–12-year-old children met DSM-IV criteria for ADHD [38]. This rate was not significantly different compared with the prevalence rate in clinic-referred children without ASD, lending support to the idea that children with ASD are not immune to comorbid ADHD as a separate diagnosis any more than children with other developmental disabilities.

A number of researchers have pointed to ADHD as the most common co-occurring diagnosis with ASD. In a Greek sample, Stampoltzis *et al.* found ADHD to be the most common co-occurring disorder [39]. ASD and ADHD symptoms both appear early in development, although, ASD symptoms are evident first [40]. As a result, children with ASD should be screened for this comorbid disorder by 4–5 years of age at the latest. The need for early screening is underscored by the high rates of symptom overlap and comorbidity between ASD and ADHD [41]. Family history should also be assessed, as family members with ADHD symptoms are a risk factor [42]. Level of IQ does not affect these patterns. Rates of comorbid ADHD are high regardless of whether the person is experiencing high- or low-functioning autism [43].

Several papers have been published on behavior patterns in comorbid ASD and ADHD. Children with ASD had fewer deficits in attention compared with those with ADHD only. When both disorders were present, attention profiles were similar to ASD [44]. For children diagnosed with ASD who exhibit externalizing behaviors, such as aggression and delinquency, comorbid ADHD should be considered [45]. It is possible that certain subtypes of ADHD may be more prevalent than others in individuals with comorbid ASD. Sinzig *et al.* describe two possible subtypes: inattentive–stereotyped and hyperactive–communication impaired [46]. These data are preliminary, and much more research is needed. This information is important, however, and should be used to guide the clinician. With the recognition that ADHD and ASD have substantial overlap, a number of measures have been developed. Some scales have been developed specific to this particular symptom profile and are used in the diagnostic process. A few of these measures are discussed next.

The Autism-Tics, ADHD and other Comorbidities Inventory (A-TAC) [47] closely follows DSM-IV diagnostic criteria. An initial psychometric study yielded 178 items. After further study and development, 96 key items and 163 additional items were established in a structured format. Factors for the scale include communication, social interactions, flexibility, ADHD, motor coordination, perception, learning, executive function, tics, compulsive/obsessive behaviors, feeding, separation issues, anxiety, opposition/conduct problems, mood and ability to relate to reality. While this scale is in the very initial stages of development, the idea is promising.

A second measure that has been more extensively studied is the Baby and Infant Screen for Children with Autism Traits (BISCUIT) test, based on the DSM-IV and the proposed DSM-5 criteria. The sample used in developing this test included children 17–36 months of age. Over 80 studies have been published on this scale. The number of infants and toddlers assessed in individual studies varied from 270 to over 3000 children at risk of a developmental disability. The BISCUIT test has three distinct parts. Part 1 is used to diagnose pervasive developmental disorder not otherwise specified and autism with norms and cut-offs.

Part 2 measures comorbid psychopathology along five factors: tantrum/conduct behavior, inattention/impulsivity, avoidant behavior, anxiety, repetitive behavior and eating/sleep problems [48]. Part 3 of the BISCUIT measures CB. All three components of the scale have sound psychometrics. An extensive review of this scale is available elsewhere [49].

The Multi-Dimensional Scale for Pervasive Developmental Disorders and Attention Deficit Disorder (MSPA) was recently developed by researchers in the Department of Psychiatry at Kyoto University (Kyoto, Japan) [50]. Their sample consisted of 179 people ranging in age from 3 to 49 years, all of whom had evidence of autism, Asperger's syndrome or ADHD. The test consists of five pervasive development disorder domains (emotion, stereotyped/repetitive movement, communication and social behavior), two factors on developmental coordination disorder (gross and fine motor), three ADHD factors (impulsivity, inattention and hyperactivity) and four general factors (sleep, sensory, learning and language development). The authors report good reliability and validity.

There are also a large number of well-established scales specific to ADHD. Given that these comorbid methods of assessment are new, a more established ADHD scale may be considered in conjunction with one of these comorbid measures.

Depression & anxiety

Whereas ADHD symptoms are often apparent in early childhood, symptoms of depression and anxiety disorders may not arise until later in childhood or adolescence. Researchers have noted that these problems may be particularly acute for the first time during adolescence [51,52]. Using the Kiddie–Schedule for Affective Disorders and Schizophrenia diagnostic interview to assess past and present psychopathology in children and adolescents, Gjevik *et al.* report high rates of depression among children and adolescents diagnosed with ASD [53]. Owing to the overlap of depression and anxiety symptoms, many researchers look at both and their covariation with ASD. The clinician should note that ID may be a factor in comorbid depression and anxiety. Children and adolescents with ASD and a higher IQ were found to be more likely to demonstrate depression or anxiety [54], but other studies have found no difference in rates based on IQ [55]. This topic warrants more study. In addition, while there has been a good deal of research on these comorbid conditions, it is nothing compared with the high activity in researching ADHD plus ASD. Depression and anxiety issues in children and adolescents with ASD put the individual at risk of poor self-esteem, academic problems and greater potential of being bullied [51].

More has been written on comorbid anxiety versus comorbid depression. The key for these comorbid disorders, as well as the other common comorbid conditions with ASD, is that symptom presentation looks very similar to what one should see if it was present as a single disorder. However, some subtypes of given disorders may be more common. Chang *et al.* suggest that social deficits that are part of ASD may mean that social anxiety is more common than other anxiety-related problems [56]. Diagnostic overshadowing may cause social phobia to be misidentified as being only a core symptom of ASD [57]. The important point is to look closely at those anxiety symptoms that overlap the least with ASD, and use this information to help make a diagnosis.

Researchers have also suggested that higher rates of generalized anxiety are evident in ASD versus the general population [38,58]. Additionally, while symptom presentation may be similar, the person with ASD may lack emotional insight into their symptoms and anxiety may be associated with 'sensory sensitivity', which is common in ASD [52,59].

A number of comorbidity scales have been designed or adapted to assess for depression and anxiety in persons with a diagnosis of ASD. This factor is significant because both conditions are very common in persons with ASD [19]. Some tests are specific to one disorder, but most test for depression, anxiety and usually several other comorbid psychopathologies. This approach also makes sense because "comorbid neurobehavioral syndromes differentially impact clinical features of co-occurring anxiety symptoms" [60] and we would add depression to this as well.

Settipani *et al.* describe 100 children 7–16 years of age with anxiety disorders who also demonstrated ASD traits [61]. These data underscore the need to assess for anxiety. Several measures for anxiety, or anxiety plus depression and other comorbidities have been adapted from the general child anxiety disorders literature. Several of these measures are described next.

The Coping Questionnaire – Child and Parent (CQ–C/P) begins with a structured interview to identify three anxiety-provoking situations for the child. The measure then uses a Likert scale from 1 (not at all able to help self) to 7 (totally able to help self) to rate three social scenarios that test how children cope with anxiety-inducing situations. At the end of the scene presentation, participants are assessed on how they are able to adapt to differing stressful situations. The child version has indicated strong test–retest reliability; the parent version has demonstrated moderate inter-rater reliability. Both measures have proven sensitivity to treatment effects and utility in documenting improvement [62]. Although the CQ–C/P has not been standardized in a sample of children with ASD, it shows utility in assessing anxiety in this population.

The Multidimensional Anxiety Scale for Children (MASC) [63] has 39 items and is a child and parent report measure intended for children aged 8–19 years. The measure yields a Total Anxiety Scale, consisting of four subscales confirmed by factor analysis: social anxiety; physical symptoms; separation anxiety; and harm avoidance. The measure also includes an inconsistency index. The MASC has generally acceptable psychometrics within the general population of children and successfully discriminates between those with a DSM-IV diagnosable anxiety disorder and the normative sample, although the normative sample contained a distinctly low proportion of minorities compared with census data. Although the MASC has not been normed in children with ASD, the measure has been used to measure treatment effects for children with high-functioning autism and comorbid anxiety disorders [64].

The Anxiety Disorders Interview Schedule – Child and Parent version (ADIS–C/P) [65] is a semi-structured interview for child and parent. This measure is based on the DSM-IV criteria and has established reliability and convergent validity. The ADIS–C/P has shown good interviewer/observer reliability ($\kappa = 0.75$) and test–retest reliability (0.75). The focus of the scale is the diagnosis of the child anxiety disorders covered in DSM-IV. However, mood and externalizing disorders are also included.

Scales that have been used in structured parent interviews include The Autism Comorbidity Interview – Present and Lifetime Version (ACI–PL) [66]. This scale assesses many psychiatric disorders including various mood disorders, anxiety disorders, psychotic disorders and disruptive behaviors. This measure has shown excellent criterion validity, good-to-excellent specificity and sensitivity, and good reliability. Each section begins with a description of how the specific psychiatric disorder is generally manifested in individuals with autism. Screening questions are autism-specific; for example, while the core symptoms of depression in the DSM-IV are loss of interest and change in mood, depression comorbid with autism often presents with considerably increased agitation, temper outbursts and self-injurious behaviors. If screening questions are positive, more detailed questions are asked about symptoms of the disorder that are commonly expressed in persons with an autism diagnosis. Endorsed symptoms are compared with reported baseline behavior for disorders that tend to emerge later in development. The ACI–PL also distinguishes between impairments due to comorbid psychiatric diagnoses and those due to core features of autism.

The Revised Children's Manifest Anxiety Scale (RCMAS) [67] is another measure that addresses anxiety and depression, and has been used in studies of treatment effects in children with comorbid anxiety and ASD [64]. The RCMAS-2 is the revised and current version of this 49-item scale that can be completed in 10–15 min. A short form also exists and can be completed in 5 min. Physiological anxiety, worry, social anxiety, defensiveness and an inconsistent responding index are the topics covered. A total anxiety and scale scores are generated. The test is normed on 2300 typically developing children 6–19 years of age; however small samples of children with ASD have also been studied in smaller independent studies [64] (for a review of psychometrics and studies using this and other measures used to assess anxiety in persons with ASD, see the 2012 review by Grondhuis and Aman [68]).

In addition to the aforementioned scales that have been adapted to ASD populations, there are also scales that are specifically developed for an ID population. For example, a number of studies have been published with the Autism Spectrum Disorders – Comorbidity for Children (ASD–CC) [69]. This scale is Part 2 of a 3-part battery. Part 1 is used to diagnose ASD, while Part 3 is geared toward the evaluation of CB. The comorbidity scale features 49 items. Factors include tantrums, repetitive behavior, worry/depression, avoidant

behavior, undereating, overeating and conduct. This test has sound psychometrics for children diagnosed with ASD between 3 and 16 years of age. (See Grondhuis and Aman's review for a more detailed overview of these anxiety/depression comorbid scales [68].)

The clinician has a number of test options available to assist in the evaluation of depression and anxiety in persons with ASD. As the assessment of these comorbid disorders matures, the scales developed are likely to be more tailored to the ASD population. For now, however, there are still a number of useful options.

Challenging behaviors

CBs are not core features of ASD or a form of mental disorder. Nonetheless, they occur very often in conjunction with ASD. Extrapersonal CBs interfere with goal-directed behavior between the individual and the caretaker, forcing the caretaker to stop their current activity to attend to the client. CBs directed towards others include acts such as physical and verbal aggression, tantrums and property destruction. Intrapersonal CBs may include self-injurious behaviors or seclusionary behaviors. However they are conceptualized, CBs have a negative impact on the individual, potentially leading to stigmatization and rejection by peers and placement in more restrictive settings for the safety of themself and others. A common rationale for prescribing antipsychotic drugs to the ASD population can be attributed to this high covariation [70–71]. It is, therefore, important for clinicians to be aware of how CBs may influence prescribing practices. Drug companies have suggested that CBs are symptomatic of irritability, which in turn is treated with a psychotropic drug, usually an antipsychotic. Irritability as a symptom is problematic, however, because it is not well defined in the literature. Researchers have described irritability as CB, impulsivity and a host of other symptoms. Thus, claims of drug efficacy for irritability among persons with ASD are tenuous. Controlled studies using a systematic definition have not been conducted at this time, and are urgently needed.

A second point is that the vast majority of CBs have environmental causes. These behaviors occur at higher rates in the ASD population due to poor communication and problem-solving skills. Similarly, insistence on routines can result in CB. The primary causes or maintaining variables of CB are attempts to gain attention, escape unpleasant activities, efforts to obtain tangible items, such as food, or responses to pain. Hundreds of articles and books on an assessment approach that considers these causes, referred to as functional assessment, have been published. As a result, a first step in assessing CBs is to determine if the CB has an environmental cause. This hypothesis is typically the case, versus the less likely, but certainly possible, underlying mental health cause.

There are a number of well-established scales that can be used to identify and monitor CB. Perhaps the best established of these is the Behavior Problems Inventory (BPI-01). While established initially for persons with ID, this measure is also well established with the adult ASD plus ID population [72,73]. The scale consists of 49 items that are based on a caregiver's response. Three subscales have been established through factor analysis: self-injurious behavior; stereotypies; and aggressive/destructive behavior. The scale also has a very well-developed reliability and validity, and has been translated into a number of languages.

Designed to assess children with ASD from age 1 to 17 years, the Pervasive Developmental Disorder Behavior Inventory (PDDBI) utilizes parent and teacher report to assess both CBs and adaptive skills [74]. The PDDBI has shown good inter-rater reliability and internal consistency with both parent and teacher versions, although agreement was lower when comparing parent and teacher scores to one another than when comparing the scores of two teachers. The greater inter-rater discrepancy between teacher and parent report probably reflects, in part, actual differences in behaviors in different settings, thus making the measure a useful option for measuring progress or generalization of adaptive and coping skills across environments. The scale provides age-based standard scores and includes six maladaptive behavior subscales: aggressiveness/behavior problems; arousal problems; semantic/pragmatic problems; sensory/perceptual approach behaviors; social pragmatic problems; and specific fears. Adaptive subscales include learning, memory, receptive language, phonological skills, semantic/pragmatic ability and socially appropriate behaviors. The authors report evidence of criterion validity with the PDDBI significantly correlated with other commonly used ASD measures, including the Autism Diagnostic Interview – Revised and the Childhood Autism Rating Scale.

The Aberrant Behavior Checklist (ABC) is another informant-based measure that was specifically designed for use in the ID population [75]. Normative data for the 58-item measures have been established for children and adolescents with ID recruited from public schools as well as adults with ID living in group homes [75,76]. The ABC provides scores on five scales including: irritability, agitation and crying; lethargy/social withdrawal; stereotypic behavior; hyperactivity/noncompliance; and inappropriate speech. The irritability subscale includes various types of CBs such as self injury, aggression, physical violence as well as temper tantrums, screaming, mood changes and crying over minor annoyances.

BISCUIT Part 3 is an informant measure that has been discussed briefly earlier in this paper. Topics covered include aggressive/destructive behavior, stereotypies and self-injurious behavior [49].

The Autism Spectrum Disorder – Behavior Problems for Children (ASD–BPC) is a 20-item measure designed for children with ASD, 2–16 years of age. Factors include internalizing and externalizing behavior and cover many ASD specific items: plays with own saliva; repeated and unusual body movements; and repeated or unusual vocalizations. This test also has well established reliability and validity [77].

The Developmental Behavior Checklist – Teacher Version consists of 94 items and is normed in children 4–18 years of age [78]. Informants were teachers who had known the child for at least 2 months. The scale can be completed in approximately 20 min and covers six subscales: communication disturbance; disruptive/antisocial; self-absorbed; anxiety; autistic relating; and social relating. Good psychometrics have been established.

The Nisonger Child Behavior Rating Form (NCBRF) contains 10 items on social competence and 66 items on CB. This scale was developed for persons with ID, but is also appropriate for persons with ASD [79]. The test is designed to be completed by a caregiver and each item is rated 0–3. Children 5–18 years of age have been studied. Good reliability and validity have been established. The test has also been factor analyzed. Subscales that emerged are conduct problems, insecure/anxious, hyperactivity, self-injury, stereotypic, self-isolated/ritualistic and overly sensitive behavior.

One component of assessment for CB is canvassing a broad group of behaviors to determine which behaviors are problematic and at what intensity. Once this step of the process is completed, a second step, functional assessment, should be undertaken. The purpose is to determine what causes or maintains CB. This method only deals with environmental causes. However, most research points to the conclusion that 80–90% of cases have environmental causes that can be identified. As a result, the routine use of functional assessment for CB of persons with ASD is recommended. The scale with the best psychometrics for the ASD population for this purpose is the Questions About Behavioral Function (QABF) [80]. This measure is based on the principles of applied behavior analysis, and focuses on what outcomes are likely in play when explaining why CBs occur, when they occur, as well as around whom and during what activities and events they occur. The QABF consists of 25 items with 5 items for each of five subscales: attention; escape; nonsocial (e.g., self-stimulation); physical (e.g., pain); or tangible.

Conclusion & future perspective

Comorbid psychopathology is common among persons with ASD and it is imperative that clinicians do not see disorders as nonoverlapping. This realization is becoming broadly accepted in the clinical and research communities. Symptoms for given disorders are distinct, and some occur at very high rates among persons with ASD. As a result, the clinician should be aware of the conditions likely to co-occur with ASD, which also varies according to the person's age. Clinicians should also be familiar with the assessment methods that are available to assist in diagnosis and stay abreast of new findings as research continues in this area.

Following the increased recognition of comorbid psychopathology in individuals with ASD there has been a rapidly growing amount of research literature on what disorders occur, how they are expressed and patterns of overlapping disorders. As a result, a much better understanding of the context in which ASD occurs and is expressed is emerging. Another major development is the rapid expansion of scaling methods to assist in diagnosis, understanding the nature of the disorder and for evaluating treatment effectiveness. Most of these methods began with the conversion of existing scales on ADHD, anxiety, depression and general childhood psychopathology. The trend is toward

ASD-specific scales, and this development is likely to continue and accelerate. The development of these trends and methods has had and will have even greater impact on clinical practice in the medium to long term. There is always a time lag between the development of research information and broad clinical application. Nonetheless, this greater access to information people have in their daily lives is likely to shorten the knowledge development to implementation gap within the next 5 years.

Future research should continue to improve diagnostic measures for identifying psychopathology as these disorders are expressed in persons with ASD of various levels of intellectual functioning. Over the next several years, diagnostic tools should be developed and refined to be sufficiently specific to aid differential diagnosis in disorders with similar symptoms, such as studying differences in executive functioning and capacity for sustained attention to further establish criteria for ASD + ADHD diagnoses, and the underlying functions of CBs that may be attributable to any number of factors. It is also possible that subtypes of ADHD or other disorders may be more prevalent with comorbid ASD, an important area of continuing investigation. Such research will also help establish base rates of respective disorders among individuals with ASD. Although beyond the scope of this paper, research is beginning to investigate the development of treatments specifically tuned to the needs of those with ASD and the commonly co-occurring disorders discussed here. However, much work remains in this area. Continued research over the next decade aimed at improving diagnostic accuracy should continue to inform development, implementation and evaluation of interventions designed to best meet the needs of those with co-occurring ASD and psychopathology.

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