

Detecting Autism Spectrum Disorder in Children With Intellectual Disability: Which *DSM-IV-TR* Criteria Are Most Useful?

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Abstract

The diagnosis of autism spectrum disorders (ASDs) in older children with intellectual disabilities (IDs) is challenging because of overlap in symptomatology and the high comorbidity of these disorders. On the basis of a sample of 89 older children with IDs (aged 6–15 years) referred to an ASD clinic, semistructured parent interviews were used to investigate the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.) diagnostic criteria that differentiated children with ASDs from those without ASDs. Diagnostic criteria related to impaired social interactions, stereotyped or idiosyncratic language, poor conversational skills, lack of pretend and imitative play, and restricted or narrowed interests were related to ASD diagnoses. The findings of this study have implications for improving ASD diagnostic evaluations in children with IDs.

Keywords

autism, intellectual disability, evaluation, diagnosis, parent interview

The diagnosis of autism spectrum disorders (ASDs) in children with intellectual disabilities (IDs) is particularly challenging for clinicians. Overlap in the symptomatology of ASD and ID and the high comorbidity of these disorders complicate the diagnostic process (Croen, Grether, Hoogstrate, & Selvin, 2002; Goin-Kochel, Mackintosh, & Myers, 2006; Jick & Kaye, 2003; Skellern, Schluter, & McDowell, 2005). Approximately 50% to 70% of individuals with ASDs have IDs (Ballaban-Gill, Rapin, Tuchman, & Shinnar, 1996; Edelson, 2006; Fombonne, 2005). Similarly, individuals with IDs often exhibit autistic behaviors, such as poor social connectedness, delayed or absent speech, and stereotyped movements (Deb & Prasad, 1994; Kaminer, Jedrysek, & Soles, 1984; Wing, 1981).

Given the overlap in ASD and ID, structured parent interviews of diagnostic criteria for ASD are prone to false positives (i.e., criteria endorsed when ASDs are not present) for children with IDs (Cox et al., 1999; Fombonne, 1992; Lord, 1995; Lord et al., 1997; Lord, Storoschuk, Rutter, & Pickles, 1993). Although ASD diagnostic evaluations involve information from a variety of sources (i.e., standardized observations, assessments, and clinical judgment), parent interviews are critical to illuminating a child's early developmental history and current behavior (American Academy of Child and Adolescent Psychiatry, 1999; Cure Autism Now Foundation Consensus Group, 1998). Insight into the parent-reported autistic symptomatology that does and does not differentiate ASDs in children with IDs is

therefore necessary to improve the detection of ASDs in children with IDs. The accurate diagnosis of ASDs in children with IDs, in turn, is necessary for guiding interventions to address the overlapping but unique needs of children with and without ASDs.

Structured or semistructured parent interviews to detect ASD (e.g., Rutter, Le Couteur, & Lord, 2003; Schopler, Reichler, DeVellis, & Daly, 1980; Stone, Coonrod, Pozdol, & Turner, 2003) are traditionally based on diagnostic criteria presented in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev., *DSM-IV-TR*; American Psychiatric Association, 2000). A *DSM-IV-TR* diagnosis of Autistic Disorder requires impairments in three domains, including Social Relatedness (i.e., deficits in social interest or interactions), Communication (i.e., deficits in language development or atypical speech), and Restricted/Repetitive/Stereotyped Patterns (i.e., odd or stereotyped interests or behaviors). A diagnosis of Pervasive Developmental Disorder Not Otherwise Specified is given if some but not all criteria are met for Autistic Disorder, the onset of symptoms occurs after 3 years of age, or there is an atypical presentation

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of symptoms. A diagnosis of Asperger's Disorder is not applicable to children with IDs.

Previous studies of structured or semistructured parent interviews suggest that diagnostic criteria in the Social Relatedness domain are useful for identifying ASDs in children with IDs. In an early study, parent interviews of *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev., *DSM-III-R*; American Psychiatric Association, 1987) diagnostic criteria for ASD were examined in 138 children and adults with IDs referred to an autism clinic (Van Bourgondien, Marcus, & Schopler, 1992). The Social Relatedness criteria (i.e., problems with social relatedness, imitation, nonverbal communication, and peer interaction) were related to a diagnosis of ASD, with the exception of inability to initiate and sustain conversation. Stone and Hogan (1993), using the *Parent Interview of Autism*, another structured parent interview based on the *DSM-III-R*, found that all of the Social Relatedness criteria differentiated young children with ASDs (most had IDs) from those with IDs only. Similarly, parent-reported deficits in joint attention have been shown to differentiate young children with ASDs (with and without IDs) from those with IDs only (Mundy, Sigman, & Kasari, 1994). On the *Autism Diagnostic Interview-Revised* (ADI-R; Rutter et al., 2003), which is based on the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994), several criteria within the Social Relatedness domain had moderate to high sensitivity and specificity for distinguishing ASDs in children with IDs, particularly for those who were verbal (Lord et al., 1997). The sensitivity and specificity for identifying ASDs in children with IDs were particularly good for impairments in nonverbal social behavior (i.e., inappropriate facial expressions).

Findings regarding the usefulness of diagnostic criteria in the Communication domain for distinguishing ASD from ID are less clear. In an early study, all of the Communication criteria based on *DSM-III-R* (i.e., impairments in language use and understanding and imaginative play) differentiated children with ASDs (most had IDs) from those with IDs only (Stone & Hogan, 1993). Using the ADI-R, the only Communication criteria to significantly distinguish young children with ASDs and IDs from those with IDs only were stereotyped speech and the use of others' bodies to communicate (Lord et al., 1993). Similarly, Communication criteria had poor specificity for signaling ASDs in nonverbal children with IDs on the ADI-R (Lord et al., 1997). However, specificity was moderate to high for criteria related to odd or stereotyped communicative behaviors in verbal children with IDs. These findings have led several researchers to postulate that criteria related to quantitative differences in language, such as delayed or lack of spoken language or impaired conversational skills, may not signal ASDs in children with IDs given global deficits in language.

However, qualitative differences in language such as stereotyped or odd speech and limited imaginary and pretend play may be useful (Lord, 1995; Lord et al., 1993; Vig & Jedrysek, 1999; Sigman & Ungerer, 1984).

Parent-endorsed diagnostic criteria in the Restricted/Repetitive/Stereotyped Patterns domain do not appear to be as useful in identifying ASDs in children with IDs, particularly those with moderate to profound IDs (Freeman et al., 1981). Van Bourgondien et al. (1992) found that the only Restricted/Repetitive/Stereotyped Patterns criterion significantly related to a diagnosis of ASD was a restricted range of interests. Using a structured parent interview based on *DSM-III-R* criteria for ASD, Stone and Hogan (1993) found that neither repetitive or stereotyped behavior nor a need for sameness differentiated young children with ASDs (most had IDs) from those with IDs only. Similarly, Lord (1995) and Lord et al. (1993) found subtle to no differences in insistence on routines, preoccupation with parts of objects, repetitive activities, and stereotyped movements between young children with IDs who had ASDs and those who did not. Using the ADI-R, the only criterion with at least moderate sensitivity and specificity (>70%) for both verbal and nonverbal children with IDs was stereotyped hand and finger mannerisms (Lord et al., 1997). In summary, diagnostic criteria within the domain of Restricted/Repetitive/Stereotyped Patterns do not appear to be able to distinguish ASDs in children with IDs, with the possible exception of restricted range of interests and stereotyped motor movements.

These previous studies were largely based on diagnostic criteria presented in older versions of the *Diagnostic and Statistical Manual of Mental Disorders* (Lord et al., 1993; Stone & Hogan, 1993; Van Bourgondien et al., 1992). Given that criteria for Autistic Disorder was altered in *DSM-IV*, an updated investigation of the usefulness of diagnostic criteria for identifying ASDs in children with IDs is warranted. In addition, previous studies focused on younger children with IDs aged less than 6 years (Lord, 1995; Lord et al., 1993; Mundy et al., 1994; Stone & Hogan, 1993). Researchers highlight the benefit of diagnosing ASD at early ages (Charman & Howlin, 2003; Filipek et al., 2000; Smith, Groen, & Wynn, 2000). However, diagnostic evaluations continue to be delayed in a marked portion of children, and many children are not diagnosed with ASDs until after 6 years of age (Howlin, & Asgharian, 1999; Howlin & Moore, 1997; Mandell, Listerud, Levy, & Pinto-Martin, 2002). Therefore, research is needed to determine whether the parent-reported criteria found to be useful for identifying ASDs in younger children with IDs are also useful for an older population.

In the present study, endorsement of *DSM-IV-TR* criteria for Autistic Disorder was evaluated via semistructured interviews with parents of older children with IDs (aged 6–15 years)

referred to an ASD clinic. The following predictions were made on the basis of studies of younger children with IDs using older versions of the manual. It was hypothesized that all of the Social Relatedness criteria would discriminate older children with ASDs and IDs from those with IDs only. Within the domain of Communication, criteria related to qualitatively deviant communication (i.e., lack of imaginary and pretend play and stereotyped language) were predicted to discriminate older children with ASDs and IDs from those with IDs only; however, criteria related to delays or lack of speech or poor conversational skills would not. Within the Restricted/Repetitive/Stereotyped Patterns criteria, those related to a restricted range of interest and stereotyped or repetitive motor movements were expected to differentiate older children with ASDs and IDs from those with IDs only, although this effect was expected to be small.

Method

Participants

Data for this study were collected through an ASD clinic located in a large tertiary hospital in the northwestern region of the United States. As part of the ASD clinic, all children received a battery of cognitive, language, adaptive behavior, and ASD measures, including a semistructured parent interview of *DSM-IV-TR* criteria for Autistic Disorder. This study is based on responses to the semistructured parent interview for all children diagnosed with IDs for whom complete data were obtained.

Three hundred sixty-three children (aged 6–18 years) were referred to the ASD clinic by their primary medical care providers from 2003 to 2007. One hundred five of these children had IDs (i.e., $IQ \leq 70$ and concomitant impairments in adaptive behavior). The 89 children (84.8%) with IDs for whom complete data were collected were included in this study. For the remaining 16 children, the full assessment protocol was not completed because of recent testing elsewhere. One-way analyses of variance (ANOVAs) indicated that there was not a significant difference in gender, $F(1, 104) = 0.60, p = .44$; age, $F(1, 104) = 0.80, p = .37$; or IQ, $F(1, 104) = 1.97, p = .17$, between the 89 children included in the study and the 16 children for whom data were missing. Of the 89 children included in the study, 31 received diagnoses of ASD (23 Autistic Disorder and 8 Pervasive Developmental Disorder Not Otherwise Specified), and 58 did not. Several children with IDs, both with and without ASDs, had diagnoses of comorbid psychiatric disorders. Table 1 presents the characteristics of the children with IDs in this study. Parents who accompanied children to the clinic, mostly mothers, were interviewed regarding their children's autistic symptomatology.

Table 1. Characteristics of Children With IDs in the ASD and No-ASD Groups

Variable	ASD ($n = 31$)	No ASD ($n = 58$)
Chronological age (years)		
M (SD)	9.26 (3.04)	9.39 (3.01)
Range	6.00–14.81	6.10–15.32
Sex		
Female	8 (25.81%)	18 (31.03%)
Male	23 (74.19%)	40 (68.97%)
Full-scale IQ		
M (SD)	55.04 (8.86)	56.00 (8.46)
Range	40–70	40–70
Level of ID		
Mild	16 (51.61%)	30 (51.72%)
Moderate to severe	15 (48.39%)	28 (48.28%)
Adaptive behavior		
M (SD)	53.81 (12.37)	54.76 (10.33)
Range	40–77	40–73
OWLS oral composite		
M (SD)	58.91 (12.92)	62.00 (10.67)
Range	40–82	40–86
Comorbid psychiatric disorders		
Disruptive Behavior Disorder	1 (3.23%)	2 (3.45%)
Anxiety Disorder	1 (3.23%)	4 (6.90%)
Mood Disorder	0 (0%)	2 (3.45%)
Attention-Deficit/Hyperactivity Disorder	0 (0%)	2 (3.45%)

Note: ASD = autism spectrum disorder; ID = intellectual disability; OWLS = *Oral and Written Language Scales*. Adaptive behavior is based on the general adaptive composite score from the *Adaptive Behavior Assessment System, Second Edition*, or the adaptive behavior composite score from the *Vineland Adaptive Behavior Scales, Second Edition*.

Measures

Diagnosis of ID. Diagnosis of ID was based on criteria for Mental Retardation in *DSM-IV-TR* (see Schalock et al., 2007, for a discussion of terminology shift to ID). Children were individually administered one of the following standardized tests of intellectual ability. Eleven children were given the *Wechsler Preschool and Primary Scale of Intelligence, Third Edition* (Wechsler, 2002), and 48 children were given the *Wechsler Intelligence Scale for Children, Fourth Edition* (Wechsler, 2003), which are standardized intelligence tests ($M = 100, SD = 15$). Good internal reliability and validity for the full-scale IQ are reported in the manuals. Twenty-nine children were given the *Stanford-Binet Intelligence Scale, Fifth Edition* (Roid, 2003), which also is a standardized test of cognitive ability for

individuals aged 2 years through adulthood. The full-scale IQ ($M = 100$, $SD = 15$) has satisfactory internal consistency (range = .95–.98) and good concurrent and criterion validity with the Wechsler intelligence scales (Roid, 2003). The selection of intellectual ability test was based on the chronological age of the child and previous cognitive testing.

Parents completed one of the following standardized measures of adaptive behavior. Forty-two parents completed the *Vineland Adaptive Behavior Scales, Second Edition, Parent/Caregiver Rating Form* (VABS-II; Sparrow, Cicchetti, & Balla, 2005), a caregiver rating of adaptive skills in three domains of adaptive behavior. These skill areas combine to form the adaptive behavior composite score, with standardized scoring ($M = 100$, $SD = 15$). The VABS-II also has satisfactory reliability and validity and criterion validity with the Wechsler intelligence scales (Sparrow et al., 2005). Forty-seven parents completed the *Adaptive Behavior Assessment System, Second Edition* (ABAS-II; Harrison & Oakland, 2003), a caregiver rating of adaptive skills in 10 skill areas. These skill areas combine to yield the general adaptive composite score ($M = 100$, $SD = 15$). The ABAS-II has satisfactory internal consistency (range = .97–.99), test-retest reliability (range = .86–.99) and criterion validity with the Wechsler intelligence scales (Harrison & Oakland, 2003).

Oral and Written Language Scales (OWLS). The OWLS (Carrow-Woolfolk, 1995) is a standardized language measure for children aged 3 to 21 years. The OWLS assesses a child's understanding and use of four structural categories of language (lexical, syntactic, pragmatic, and supralinguistic). These categories combine to yield a Listening Comprehension Scale and an Oral Expression Scale. These scales sum to provide the oral composite score. The OWLS has adequate test-retest reliability, interrater reliability, internal reliability, and construct and criterion validity (Carrow-Woolfolk, 1995).

Autism Diagnostic Observation Scale—Generic (ADOS-G). The ADOS-G (Lord et al., 2000) is a semistructured, standardized assessment that involves a series of activities that allow the examiner to observe the occurrence or nonoccurrence of behaviors that have been identified as being important in the diagnosis of ASD. There are four ADOS-G modules based on expressive language ability. Items used in the diagnostic algorithm are given categorical scores of 0 = no evidence of abnormal behavior/behavior not applicable/alternative abnormal behavior present, 1 = abnormal behavior present but not severe, or 2 = behavior present and of an important degree of severity (Lord et al., 2000). Diagnostic algorithms in the domains of Communication, Social Interaction, and Combined (Communication + Social Interaction) allow a child to be given an autism, an autism spectrum, or a nonspectrum classification. The authors reported good to excellent reliability of the items, domains, and classification categories (Lord et al., 2000).

Parent interview of DSM-IV-TR criteria for ASD. Comprehensive and semistructured interviews of *DSM-IV-TR* criteria for Autistic Disorder were conducted with parents by either a licensed developmental pediatrician or a psychologist. The interview was based on items in the ADI-R (Rutter et al., 2003) and questions recommended by the American Academy of Pediatrics (Plauché Johnson & Myers, 2007). The ADI-R was not used in the ASD clinic because families were not able to receive reimbursement from third-party insurance providers for this measure. The interview form is available from the first author on request.

The 12 *DSM-IV-TR* criteria within the domains of Social Relatedness (impaired nonverbal behavior, failure to develop peer relationships, lack of seeking to share, and lack of social/emotional reciprocity), Communication (delay/lack of speech, impaired conversational ability, stereotyped/repetitive/idiosyncratic language, and lack of make-believe/imitative play), and Restricted/Repetitive/Stereotyped Patterns (stereotyped/restricted patterns of interest, nonfunctional routine or ritual, stereotyped or repetitive motor mannerisms, and preoccupation with parts of objects) provided structure for the interviews. First, parents were asked general, open-ended questions about each of the diagnostic criterion (e.g., "How does your child interact with others?"). They were then asked to provide descriptions and examples in their discussions of their children's behavior. Follow-up specific probing questions were used to clarify and generate additional information (see the Appendix). For each of the follow-up questions, a rating of 1 (behavior present and seen regularly in different situations and environments), 2 (behavior sometimes seen or seen only in a specific situation or environment), or 3 (behavior not seen or not yet developed) was given. The developmental pediatrician or psychologist scored each criterion "yes" (i.e., present) or "no" (i.e., absent) on the basis of responses to the open-ended inquiries and follow-up questions. Criteria that were not easily rated were discussed with the diagnostic team, and consensus was reached between the psychologist and developmental pediatrician. In general, if at least two of the follow-up questions were endorsed (i.e., regular absence of appropriate behavior or presence of atypical behavior), the criterion was scored "yes." Only the "yes" and "no" checkbox ratings were analyzed.

Procedure

An interdisciplinary team (a licensed speech and language pathologist, developmental pediatrician, psychologist, and occupational therapist) was involved in all assessments. Clinicians often had access to medical and school records prior to administering measures, which typically contained information about cognitive functioning. However, children's ASD status (i.e., whether they did or did not have

ASDs) was not known prior to the assessment. Clinicians also were naive to the purpose of the study. Children were individually administered a standardized intelligence test, the OWLS, and the ADOS-G. The ADOS-G was administered and scored immediately after administration by two licensed clinicians, at least one of whom had reached research reliability on the instrument (Lord et al., 2000). All children diagnosed with ASDs received ADOS-G communication, social interaction, and combined scores at or above the threshold for autism or autism spectrum. Four of the children without ASDs received ADOS-G combined scores at or above the threshold for autism, but these children were deemed not to have ASDs when considering all of the assessment information and clinical judgment. Parents completed the semistructured diagnostic interview of *DSM-IV-TR* criteria for Autistic Disorder, which took 1 to 2 hours. Parents also completed one of the caregiver ratings of adaptive behavior. Clinical diagnoses were based on team consensus, using all of the information available.

Results

Data Analysis Plan

To identify and subsequently control for potential differences in subject characteristics between the older children with IDs and ASDs (the ASD group) versus those with IDs but no ASDs (the no-ASD group), a multivariate ANOVA (MANOVA) was conducted. The remaining analyses were aimed at determining which *DSM-IV-TR* criteria for Autistic Disorder differentiated the ASD and no-ASD groups. An omnibus MANOVA was first conducted using all 12 *DSM-IV-TR* criteria. This was followed up with one-way ANOVAs to identify the specific criteria that differentiated the ASD and no-ASD groups. The sensitivity (i.e., true-positive rate) and specificity (i.e., true-negative rate) for the *DSM-IV-TR* criteria also were calculated.

Subject Characteristics by Group

A MANOVA was conducted using group (ASD vs. no ASD) as the fixed factor and subject characteristics (IQ [full-scale IQ standard score], gender [0 = male, 1 = female], age [years], ethnicity [0 = Caucasian, 1 = non-Caucasian], adaptive behavior [general adaptive composite score on the ABAS-II or adaptive behavior composite score on the VABS-II], language [oral composite score from the OWLS] and comorbid psychiatric disorders [0 = none, 1 = present]) as the dependent variables. There were no significant differences in subject characteristics between the group with and without ASDs, Wilks's lambda = .87, $F(1, 88) = 0.89$, $p = .52$. Given the similar subject characteristics of the ASD and no-ASD groups, subject characteristics were not controlled in the following analyses.

DSM-IV-TR Criteria by Group

A MANOVA was conducted using group (ASD vs. no ASD) as the fixed factor and *DSM-IV-TR* criteria (0 = absent, 1 = present) as the dependent variables. All 12 of the *DSM-IV-TR* criteria (4 Social Relatedness, 4 Communication, and 4 Restricted/Repetitive/Stereotyped Patterns) were entered in the MANOVA. There was a significant difference in *DSM-IV-TR* criteria by group, Wilks's lambda = .50, $F(1, 88) = 5.98$, $p < .001$, $\eta^2 = .50$. Table 2 presents the positive (i.e., rated present in the ASD group) and negative (i.e., rated absent in the no-ASD group) endorsement of each *DSM-IV-TR* criteria.

Table 3 presents the means, standard deviations, and multivariate results for the *DSM-IV-TR* criteria in the ASD and no-ASD groups. Within the Social Relatedness domain, ANOVAs indicated significant differences on all four indicators, with the ASD group having a higher endorsement than the no-ASD group. Within the Communication domain, ANOVAs indicated a significant difference in two of the four indicators, with the ASD group having a higher endorsement than the no-ASD group. Within the Restricted/Repetitive/Stereotyped Patterns domain, ANOVAs indicated a significant difference for one indicator, with the ASD group having a higher endorsement than the no-ASD group.

Sensitivity and Specificity

The sensitivity (i.e., true-positive rate) and specificity (i.e., true-negative rate) were calculated for the ASD and no-ASD groups. Table 2 presents the characteristics of the *DSM-IV-TR* criteria for ASD rated as present (vs. absent) for children with IDs. The criteria with at least modest (>60%) sensitivity and specificity included nonverbal behavior, failure to develop peer relationships, stereotyped/repetitive/idiosyncratic language, lack of make-believe/imaginative play, and stereotyped and restricted pattern of interest. Specificity was at least modest (>60%) but sensitivity was poor (<60%) for lack of seeking to share, lack of social/emotional reciprocity, and nonfunctional routine or ritual.

Discussion

ASD and ID overlap in symptomatology and often co-occur, which makes the process of differential diagnosis challenging (Croen et al., 2002; Goin-Kochel et al., 2006). In this study, the *DSM-IV-TR* diagnostic criteria were examined relative to ASD diagnoses in older children with IDs referred to an ASD clinic on the basis of semistructured parent interviews. As predicted, children with IDs and ASDs were best distinguished from those with IDs but without ASDs by diagnostic criteria in the domain of Social Relatedness. Older children with IDs and ASDs were more often reported to have poor nonverbal communication behaviors, difficulty initiating and sustaining peer relationships, a lack

Table 2. Characteristics of the *DSM-IV-TR* Criteria for ASD Rated as Present Versus Absent for Older Children With IDs in the ASD and No-ASD Groups

Criterion	ASD		No ASD		Sensitivity	Specificity
	Present (n)	Absent (n)	Present (n)	Absent (n)		
Social relatedness						
Nonverbal behavior	19	8	14	44	70.4%	75.9%
Failure to develop peer relationships	18	9	21	37	66.7%	63.8%
Lack of seeking to share	11	16	10	48	40.7%	82.8%
Lack of social/emotional reciprocity	15	12	15	43	55.6%	74.1%
Communication						
Delay/lack of speech	17	10	32	26	63.0%	44.8%
Impaired conversational ability	20	7	30	28	74.1%	48.3%
Stereotyped/repetitive/idiosyncratic language	19	8	14	44	70.4%	75.9%
Lack of make-believe/imaginative play	18	9	7	51	66.7%	87.9%
Restricted/Repetitive/Stereotyped Patterns						
Stereotyped/restricted pattern of interest	17	10	19	39	63.0%	67.5%
Nonfunctional routine or ritual	11	16	15	43	40.7%	74.1%
Stereotyped or repetitive motor mannerisms	18	9	26	32	66.7%	55.2%
Preoccupation with parts of objects	9	18	10	48	33.3%	82.8%

Note: ASD = autism spectrum disorder; *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.); ID = intellectual disability.

Table 3. Means, Standard Deviations (in parentheses), and Multivariate Results for *DSM-IV-TR* Criteria for the ASD and No-ASD ID Groups

Criterion	ASD	No ASD	F	Partial η^2
Social Relatedness				
Nonverbal behavior	0.70 (0.47)	0.24 (0.43)	20.11	.20**
Failure to develop peer relationships	0.67 (0.48)	0.36 (0.49)	7.31	.08**
Lack of seeking to share	0.41 (0.50)	0.17 (0.38)	5.71	.07**
Lack of social/emotional reciprocity	0.56 (0.51)	0.26 (0.44)	7.58	.08**
Communication				
Delay/lack of speech	0.74 (0.45)	0.45 (0.50)	2.44	.03
Impaired conversational ability	0.70 (0.47)	0.24 (0.43)	3.88	.05
Stereotyped/repetitive/idiosyncratic language	0.56 (0.51)	0.12 (0.33)	20.11	.20**
Lack of make-believe/imaginative play	0.63 (0.49)	0.33 (0.47)	37.50	.31**
Restricted/Repetitive/Stereotyped Patterns				
Stereotyped/restricted pattern of interest	0.63 (0.49)	0.33 (0.47)	7.32	.08**
Nonfunctional routine or ritual	0.41 (0.50)	0.26 (0.44)	1.92	.02
Stereotyped or repetitive motor mannerisms	0.59 (0.50)	0.40 (0.49)	3.59	.04
Preoccupation with parts of objects	0.33 (0.48)	0.17 (0.38)	2.77	.03

* $p \leq .05$. ** $p \leq .01$.

of seeking to share interests and achievements, and limited social and emotional reciprocity than children with IDs but without ASDs. Impairments in nonverbal social behavior had a moderately large effect size, suggesting that they are particularly useful in discriminating children with IDs with ASDs from those without ASDs. This criterion also had a particularly high positive endorsement, or sensitivity, in the ASD group and negative endorsement, or specificity, in the no-ASD group. These findings are consistent with studies of younger children with ASDs and IDs (Lord, 1995; Lord et al., 1997; Mundy et al., 1994; Stone & Hogan, 1993; Vig

& Jedrysek, 1999), suggesting consistency across childhood for the diagnostic utility of criteria in the Social Relatedness domain.

In line with the prediction, fewer of the diagnostic criteria in the Communication and Restricted/ Repetitive/Stereotyped Patterns domains were useful in diagnosing ASDs in older children with IDs. In the Communication domain, stereotyped, repetitive, or idiosyncratic language and lack of make-believe/imitative play differentiated the ASD and no-ASD groups and had moderately large effect sizes. Fewer than one fourth of the children in the no-ASD group were

reported to display stereotyped, odd, or idiosyncratic language, whereas 70.4% of children in the ASD group received positive endorsements of this criterion. Similarly, fewer than one fourth of the children in the no-ASD group were reported to have impairments in pretend or imaginary play, whereas this impairment was reported to occur in more than two thirds of the ASD group. Thus, as with younger children with IDs (Lord, 1995; Sigman & Ungerer, 1984), parent-reported qualitative deficits in communication appear to be important indicators of ASDs in older children with IDs. In contrast, delayed/lack of speech and impaired conversational ability did not differentiate the ASD and no-ASD groups. For both of these criteria, the negative endorsement in the no-ASD group was low (44.8% and 48.3%), indicating that many children without ASDs were reported to have marked impairments in these areas. Previous researchers also have found that impaired speech does not differentiate ASDs from IDs in young children, likely because of the global language deficits in IDs, regardless of the presence or absence of ASDs (Lord et al., 1993, 1997).

In the Restricted/ Repetitive/Stereotyped Patterns domain, nonfunctional routines and rituals, stereotyped and repetitive motor mannerisms, and preoccupation with parts of objects did not differentiate the ASD and no-ASD groups. The positive endorsement of preoccupation with parts of objects (33.3%) was particularly low in the ASD group, and the negative endorsement of stereotyped or repetitive motor movements (55.2%) was particularly low in the no-ASD group. Past researchers also have found that criteria within the domain of Restricted/Repetitive/Stereotyped Patterns are largely ineffective at identifying ASDs in young children with IDs (Freeman et al., 1981; Lord, 1995; Van Bourgondien et al., 1992). In this study, it was found that stereotyped and restricted interest differentiated the ASD and no-ASD groups, which contradicts previous findings (Stone & Hogan, 1993; Van Bourgondien et al., 1992). It may be that young children with IDs exhibit more difficulties in restricted focus or interests than older children with IDs. Young children generally learn through repetition using focused attention, and this behavior may be exaggerated in young children with IDs, minimizing differences between children with IDs and ASDs versus ASDs only.

There were several methodological limitations to this study. Endorsement of *DSM-IV-TR* criteria for ASD was based on semistructured interviews with parents. To help ensure accurate reporting, open-ended questions with specific follow-up questions were asked, and parents were required to provide descriptions and examples to illustrate their children's behaviors. However, further investigations of the specific *DSM-IV-TR* criteria most useful for discriminating ASD in older children with IDs through observations would strengthen conclusions.

Data for this study were collected through an actual ASD clinic. Clinic procedures and decisions outside the scope of this study (e.g., time constraints, preferences of clinicians, previous testing) led to the use of multiple measures of cognitive functioning and adaptive behavior. Moreover, collecting data through an actual ASD clinic limits the generalizability of conclusions that can be drawn.

The no-ASD children with IDs were referred to an ASD clinic and thus likely exhibited more autistic behaviors than children within the broader ID population. Moreover, children with IDs often had psychiatric diagnoses other than ASD. Because of this, the present study may be an underestimation of the usefulness of the *DSM-IV-TR* criteria in detecting ASDs in children with IDs. On the other hand, the sample used in this study represents the population for which diagnostic uncertainty regarding ASD is likely most relevant. Furthermore, many children in the present sample were referred for an initial medical ASD evaluation (although several had educational labels of ASD). Findings may not generalize to children with IDs referred for medical ASD diagnoses at earlier ages and those for whom autistic symptoms may be more pronounced.

Another methodological limitation of this study was the use of an "all or none" algorithm (i.e., either a child does or does not display the behavior) in examining differences in the presence or absence of *DSM-IV-TR* diagnostic criteria for ASD. It may be more meaningful to investigate differences in the severity or type of impairments. For instance, children with IDs with and without ASDs may exhibit deficits in seeking to share interests with others, but the severity of these deficits may differ among these groups. Similarly, many researchers postulate that there are likely differences in the specific types of repetitive and stereotyped behaviors and activities that children with ASDs engage in compared with children with only ID (Bodfish, Symons, Parker & Lewis, 2000; Carcani-Rathwell, Rabe-Hasketh, & Santosh, 2006; Osterling, Dawson, & Munson, 2002). However, an all-or-none approach is consistent with the *DSM-IV-TR* and thus likely used in ASD clinics. Therefore, results from this study may best model the decision algorithm used by clinicians rendering actual diagnoses of ASD.

Overall, the findings can be interpreted to suggest that the parents of older children with IDs and ASDs are more likely to report impairments in social interactions, stereotyped or idiosyncratic language, lack of pretend or imitative play, and restricted or narrowed interests than are parents of children with IDs but without ASDs. In particular, parent endorsement of *DSM-IV-TR* criteria related to nonverbal social behavior and qualitative impairments in communication appears to be most useful in discriminating ASD from ID in older children. In contrast, the parents of older children with IDs both with and without ASDs report relatively high rates of delayed or lack of language, poor conversational

skills, restricted and nonfunctional routines, repetitive motor movements, and preoccupations with parts of objects. Therefore, it may not be useful for clinicians to focus on these behaviors when assessing for ASD. These findings indicate that parent interviews tailored around this unique subset of *DSM-IV-TR* criteria for ASD may be most appropriate for diagnosing ASD in older children with ID. Given the marked overlap in parent-reported *DSM-IV-TR* criteria for ASDs in children with IDs with and without ASDs, it is important for clinicians to use observational measures of ASD symptoms in addition to parent reports when diagnosing ASDs in children with IDs. Researchers suggest that the validity of ASD diagnosis is greatly improved in children with IDs when observational measures such as the ADOS-G are used in conjunction with parent-report measures (de Bildt et al., 2004).

More recently, measures have been developed that assess both ASD and alternative developmental disabilities (Skuse et al, 2004). At least one measure also has been designed to assess ASDs in children with IDs (Kraijer, 1997; Kraijer & de Bildt, 2005). Research is needed to examine whether these measures are better able to guide clinicians in the

differential diagnosis of ASD in older children with IDs than parent interviews of the *DSM-IV-TR* criteria for ASD. Future research also is needed to examine the endorsement of *DSM-IV-TR* criteria for ASD in adults with IDs. Researchers suggest that *DSM-IV-TR* criteria related to Social Relatedness may similarly be important for differentiating ASD from ID in this older group (Matson, Wilkins, & Ancona, 2008). In the future, researchers also should compare parent endorsement of *DSM-IV-TR* criteria for ASDs in children with and without IDs to better understand how the presentation of the core deficits of ASD differ across intellectual ability.

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Appendix

DSM-IV Diagnostic Criteria for Autistic Disorder: (*Rate each question: 1) behavior present and seen regularly in different situations and environments; 2) behavior sometimes seen or seen only in a specific situation or environment; or 3) behavior not seen or not yet developed*). A rating of Yes (present) or No (absent) is then made for each criterion

Qualitative impairment in social interaction, as manifested by two of the following:

Y N

- Marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction.
 ___ in general, will he look you/others in the eye, e.g., when he wants something
 ___ will _____ nod his head for "yes," shake his head for "no," wave "bye-bye"
 ___ at appropriate times, point to indicate his wants, use other gestures
 ___ does _____ look at you when you start talking to him or doing things with him
 ___ will he turn his head to look at you when you call his name
 ___ will he look where you point when you point to show him a toy or a picture in a book
 ___ does he point to a toy or object to show you he is interested in it
 ___ does he smile, frown, raise his eyebrows. . . show a variety of facial expressions
 (can you tell how he's feeling or what he's thinking by his facial expressions)
 ___ does he gesture with his hands when he's talking

Y N

- Failure to develop peer relationships appropriate to developmental level
 ___ is he interested in other children
 ___ does he talk to or try to join other children in their play (e.g., at the park, school or daycare,
 how does he join another child or a group; for example, start playing next to them)

(continued)

Appendix (continued)

- ___ how does he respond if other children talk to or try to play with him
 ___ how many friends does _____ have (children he plays with regularly)
 ___ does he invite friends over to play and is he invited to play at other children's houses
 (ask about play "dates" set up by parent)
 ___ what do they do when they play together, e.g., parallel play only, chase, video games,
 make believe play
 ___ are his relationships based primarily on his special interests
 ___ does he have trouble participating in groups, following cooperative rules of games

Y N

A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)

- ___ does he try to involve you in his play, in his favorite activities or does he prefer to play by himself
 ___ how does he try to engage you
 ___ does he bring a toy or book to show you what he is doing
 ___ how does he respond to praise
 ___ does he offer to share things (toys or food) with you; and will he offer to share things
 with other children
 ___ at different times, does he frown and pout, act embarrassed, look surprised or look happy
 and excited (show a range of emotions)
 ___ how does he share his feelings with you, e.g., his excitement after drawing a picture that
 he really likes, and how does he respond to praise
 ___ does he like to be held or cuddled, does he give hugs and kisses (does he imitate you or
 does he spontaneously give a hug)

Y N

Lack of social or emotional reciprocity

- ___ will he play ball by rolling or throwing it back and forth
 ___ does he play other games that require turn taking
 ___ is he interested in what game you want to play or what you want to do
 ___ does he recognize how you are feeling, e.g., when you're happy, angry or sad; when you're
 sad or ill, will he try to comfort you
 ___ does he notice when others are upset or hurt
 ___ does _____ realize certain things he does bother others

Qualitative impairments in communication as manifested by at least one of the following:

Y N

Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)

- ___ how many words and gestures does he use
 ___ does he use words or gestures to indicate his wants (e.g., does he point to indicate wants)
 ___ how does he usually let you know what he wants or when he needs some thing

Y N

In individuals with adequate speech, marked impairment in the ability to initiate or sustain conversation with others

- ___ can you have a conversation with _____. For example, if you make a comment but
 don't ask a question, will he say something in response
 ___ will he start a conversation with you just to talk or chat, not to ask for something

(continued)

Appendix (continued)

- ___ can he take turns in a conversation or is it usually one-sided, e.g., does he always want to talk about his favorite subject
 ___ does he notice when you've lost interest in talking or does he talk on and on
 ___ does he interpret what you say literally or concretely, e.g., "what's up" (what are you doing) or "you must have springs in your shoes" (to jump that high) or "hop to it" (hurry)

Y N

Stereotyped and repetitive use of language or idiosyncratic language

- ___ what word or name does _____ use to refer to himself/herself
 ___ does he sometimes mix up pronouns, e.g., you for I, he or she for I
 ___ does he say what you say right after (immediate echolalia)
 ___ does he repeat the same phrase over and over
 ___ does he use pat or set phrases, e.g., things you may have said or that s/he heard someone else say, such as from a TV show or movie (delayed echolalia)
 ___ talk to himself during play, or make nonsense noises or words to himself/herself during play (words that he made up)
 ___ does he seem to talk too loudly or too softly
 ___ does he use the same tone of voice each time or have a sing-song pattern to his/her voice?

Y N

Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

- ___ will he play games such as pat-a-cake or peek-a-boo; make hand gestures to familiar songs such as "itsy-bitsy-spider"; fill in a word in a familiar song like "wheels on the bus"
 ___ does _____ like to "pretend" or "make-believe" when playing. For example, will he pretend to talk on a toy phone or pretend to feed or take care of a doll or stuffed animal. Will he dress-up and "make believe" he is someone else
 ___ does he pretend a toy is something else, e.g., a toy banana is a phone or a block is a sandwich

Restrictive repetitive and stereotyped patterns of behavior, interests, and activities as manifested by at least one of the following:

Y N

Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

- ___ what are his favorite toys and activities
 ___ does he always play with toys in the same way, e.g., by lining up toy cars or sorting toys by color
 ___ does he have a special (all encompassing) interest in one toy, activity or subject (e.g., trains or flags) or an interest in unusual objects or topics (e.g., sprinkler systems, astrophysics)
 ___ how does he react if you try to change a favorite activity or topic of conversation
 ___ does he have an unusually good memory for the details of special interests, family activities or vacations

Y N

Apparently inflexible adherence to specific, nonfunctional routines or rituals

- ___ does _____ have rigid rituals or routines. For example, are there things he has to do in a particular way or in an exact order every time at mealtime, bedtime or during play
 ___ how does he react if his routine is interrupted or he can't complete it (e.g., a toy is broken or missing, he has to sleep at a motel when on vacation, you drive a different way home)

(continued)

Appendix (continued)

- ___ how does he react to changes in his schedule (e.g., school assembly canceled) or changes in his environment, (e.g., how the furniture is arranged at home or classroom, where he sits at the dinner table)
- ___ does he repeat certain activities over and over, for example: with objects (dropping or rolling; always carrying a specific object); cleaning (washing) hands; use of toilet paper; checking (appliances off, doors closed); counting (toys, money); or ordering (toys, clothes, towels in bathroom). Do these activities interfere with day-to-day function
- Y N
 Stereotyped and repetitive motor mannerisms (e.g., hand and finger flapping or twisting, or complex whole-body movements)
- ___ does he have any mannerisms or odd ways of moving his hands or his body that look the same each time, e.g., flapping hands when excited, walking on his toes, flicking his fingers, spinning or rocking his body, running in a circle
- Y N
 Persistent preoccupation with parts of objects
- ___ does he mostly play with objects that light up or make sounds, objects that move or spin, e.g., wheels, fans, running water
- ___ does he pay attention only to part of the toy, e.g., spinning the wheels of the car rather than driving it around on a “make-believe” road,
- ___ does he use toys or objects in unusual ways, e.g., repeatedly opens and closes doors of toy cars, touches most toys to his lips/mouths toys, holds toys very close to his eyes or looks out of the “side” of his eyes at toys
- ___ does he have an attachment to unusual objects, e.g., string

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