Autism Diagnostic Interview-Revised

Synonyms

ADI-R

Abbreviations

ADOS  Autism diagnostic observation schedule
ASD  Autism spectrum disorders

Description

The Autism Diagnostic Interview-Revised (ADI-R; Le Couteur, Lord, & Rutter, 2003; Lord, Rutter, & Le Couteur, 1994) is a standardized, semi-structured, investigator-based interview administered by trained clinicians to parents or caregivers of individuals referred for a possible autism spectrum disorder (ASD). The ADI-R includes 93 items in three domains of functioning: communication, reciprocal social interactions, and restricted, repetitive, and stereotyped patterns of behavior, as well as other aspects of behaviors. All items in the ADI-R are coded for current and past behavior. Current refers to whether the behavior has occurred in the past 3 months. For some items, "past" refers to whether the behavior "ever" occurred, whereas others ask whether the behavior was present during a specifically defined period between 4 and 5 years of age (referred to as "most abnormal 4 to 5").

Up to 42 of the interview items are systematically combined to produce a formal, diagnostic algorithm for autism based on the ICD-10 (World Health Organization [WHO], 1990) and DSM-IV (American Psychiatric Association [APA], 1994) criteria as specified by the authors. In addition to the three domains of behavior, there is a fourth domain, abnormality of development evident at or before 36 months, to indicate whether the child meets criteria for age of onset. Each domain has a cutoff; a child must meet or exceed cutoffs in all four areas to receive an ADI-R classification of "autism." Separate cutoffs are available for the communication domain, depending on whether or not the child is verbal (defined as showing "functional use of spontaneous, echoed, or stereotyped language that, on a daily basis involves phrases of three words or more that at least sometimes include a verb and are comprehensible to other people," a score of 0 on item 30 overall level of language). Other criteria including using lower cutoffs with the same set of items have been used to create an algorithm for broader classification of autism spectrum disorders (ASD) as in several collaborative studies (Dawson, Webb, Carver, Panagiotides, & McParland, 2004; Lainhart et al., 2006; Risi et al., 2006). The diagnostic algorithm for children 4 years old and above is based on the "ever/most abnormal" codes, but current behavior algorithm forms are available to facilitate a clinical diagnosis for children from 2 years old and above.

A toddler version of the ADI-R was also developed several years ago to provide descriptive data for research with children under 4 years of age. The Toddler ADI-R has a total of 125 items, including 32 new questions and codes about the onset of autism symptoms and general development. Other items are identical to the ADI-R, with the exception that the Toddler ADI-R does not have codes for behaviors between 4 and 5 years of age.

Previous analyses suggested that the diagnostic algorithm was useful for children with a nonverbal mental age above 2 years (Le Couteur et al., 1989; Lord et al., 1994; Rutter, Le Couteur & Lord, 2003). Thus, the interview had been appropriate for the diagnostic assessment of any person within the age range extending from early childhood to adult life, provided that they have a nonverbal mental age above 2 years. Recently, however, newly developed algorithms for toddlers and young preschoolers have shown improved predictive validity compared to the preexisting algorithms for young children from 12 to 47 months of age (Kim & Lord, 2011). These algorithms extend the use of the ADI-R to children as young as 12 months and a nonverbal developmental level of at least 10 months. In addition, these new algorithms include items present in both the toddler and standard versions of the ADI-R, allowing for use of the algorithms with either version.

Most items in the ADI-R relate to behaviors that are rare in individuals who do not have ASD and/or who do not have profound intellectual disabilities. Thus, numerical estimates of the scores of typically developing children based on general population have not been obtained. However, there have been several comparisons to children and adolescents...
with other disorders, which have been used in the development of the diagnostic algorithms (Le Couteur et al., 1989; Lord et al., 1994; Kim & Lord, 2011). Researchers have used individual domain scores or an overall total of the three domains as estimates of autistic symptom severity, though the validity of this approach has not been directly tested. Scores have been published for many research populations but not yet systematically dimensionalized.

Historical Background

The ADI was first developed in 1989 (Le Couteur et al., 1989), which was modified in 1994 (Lord et al., 1994). The 1994 version was somewhat shorter than the original in order to make the interview more feasible in both clinical and research settings. The current version of the ADI-R was published in 2003 by Western Psychological Services.

The development of the toddler version of the ADI-R was completed in 2006 for research purposes. Following the development of the toddler version of the ADI-R, there was an increase in demand for diagnostic instruments for very young children, which prompted the development of the new diagnostic algorithms for toddlers and young preschoolers (Kim & Lord, 2011). The final algorithms for toddlers and young preschoolers contain fewer items than the original algorithms and are appropriate for use with children 12 to 47 months of age.

Psychometric Data

Psychometric properties for the original ADI were reported for a sample of 16 children and adults with autism and 16 children and adults with intellectual disabilities; each group included individuals that spanned wide ranges of age and performance IQ (with a mean age of 12.28 years and a standard deviation of 3.43 from a performance IQ of 43 to 71). Participants were carefully selected and blindly interviewed and coded. Interrater reliability was assessed, with multirater kappas ranging from 0.25 to 1 for each item. Intraclass correlations were above 0.94 for all subdomain and domain scores. The majority of individual items showed good discriminative validity between the autism group and the group of individuals with nonautism intellectual disabilities (Le Couteur et al., 1989).

Psychometric properties for the development of the algorithms for the current ADI-R were based on a sample of 25 children with autism and 25 children with intellectual disabilities who were carefully selected and blindly interviewed and coded (Lord et al., 1994; Rutter, Le Couteur, & Lord, 2003). These children ranged in chronological age from 36 to 59 months, with nonverbal mental ages ranging from 21 to 74 months. Using a sample of 10 children, interrater reliability was assessed; multirater kappas ranged from 0.63 to 0.89 for each item. Using the same sample, intraclass correlations were above 0.92 for all subdomain and domain scores. In addition, after the initial standardization of the ADI-R in 1989, a separate sample of 53 children with autism and 41 nonautistic children with intellectual disabilities or language impairments was used to further assess the validity of the ADI-R (Lord, Storoschuk, Rutter, & Pickles, 1993). The results of the study showed that the interrater reliability was as high as the initial study, with multirater kappas ranging from 0.62 to 0.96 for individual items. Test-retest reliability was also very high, with all coefficients in the 0.93-0.97 range.

The majority of individual items in the current ADI-R showed good discriminative validity between children with autism and children with intellectual disabilities (see Lord et al., 1994). The existing algorithms differentiated children with autism over 36 months of age from children with nonspectrum disorders, showing high sensitivity and specificity (both over 0.90). Further analyses of data from preschool children revealed that the ADI-R algorithms differentiated children over 2 years with ASD from those with other developmental disorders. However, for children under 2 years, discrimination between nonverbal children with ASD and nonverbal children without ASD was poor, resulting in low specificity, especially for children with mental ages under 18 months, (Lord et al., 1993).

In a more recent study including a larger sample (Risi et al., 2006), the ADI-R showed high sensitivity (above 80%) for children with ASD under 3 years of age, but lower specificity for the comparison of nonautism ASD versus nonspectrum disorders (around 70%). Ventola and colleagues (2006) reported that, for children between 16 and 37 months of age, the diagnostic classifications made based upon the ADI-R algorithm resulted in lower sensitivity than those made using the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999), Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1980), or clinical judgment using the DSM-IV criteria. Wiggins and Robins (2008) also found that ADI-R algorithms resulted in poor sensitivity for children in the same age range when the standard cutoff for the RRB domain was included in the diagnostic criteria. Given the low sensitivities and specificities being reported for young children, new ADI-R algorithms were developed for toddlers and preschoolers between 12 to 47 months of age using a sample of 491 children with ASD, 136 with nonspectrum disorders (NS), and 67 with typical development (Kim &
Lord, 2011). The new ADI-R algorithms consist of two different cutoff scores: one for research (more restrictive, higher specificity with lower sensitivity) and one for clinical purposes (more inclusive, higher sensitivity with lower specificity). They also include "ranges of concern" for clinical use (discussed below). In this sample, sensitivity using the clinical cutoff ranged from 80% to 94% and specificity ranged from 70% to 81% for the comparison of nonautism ASD vs. NS. Using the research cutoffs, the comparison of nonautism ASD vs. NS resulted in sensitivity ranging from 80% to 84% and specificity ranging from 85% to 90%.

Clinical Uses

The ADI-R offers a profile of a child, adolescent, or adult which includes information regarding reciprocal social interactions, language and communication, and restricted, repetitive, and stereotyped behaviors and interests. Items are scored based on caregivers' detailed descriptions of the history and behaviors of their child, thus allowing the clinician to gather both quantitative and qualitative information. One important caveat for clinical users to recognize is that diagnostic classifications based on the algorithms and true clinical diagnosis are not the same. Clinical diagnosis is based on multiple sources of information, including direct observations (Le Couteur, Haden, Hammal, & McConachie, 2007; Risi et al., 2006; Kim & Lord, in press). Risi and colleagues (2006) found a better balance of sensitivity and specificity when the ADI-R and the ADOS were used in combination compared to when each instrument was used alone. The combined use of these instruments resulted in sensitivity and specificity of 82% and 86%, respectively, for children with autism compared to children with nonspectrum disorders over age 3 years. For younger children, sensitivity and specificity for the same diagnostic comparison using both instruments were 81% and 87%, respectively. In contrast, when each instrument was used alone, specificities ranged from 59% to 72%. Le Couteur and her colleagues (2007) also examined the combined use of the ADOS and ADI-R for preschoolers with ASD using revised ADOS algorithms (Gotham, Risi, Pickles, & Lord, 2007). Consistent with Risi's 2006 study, the authors found that combining information from both ADOS and ADI-R provided improved diagnostic accuracy compared to either instrument in isolation. Similarly, using the newly developed ADI-R algorithms for toddlers and young preschoolers and the revised ADOS and new ADOS-Toddler algorithms, Kim & Lord (2011) also found that for very young children, the combined use of the ADOS and ADI-R improved diagnostic validity compared to when each instrument was used alone. Thus, even though the ADI-R provides information about the individual's history and description of his or her current functioning from a broad range of contexts, the ADI-R alone cannot be used to make a clinical diagnosis.

The diagnostic algorithm cutoffs allow classification of ASD based on patterns of behavior, meeting the current DSM-IV or ICD-10 diagnostic criteria for autistic disorder. In addition to single cutoff scores, the new algorithms for toddlers and young preschoolers provide clinicians and researchers with several different options for the diagnostic classification of young children. For clinical purposes, ranges of concern (little-to-no concern, mild-to-moderate concern, and moderate-to-severe concern) that represent the severity of autism symptoms in young children are also provided. A clinician or a researcher can use these ranges of concern to inform decisions about whether or not a child should be followed up with further assessments or should be quickly referred for treatment services irrespective of diagnostic cutoffs. Scores that fall in the little-to-no range of concern indicate that the child is reported to have no more behaviors associated with ASD than children in the same age range who do not have ASD. On the contrary, a child who scores in the mild-to-moderate range has a number of behaviors consistent with, but perhaps not unique to, ASD. For clinical purposes, children in the mild-to-moderate or moderate-to-severe ranges of concern should receive further evaluation and follow-up, including other cognitive and language assessments, and recommendations for treatment. In addition to ranges of concern, single cutoff score can be used when more strictly stratified groupings are necessary, such as for intervention, neuroimaging, or genetic research. These different alternatives allow clinicians and researchers to be transparent about the choices they make, recognizing that diagnostic decisions about ASD in very young children are less stable and precise than for older children and adolescents.

In addition to the diagnostic algorithms, the ADI-R includes a current behavior algorithm form that can be used in clinical settings to assess changes that occur during or after interventions or that may reflect increasing developmental maturity or changing life circumstances. Because the current behavior algorithm form has not been empirically validated, it is not intended to be used as a diagnostic algorithm. The development of a new algorithm is underway by the authors in anticipation of an updated protocol and algorithm with new criteria. A shorter version of the ADI-R that can be used over the phone is also in the process of being developed and validated. The ADI-R provides a useful structure to obtain history and understand a caregiver's perspective on his or her child's
symptoms associated with ASD. However, it requires substantial practice to administer reliably, and it takes approximately two to three hours to administer. The ADI-R should only be used by appropriately experienced clinicians who are familiar with ASD and relevant behaviors. Training workshops and videotapes are available to help clinicians and researchers understand the scoring and administration of the ADI-R. For research use, interviewers must meet standards for reliability.

See Also

Autism Diagnostic Observation Schedule
Autism Diagnostic Observation Schedule (ADOS): Toddler Module

References and Readings

Psychological Services.