

Differential Diagnosis of Hispanic Children Referred for Autism Spectrum Disorders: Complex Issues

Terry Overton · Cheryl Fielding ·
Roman Garcia de Alba

Published online: 2 February 2007
© Springer Science+Business Media, LLC 2007

Abstract This study examines the decision-making process used for differential diagnosis of a sample of Hispanic children referred for autism spectrum disorders (ASDs). Of the sample of 28 children, 18 were diagnosed with ASDs. Of the 10 children who were not diagnosed with ASDs, 80% were found to have multiple diagnostic labels or comorbidities. Mann-Whitney *U* analyses determined the differences between the children with the most severe social impairment, children with less severe social impairment and the non-autistic children on several domains commonly used to assess ASDs. These analyses indicated significant differences in some characteristics of the children in the sample. Based on these results, a decision-tree for the diagnosis of children with and without ASDs with comorbid disorders was developed.

Keywords Assessment · Autism spectrum disorders · Comorbid disorders · Differential diagnosis

Introduction

The incidence of autism spectrum disorders (ASDs) has increased markedly and now represents approximately one in 500—one in 166 children (Center for Disease Control, 2006; Harpaz-Rotem & Rosenheck, 2004). Accurate diagnosis of ASDs is complicated by multiple diagnostic criteria used in multiple settings, including APA clinical criteria used in psychiatric and

psychological settings, ICD-10 used in medical settings, and federal and state criteria used in educational diagnosis (APA, 2000; IDEA, 1997; McConachie, Couteur, & Honey, 2005; Tryon, Mayes, Rhodes, & Waldo, 2006). A child might be diagnosed in a medical clinic using one set of criteria and then may be required to meet an additional set of criteria to receive services in a different setting. For example, in public schools, children with a medical diagnosis must also meet the criteria of federal regulations for receiving services in IDEA before receiving educational interventions (Noland & Gabriels, 2004).

In addition to the multiple sets of diagnostic criteria, discussions of the changing of definitions of specific disorders within the autism spectrum in the literature, and broadening the definitions of spectrum disorders adds to the confusion (Rutter, 2005; Wing, 2005). Uncertainty exists in the literature between the discussions of the criteria and definitions of the different types of ASDs such as Asperger's syndrome, atypical autism, and high-functioning autism (Klin, Sparrow, Marans, Carter, & Volkmar, 2000). For example, researchers found that the cognitive profiles of children with Asperger's disorder and high-functioning autism were similar even though cognitive functioning is believed to be a criteria for Asperger's disorder (Ghaziuddin & Mountain-Kimchi, 2004). In another study it was determined that children often met criteria for both autism and Asperger's disorder; however, clinicians do not always follow the decision-making process specified in the DSM-IV (Tryon et al., 2006). Moreover, children with ASDs often have associated features or comorbidities that increase the complexity of diagnosis (Bradley, Summers, Wood, & Bryson, 2004). Parents report that approximately 85% of their

T. Overton (✉) · C. Fielding · R. G. de Alba
Educational Psychology Department, University of Texas-
Pan American, Edinburg, TX 78541, USA
e-mail: overtont@panam.edu

children with autism had significant levels of emotional or conduct problems among other difficulties (Center for Disease Control, 2006). For example, children and adults with ASDs may have comorbid attention deficit–hyperactivity disorder (Clark, Feehan, Tinline, & Vostanis, 1999; Goldstein & Schwebach, 2004), anxiety disorders (Farrugia & Hudson, 2006), Tourette’s syndrome (Baron-Cohen, Mortimore, Moriarty, Izaguirre, & Robertson, 1999), depression (Tantam, 2000), and mental retardation (Edelson, 2006). In very young children, neurodevelopmental disorders are difficult to distinguish from each other because of overlapping symptoms across the various disorders (McConachie et al., 2005; Trillingsgaard, Sorensen, Nemec, & Jorgensen, 2005).

The diagnostic process is influenced by developmental issues that are evidenced in ASDs such as time of onset and age of manifestation of symptoms (Werner, Dawson, Munson, & Osterling, 2005), regression following typical development (Werner & Dawson, 2006), and the age of the child when the parent becomes aware of possible developmental problems (Baghdadli, Picot, Pascal, Pry, & Aussilloux, 2003; De Giacomo & Fombonne, 1998). For example, some children with ASDs may not exhibit repetitive behaviors, a DSM-IV criterion, until they reach 3 or 4 years of age or more. Professionals and parents may not recognize other less obvious characteristics, such as a lack of initiating joint attention, and therefore delay the diagnostic evaluation. Once the parents become concerned about development, it may be months or several years before a firm diagnosis is made (Hutton & Caron, 2005). If symptoms are not clear, parents may be told to wait for more specific symptoms to occur, or parents may seek diagnosis from multiple practitioners before receiving an accurate diagnosis.

The child’s race and socio-economic status also may influence the age at which a diagnosis is made. For example, one study found that the average age in which Medicaid eligible Latino children were diagnosed was 8 years of age compared with white children, who are likely to be diagnosed at 6 years of age, and African-American children who are diagnosed, on average, at more than 7 years of age (Mandell, Listerud, Levy, & Pinto-Martin, 2002). Researchers have determined that the number of children identified with autism in public schools varies according to financial resources (Palmer, Blanchard, Jean, & Mandall, 2005). This may influence the number of children found to have ASDs in a specific geographic area when the public school system lacks resources for parents who refer their children to the school diagnostic teams. For children from Hispanic

families who also live in poor socio-economic environments, this may affect the likelihood of receiving a timely diagnosis of ASDs.

Making an accurate diagnosis for children who are culturally and linguistically diverse is more complicated given the misinterpretation that may take place while observing the child when the examiner is not familiar with the culture (Rhodes, Ochoa, & Ortiz, 2005). Furthermore, a recent study indicated that Hispanic parents tend to report lower rates of autism than parents of other groups (Center for Disease Control, 2006). This CDC study left questions unanswered regarding the reasons for lower reporting and the authors were cautious about linking lower reporting to lower prevalence rates in Hispanic children. The CDC concluded that children with autism in Hispanic families may be under diagnosed. Moreover, the three states in the United States with the highest percentage of Hispanic population, Texas, California, and New Mexico, seem to have lower than expected rates of children identified with autism. The total percent of children with autism who are Hispanic in Texas, California, and New Mexico is 23% of all children with autism in those states (U.S. Department of Education, 2002). The Hispanic population of those states is 32% for Texas and California and 42% for New Mexico (U.S. Census Bureau, 2001), indicating that there are fewer children with autism who are Hispanic than expected. These inconsistencies seem to underscore the importance of determining factors that compound the diagnostic process for children of Hispanic families.

In this clinical study, we examined the results of 28 evaluations of Hispanic children who were consecutively referred for differential diagnosis of ASDs, or, children who were referred to confirm the working hypothesis of the primary care physician, who was hesitant to make the diagnosis of an ASD without standardized assessment. In this clinical sample, only six of the 28 referred children had not had a previous evaluation and did not have a diagnostic label. Therefore, 79% of the children within the sample received a diagnosis that the parents, school personnel, or primary care providers, felt was an inaccurate diagnostic label. A review of the records of prior evaluations, and reports from parents, indicated that the previous diagnoses were made using brief clinical interviews or partial evaluations that relied heavily on indirect measures. For example, parents often reported that they visited a clinician’s office where they were briefly interviewed while their child played alone in the room. Other parents reported that their child was not present at the interview and that they were

asked to complete a parent rating form. Parents were then given an evaluation report with a diagnosis.

The evaluations conducted by the first two authors in this study were comprehensive and used both direct and indirect measures of assessment from multiple sources and in multiple settings. Indirect assessment included parent interview, parent rating forms, and teacher rating forms. The direct assessment included instruments like the Autism Diagnostic Observation Schedule (ADOS) or Roberts-II, when appropriate, and informal observations in the child's classroom or other natural environment. As a result of the comprehensive evaluation, a greater amount of information was obtained which made it possible for the researchers to detect salient domains that could potentially differentiate between children who had been accurately diagnosed with an ASD and those without.

The authors of this study reviewed the comprehensive evaluation results to determine how the diagnostic process was completed. Given the information that was provided during the process of these differential diagnostic evaluations, the authors concluded that a distinguishing characteristic that was consistently applied during the diagnostic process was the level of social impairment of each child. The core features of ASDs required in the DSM-IV include qualitative abnormalities in communication, social reciprocity, and restrictive, repetitive, or stereotyped patterns of behavior, as evidenced prior to age 3 years. However, the authors noted that the critical component used in the decision-making process was the child's ability and capacity to relate voluntarily to the social overtures of others and to initiate spontaneous social overtures toward others. The concept of social impairment, as indicated by the child's involuntary inability to interact socially, was therefore, the core feature used to distinguish between children with and without ASDs. Moreover, the level of social impairment was considered when making distinctions between autism, Asperger's disorder, and PDD-NOS.

Methods

Participants

The children in this study were referred to the first two authors by their respective school systems, primary care physicians, or parents who were unable to secure a diagnosis in past attempts. The children in this study were all from a region that has a population which is 96.6% Hispanic (Region One Education Service Center, 2005). The schools in this region are located in counties that are considered economically disadvantaged with 39.7% of the students within the schools being identified as limited English learners. Two of the children in this clinical sample live in monolingual Spanish-speaking homes and the remainder of children in the sample live with bilingual family members. Eight of the 28 children in the sample were female. The children ranged in age from 20 months to 16 years of age. In the sample, the number of previous diagnoses per child ranged from 0 to 15 with an average number of previous diagnoses at 2.5 per child. Parents of five children reported that their child had experienced regression between the age of 18 and 24 months. Table 1 includes the description information about this sample. Table 2 presents the previous diagnostic information.

Instruments

The instruments used in this study included those commonly used in the diagnosis of ASDs. The Autism Diagnostic Inventory-Revised is a clinical interview method that asks parents to recall developmental milestones, onset of presenting problems, current behavioral concerns, and detailed information regarding qualitative abnormalities in communication, social reciprocity, and restricted, repetitive, and stereotyped patterns of behavior (Rutter, Le Couteur, & Lord, 2003). The ADOS is a direct assessment method in which the child is placed in a structured task that

Table 1 Descriptive statistics for the sample

	Total number	Range	Average	Percent of cases (%)
Previous diagnoses	69	0–15	2.5	79
Age	28	20 months–16 years of age	6 years and 8 months	100
Age of first concern	28	4–60 months	28 months of age	100
Parents reporting regression	5	Between 18 and 24 months	NA	7 of sample, 27 of ASD cases

Table 2 Previous diagnostic labels found in review of records

Previous diagnostic label	Number of occurrences	Percent of sample with specific previous diagnosis (%)
PDD-NOS	7	25
Autistic disorder	4	14
Dysthymic disorder	2	7
ADHD	10	38
Generalized anxiety disorder	1	3.6
Communication disorder	6	21
Mental retardation	5	18
Mixed receptive–expressive disorder	4	14
Disruptive behavior disorder	1	3.6
Impulse control disorder	2	7
Personality change disorder	1	3.6
Reading disorder	3	11
Disorder of written expression	2	7
Phonological disorder	1	3.6
Pica	1	3.6
Febrile seizures	1	3.6
Lead poisoning	1	3.6
Conduct disorder	1	3.6
Psychotic disorder-NOS	2	7
Learning disability	2	3.6
Dissociative disorder	1	3.6
Trichotilomania	2	7
Bipolar disorder	1	3.6
Jaundice	1	3.6
Fevers	1	3.6

invites the child to interact with the examiner and with specific stimuli to ascertain if the child displays symptoms of an ASD (Lord, Rutter, DiLavore, & Risi, 2002). The Child Behavior Checklist (CBCL) includes a parent rating form and teacher rating forms in which the adult caregiver or teacher is asked to rate the child on specific behaviors (Achenbach & Rescorla, 2000, 2001a, b). This rating form screens children for a variety of behavioral and emotional disorders such as attention deficit disorders and depression. The Vineland-II Adaptive Behavior Scales, and the Classroom Edition of the Vineland, are questionnaires in an interview format in which the parent, caregiver, or teacher, rates the child’s ability to function within the natural environment on specific tasks in the domains of communication, socialization, and daily living skills (Sparrow, Balla, & Cicchetti, 1984, 2005). When additional assessment was required, verbal children were administered the Roberts-II (Roberts & Gruber, 2005), and in a few cases where psychosis or schizophrenia was a rule out consideration, the Rorschach, using the Exner Scoring, was administered (Exner &

Weiner, 2005). The Children’s Depression Inventory (Kovacs, 1992), the Reynold’s Adolescent Depression Scale (Reynolds, 2002), or the Revised Manifest Anxiety Scale (Reynolds, 2000) were administered to collect additional information regarding the possibility of depression or anxiety disorders for children who were verbal.

A majority of the parents of the children in this study were bilingual and fluent in both English and Spanish. For these parents and their children, the administration of instruments was conducted in English. For parents who were only Spanish-speaking, the ADI-R was administered in Spanish and parent rating forms, such as the CBCL, were provided in Spanish. When necessary, Spanish interpretation was provided during the administration of the ADOS. Children who required the administration of additional assessment instruments, such as the Roberts-II, were administered the test in English or with a Spanish interpreter when the primary language was Spanish in the home.

Procedures

Following informed consent procedures, children were evaluated in their school settings or other natural environments. All children in the sample, with the exception of one child, were administered the ADOS. All parents, with the exception of two parents, completed the ADI-R. The first author was clinically and researched trained in the ADOS and the ADI-R and the second author was clinically and research trained in the ADOS. Prior to the evaluation, all children were observed in their natural classroom settings, or other natural settings, engaging in typical activities (playing with parent, classroom activities, etc.).

The examiners considered each child’s expressive language ability and administered the appropriate Module on the ADOS in accordance with the guidelines of the manual. For students who previously had been evaluated, clinical and school records were reviewed. Once the child completed the ADOS, the examiners considered any additional assessments to administer for the purpose of differential diagnosis. In most cases, parents or teachers completed the CBCL or Teacher Report Form of the CBCL. The Vineland Adaptive Behavior Scales-II or the Vineland Adaptive Behavior Scales, Classroom Edition, was completed for most children or reviewed in previous testing records.

Classification System

Following the evaluation of the 28 children in the sample, the two examiners independently ranked each

child, based on clinical judgment and independent of all test scores, in order to group the cases for levels of social impairment. The initial ranking was completed and resulted in 85% inter-rater reliability. For the cases ranked differently by the examiners, each case was discussed and agreement was reached about ranking based on the core diagnostic feature of level of social impairment.

The purpose of ranking the cases was to assist in the analysis of the decision-making used in differential diagnosis. This procedure was a first step in distinguishing the diagnostic differences between non-autistic, autistic, and a middle group of children who fell within the possible categories of Asperger's disorder, high-functioning autistic, or atypical autism. The three groups were based on the most severe level of autism or social impairment. Social impairment severity was based on the concept of "an involuntary lack of capacity to respond to the social overtures of others, initiate social contact, and to function socially in the natural environment" (Overton, Fielding, & Garcia de Alba, submitted).

Using this definition, each case was independently assigned a rank of severity with three indicating the most severely socially impaired, two, moderately socially impaired, one, mildly socially impaired but not on the ASD spectrum. The criteria for the individual ranks are presented in Table 3.

The final grouping of cases were assigned the following labels: Group 3—included the children ranked as the most severe social impairment, Group 2—included the middle group of less severely socially impaired, and Group 1—included the non-ASD group. To evaluate the examiner's clinical judgment of levels of impairment of social functioning, the ranked groups were correlated with the ADOS scores. A Spearman rho was conducted which indicated a correlation of

.724 (for complete results see Overton et al., submitted). The ADOS scores by ranks are presented in Fig. 1. The ADI-R scores by ranks are presented in Fig. 2. Differential and dual diagnostic procedures were investigated further by completing additional analyses. Additional data analyses included descriptive statistics and Mann-Whitney *U* comparisons.

Results

The completed diagnostic evaluations resulted in 64% of the children receiving a diagnosis of ASDs including 14 with autism, two with Asperger's disorder, and two with PDD-NOS. Six of the 18 children who were found to have ASDs or 33% of those with ASDs, were female. The children who were not diagnosed with an ASD received various other diagnoses such as Tourette's syndrome, mental retardation, severe receptive-expressive language disorder, attention deficit disorder, oppositional defiant disorder, and many with additional comorbid disorders of anxiety or depression. Of the total sample, 41% of the children received more than one diagnosis with 27% of the children with ASDs manifesting comorbid disorders such as anxiety, ADHD or ADHD features, or depression. Eighty percent of the children who were in the non-autistic group had comorbid disorders. The diagnostic results of the study are provided in Table 4.

In an effort to investigate differential diagnosis of ASDs and other disorders further, the age of awareness of developmental concerns, time to diagnosis, and age of diagnosis were analyzed. Parents reported the age of their child when they first became concerned about their child's development, which ranged from 4 to 60 months. The age in which their child received their diagnosis ranged from 24 months to 16 years of

Table 3 Criteria used for classification

Rank of 3—meets at least three of the following four criteria

- Child did not respond to social overtures made by others
- Child made no spontaneous overtures toward others for the purpose of social engagement
- Eye contact sustained for less than 3 s
- When prompted to engage in natural environment, child does not respond socially to others

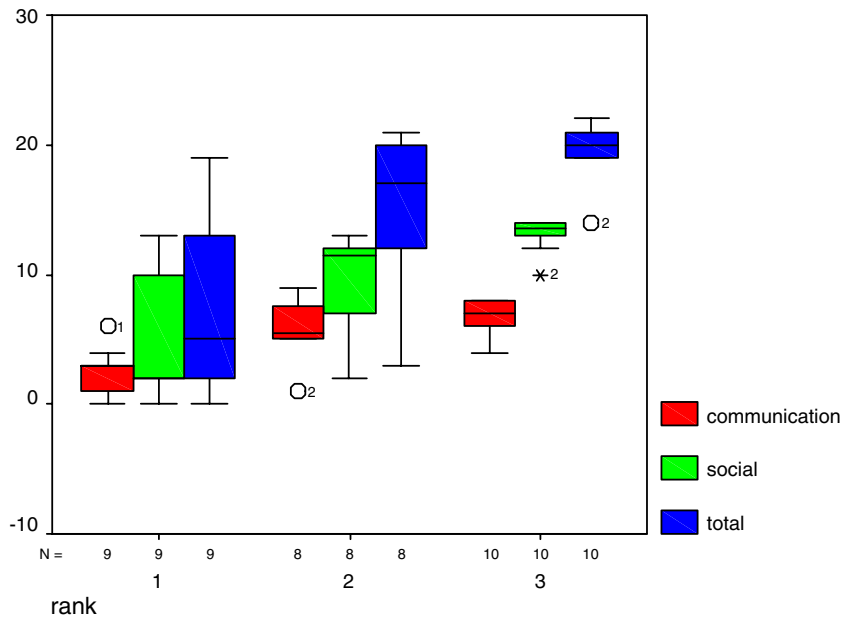
Rank of 2—meets at least three of the following four criteria

- Child did not respond to the social overtures of others on at least two occasions and did respond to the social overtures of others on at least two occasions
- Child spontaneously initiates at least one social overture in the natural environment, excluding requesting
- Child responds when prompted to interact socially in the natural environment on at least one occasion
- Maintains eye contact for more than 3 s during a social interaction other than for the purpose of requesting

Rank of 1—meets at least three of the following four criteria

- Child is able to respond to at least 60% of social overtures (e.g., 3/5 times)
- Child spontaneously initiates social overtures toward others two more times in the natural environment
- Voluntarily participates in a group activity at least one time in the natural environment
- Maintains eye contact with vocalization/verbalization for more than 3 s during a social interaction

Fig. 1 ADOS scores by ranked groups



age. The average age of diagnosis for children in the study who were diagnosed with autism was 5 years of age. The average age of diagnosis for children with Asperger’s was 13.5 years of age; the average age of diagnosis for children with PDD-NOS was 5 years; and the average age of children who were not diagnosed with ASDs but with other disorders was 8 years and 8 months of age.

The time from the parent’s awareness of developmental concerns to the actual diagnosis was calculated by group rank and for the total sample. The non-ASD

group had an average time to diagnosis of 58 months. The middle group, or the ASD group with less severe social impairment, had an average time to diagnosis of 49 months. The most significantly socially impaired group had an average time to diagnosis of 43 months. The chronological age averages by rank groups indicate that the most severely socially impaired group had the youngest chronological age average of 64 months, the less impaired Group 2 had an average age of 86 months, and the non-ASD group had an average chronological age of 91 months.

Fig. 2 ADI-R scores by ranked groups

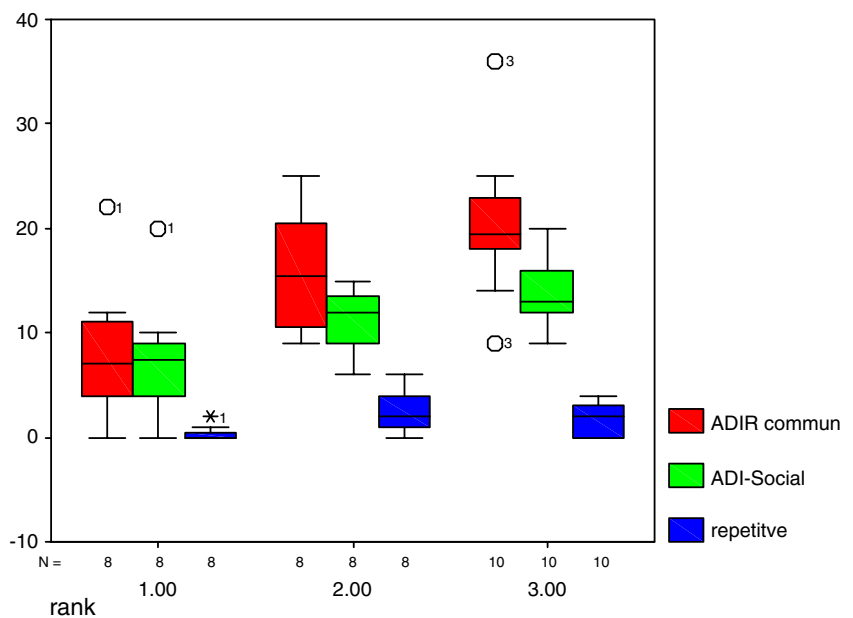


Table 4 Diagnostic categories of sample

Category	Number	Percent of sample (%)
All ASDs	18	64
Autistic disorder	14	50
Asperger's disorder	2	7
PDD-NOS	2	7
Anxiety	2	7
ADHD or features	7	25
ODD	2	7
Tourette's disorder	1	3.6
Seizure disorder	1	3.6
Mixed receptive–expressive language disorder	1	3.6
Mental retardation	2	7
MR & autistic disorder ^a	3	11 (21% of autistic children)
Separation disorder	1	3.6
Thought disorder	1	3.6
Selective mutism	1	3.6

^a Suspected based on VABS-II, not confirmed

In order to obtain a better understanding of the critical issues involved in making accurate differential diagnoses, rank comparisons were made on the most commonly used domains when assessing children with autism as assessed by the ADOS and the ADI-R. The three previously mentioned groups were used for these comparisons (i.e., non-autistic, mild-moderately impaired, and severely impaired). Given the small sample sizes and the level of scale (ordinal) used for statistical analysis, it was determined that the non-parametric Mann-Whitney *U* test was an appropriate procedure to compare the groups. For purposes of these analyses, Group 1 will be used to refer to the non-autistic group, Group 2 will be used to refer to the mild-moderately impaired group, and Group 3 will be referred to as the most severely socially impaired group.

Statistically significant differences between the rankings were found on three different domains of the ADOS when comparing the rankings between Group 1 and Group 3. The Communication domain yielded a significant *z*-score of -3.47 ($p < .001$). The Social Reciprocity domain also yielded a significant *z*-score of -3.12 ($p < .002$). Significant differences also were found on the Total Algorithm score yielding a *z*-score of -3.45 ($p < .001$). Comparisons between Groups 1 and 2 yielded similar results with the exception of the Social Reciprocity domain. The obtained *z*-score of -2.52 ($p < .05$) on the Communication domain was found to be statistically significant as well as the Total Algorithm score with an obtained *z*-score of -2.13 ($p < .05$). When the two ASD groups were compared to each other, Groups 2 and 3, significant differences

Table 5 Ranked groups comparison of ADOS scores

Groups compared	ADOS communication	ADOS social	Total score
Groups 1 & 3 ($N = 9, 10$)			
Mann-Whitney <i>U</i>	3.00	7.500	3.00
<i>Z</i>	-3.466	-3.124	-3.451
	$p < .001$	$p < .002$	$p < .001$
Groups 1 & 2 ($N = 9, 8$)			
Mann-Whitney <i>U</i>	10.00	21.00	14.00
<i>Z</i>	-2.519	-1.460	-2.129
	$p < .012$	NS	$p < .033$
Groups 2 & 3 ($N = 8, 10$)			
Mann-Whitney <i>U</i>	29.500	9.500	19.00
<i>Z</i>	-.950	-2.769	-1.892
	NS	$p < .006$	NS

were only found on the Social Reciprocity domain with an obtained *z*-score of -2.77 ($p < .05$). The results of these analyses are presented in Table 5.

Additional analyses between the non-ASD group (Group 1) and the two ASD groups (Groups 2 and 3) indicated additional differences between groups on the ADI-R. Significant differences between Group 1 and Group 3 were found on the Communication domain with a *z*-score of -2.80 ($p < .01$), the Social domain with a *z*-score of -2.63 ($p < .01$), and the Repetitive Behaviors domain with a *z*-score of -2.4 ($p < .05$). When comparing Group 1 and Group 2, significant differences were found on the Communication domain ($z = -2.26$, $p < .05$) and the Repetitive Behaviors domain ($z = -2.47$, $p < .05$). However, no significant differences were found between Groups 2 and 3. The results of the ADI-R comparisons are presented in Table 6.

Similar non-parametric analyses were conducted between the ranked groups and the results obtained on the CBCL for both the 1.5–5 years form and the

Table 6 Ranked groups comparison of ADI-R scores

Groups compared	ADI-R communication	ADI-R social	ADI-R repetitive behaviors
Groups 1 & 3 ($N = 8, 10$)			
Mann-Whitney <i>U</i>	8.500	10.500	18.000
<i>Z</i>	-2.803	-2.627	-2.399
	$p < .005$	$p < .009$	$p < .016$
Groups 1 & 2 ($N = 8, 8$)			
Mann-Whitney <i>U</i>	10.5000	14.500	12.500
<i>Z</i>	-2.263	-1.846	-2.466
	$p < .024$	NS	$p < .014$
Groups 2 & 3 ($N = 8, 10$)			
Mann-Whitney <i>U</i>	24.500	25.500	36.500
<i>Z</i>	.167	.194	.748
	NS	NS	NS

6–18 years age form. The analyses were conducted on the narrow band or problem scales, internalizing and externalizing scores, and the DSM-oriented scales for both age groups. In addition, standard scores for the Vineland-II Adaptive Behavior Scales also were compared by using the Mann-Whitney *U* test. However, the results of these analyses did not yield any significant differences between groups on either the CBCL, the Teacher Report Form, or the Vineland-II.

Discussion

The differential diagnosis of children referred for the determination of possible ASDs, who also may have comorbidities, is a complex task. This sample of children, all Hispanic children from bilingual Spanish/English or monolingual Spanish homes, were likely to be influenced by factors that contribute to a later diagnosis, and by factors that make the diagnostic process difficult. The investigators set out to analyze the differences between the children in this sample who were the most socially impaired, less socially impaired, and children who were not found to be on the autism spectrum. These differences were evident between the most socially impaired and the non-autistic children by their differences on both the ADOS and the ADI-R.

The differentiation between the group ranked most severe in social impairment, the middle group of children with less social impairment, and the non-autistic group, was not as clear when using only the ADOS or only the ADI-R. The authors of this study believe that social impairment is at the core of the disorder known as autism, and therefore defined the severity of the cases based on this concept. The authors applied this definition to each case and ranked the children independent of the ADOS or ADI-R scores. It is not surprising that there was a statistical difference between Groups 2 and 3 on the social reciprocity score of the ADOS since the authors based the ranking on level of social impairment. This supports the concept that the Group 3 children seemed to have a greater degree of qualitative abnormality in social reciprocity. It is interesting; however, that the social reciprocity score was not significantly different between these same groups on the ADI-R. Moreover, a statistical difference between Groups 1 and 2 on communication on the ADOS, but not social reciprocity, may suggest that, in this sample, the children at the higher end of the spectrum had more difficulty communicating and were similar in social reciprocity to the non-autistic group. It is important to remember that the non-

autistic children also were children referred for clinical issues and were not children who were free from behavioral or social problems. The Group 1 children also manifested social skills challenges and were therefore referred for an evaluation to determine if they had an ASD. The Group 1 children; however, were more likely to have social difficulties due to depression, anxiety, mental retardation, or communication difficulties. Arriving at the appropriate diagnosis for children such as those in our sample in Groups 1 and 2 is perhaps the most challenging task for practitioners.

The results of the differences between the groups on the ADI-R also warrant discussion. Like the ADOS scores, there were statistically significant differences between the Groups of children in the non-autistic Group 1 and the more severely socially impaired children in Group 3. There was also a significant difference between the children in Groups 1 and 2 in communication. In addition, there was a statistically significant difference between the children in these groups in restrictive, repetitive, or stereotyped patterns of behavior. This index is not included on the ADOS algorithm and therefore could not be compared.

Unlike the ADOS, on the ADI-R there were no significant differences between the two groups of children with ASDs, Groups 2 and 3. This suggests that when a parent of a child in either group reports their child's symptoms, they perceive or experience their child's behaviors in a similar manner. It may also suggest that the ADI-R is not as sensitive to the subtle behavioral differences of children with various levels of severity of social impairment. Another possible explanation of the similar outcomes on the ADI-R of children in Groups 2 and 3 may be that the ADI-R is based solely on the memory of the parent. Even though the instrument is constructed to probe for specific details about the behaviors associated with autism during the entire developmental period, parents may not accurately recall their child's behavior several years after the behavior occurred. This may contribute somewhat to the lack of sensitivity of the instrument.

Once a child has been evaluated for a possible ASD, the next step in the process is to determine if there are other comorbid challenges facing the child that may impact interventions. Twenty-one percent of the children in this sample diagnosed with an ASD also had comorbid difficulties. In the non-autistic group, eight of 10 children, or 80% of the children in this sample without ASD had more than one diagnosis. This speaks to the level of challenges these children were facing and also to the level of difficulty in making these complex diagnoses. It is also of interest to observe the

differences in the types of diagnoses made prior to the comprehensive assessment and frequencies of the occurrences of these diagnoses compared to the conclusions following the comprehensive evaluation. For example, the most common classification found in the review of previous assessment was ADHD followed by PDD-NOS and communication disorders. This seems to indicate that these young children were receiving diagnostic labels based on partial symptoms or even, in some cases, inaccurate labels, such as dissociative disorder. Following the comprehensive evaluations using direct measures and observations in the natural environments, the most commonly diagnosed disorder was autistic disorder followed by ADHD. In this small sample of Hispanic children, the misdiagnosis of children with spectrum disorders with non-spectrum disorders, such as ADHD, may indicate one possible contributing factor to the under representation of Hispanic children with autism. Hispanic children with

spectrum disorders may be diagnosed with other psychological and behavioral disorders rather than spectrum disorders.

The authors of this study conducted a qualitative analysis of the decision-making process used for diagnosis of these 28 children who were referred for possible ASDs. For children who were referred for pervasive developmental disorders and who were found to have ASDs, guidelines for the procedure used in making this determination is presented in Fig. 3. This procedure should include direct and indirect assessment methods such as the administration of the ADOS, the ADI-R, the CBCL, Vineland, and observations in the natural environment. Other assessment measures, such as different adaptive behavior measures, may be employed as well as the measures employed in this study. The core criteria and questions to answer during this process are included. Distinctions may need to be made to determine if the child meets

Fig. 3 Differential diagnosis in children referred for pervasive developmental disorders

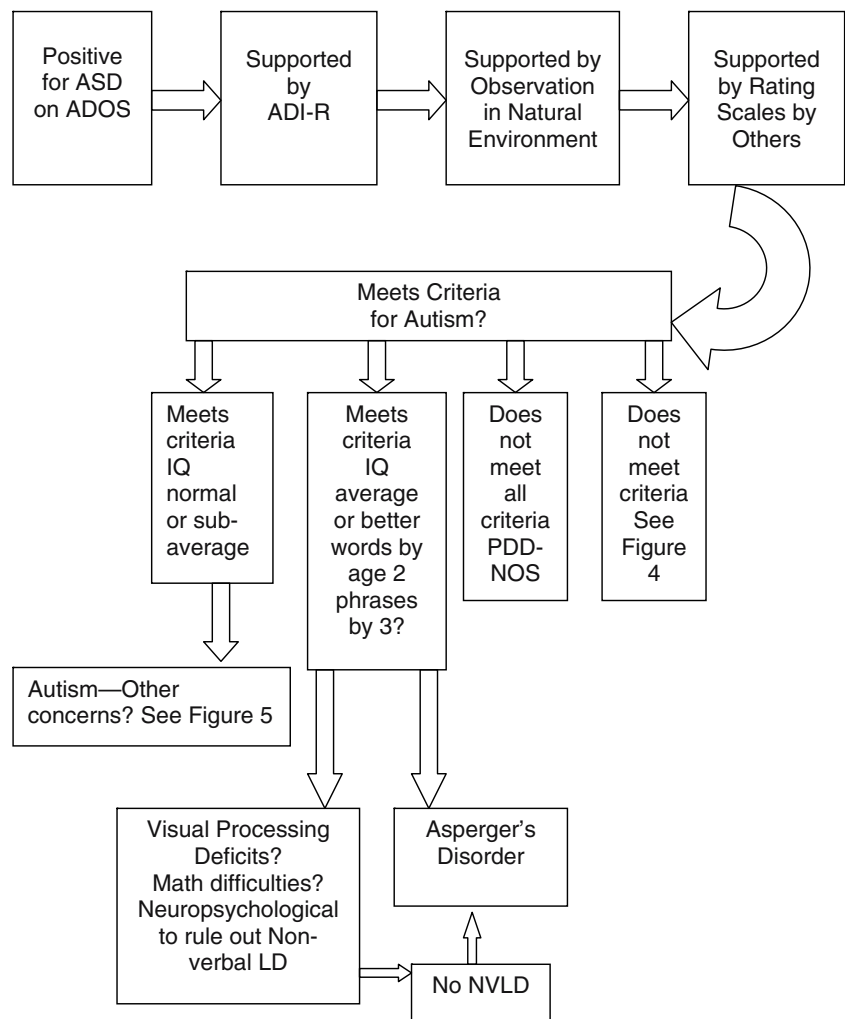
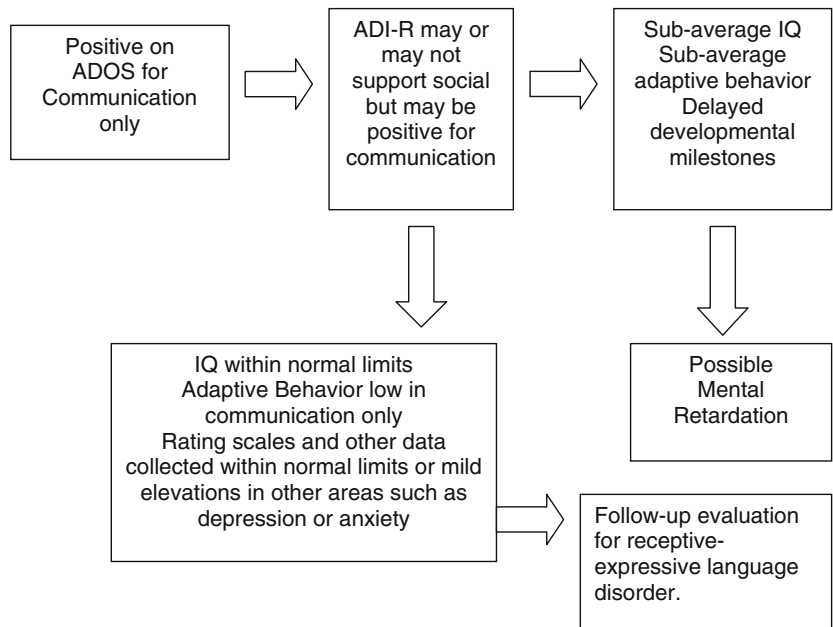


Fig. 4 ASD rule out with consideration of communication disorder, developmental delay or mental retardation



criteria for other diagnostic categories, such as non-verbal learning disability or Asperger’s disorder. Guidance is provided for these considerations.

When a child does not seem to meet all of the diagnostic criteria for an ASD but meets some of the criteria, the clinician must consider the possibility of developmental delay, mental retardation, or communication disorder, as well as PDD-NOS. Fig. 4 presents guidelines for considering mental retardation and communication disorder.

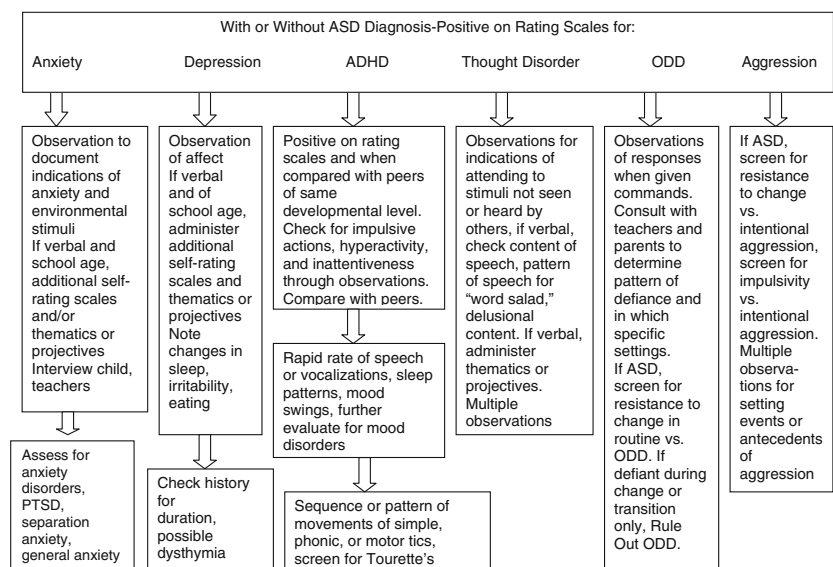
A child, with or without an ASD, may have positive results on other assessment instruments indicating possible emotional or behavioral disorders or features

of those disorders. For example, a child with an ASD may also have features of anxiety or ADHD, or may have a mood disorder, such as depression, or an anxiety disorder. Fig. 5 presents guidelines for these differential diagnoses and the consideration of comorbid disorders.

Limitations of this Study and Implications for Future Research

A common limitation in clinical research of children with disabilities is the use of a convenient clinical

Fig. 5 ASD with comorbid disorders or features of disorders



sample rather than analyzing data collected from a random sample and this was a limitation in this analysis. This sample included children only from homes in which the parents were either bilingual or monolingual Spanish, which may offer some insight into the evaluation of this particular group of minority children with behavioral challenges that permeate across social, behavioral, and communication domains. Further research is needed in the area of diagnosing children from this minority group who have complex disorders.

Additional considerations for research might include investigating how parents of this minority population access health care and psychological providers for evaluation purposes and how their cultural beliefs impact this process. For example, in the geographic area of this specific study, it is common practice for some families to access their local curandera for intervention before contacting a typical American health care provider. This practice may delay the diagnostic process. Moreover, in a dual language environment, some parents informed the authors that language acquisition was slightly delayed in their other children, or other relatives, and they did not know that this delay in the referred child was perhaps symptomatic of a developmental disorder.

An additional limitation of this study was the application of a new operational concept of levels of social impairment that may or may not be useful or generalizable to other clinical samples. This concept requires further study to determine if it will benefit clinicians faced with the difficult task of diagnosing children with ASDs. Moreover, the authors' qualitative analysis and proposal of a decision-making process for this diagnostically challenging group of children has not been tested in the field and may be of limited use to practitioners in evaluating children with and without ASDs who present with symptoms from multiple disorders. Additional research should be conducted that evaluates the use the proposed classification system as well as the decision-making process.

References

- Achenbach, T. M., & Rescorla, L. A. (2000). *Child behavior checklist for ages 1½–5*. Burlington, VT: University of Vermont, Department of Psychiatry.
- Achenbach, T. M., & Rescorla, L. A. (2001a). *Teacher's report form*. Burlington, VT: University of Vermont, Research Centre for Children, Youth and Families.
- Achenbach, T. M., & Rescorla, L. A. (2001b). *Child behavior checklist for ages 6–18*. Burlington, VT: University of Vermont, Research Centre for Children, Youth and Families.
- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- Baghdadli, A., Picot, M. C., Pascal, C., Pry, C., & Aussilloux, C. (2003). Relationship between age of recognition of first disturbances and severity in young children with autism. *European Child & Adolescent Psychiatry*, *12*, 122–127.
- Baron-Cohen, S., Mortimore, C., Moriarty, J., Izaguirre, J., & Robertson, M. (1999). The prevalence of Gilles de la Tourette's syndrome in children and adolescents with autism. *Journal of Child Psychology and Psychiatry*, *40*(2), 213–218.
- Bradley, E. A., Summers, J. A., Wood, H. L., & Bryson, S. E. (2004). Comparing rates of psychiatric and behavior disorders in adolescents and young children with severe intellectual disability with and without autism. *Journal of Autism and Developmental Disorders*, *34*(2), 151–161.
- Center for Disease Control (May 5, 2006). *Parental report of diagnosed autism in children aged 4–17 years—United States, 2003–2004. Morbidity and mortality weekly report*. Centers for Disease Control and Prevention Department of Health and Human Services.
- Clark, T., Feehan, C., Tinline, C., & Vostanis, P. (1999). Autistic symptoms in children with attention deficit-hyperactivity disorder. *European Child & Adolescent Psychiatry*, *8*, 50–55.
- De Giacomo, A., & Fombonne, E. (1998). Parental recognition of developmental abnormalities in autism. *European Child & Adolescent Psychiatry*, *7*(3), 131–136.
- Edelson, M. G. (2006). Are the majority of children with autism mentally retarded? A systematic review of the data. *Focus on Autism and Other Developmental Disabilities*, *21*(2), 66–83.
- Exner, J. E., & Weiner, I. B. (2005). *Rorschach interpretation assistance program, version 5*. Lutz, FL: Psychological Assessment Resources, Inc.
- Farrugia, S., & Hudson, J. (2006). Anxiety in adolescents with Asperger syndrome: Negative thoughts behavioral problems, and life interferences. *Focus on Autism and Other Developmental Disabilities*, *21*(1), 25–35.
- Ghaziuddin, M., & Mountain-Kimchi, K. (2004). Defining the intellectual profile of Asperger syndrome: Comparison of high-functioning autism. *Journal of Autism and Developmental Disorders*, *34*(3), 279–284.
- Goldstein, S., & Schwebach, A. J. (2004). The comorbidity of pervasive developmental disorder and attention deficit hyperactivity disorder: Results of a retrospective chart review. *Journal of Autism and Developmental Disorders*, *34*(3), 329–339.
- Harpaz-Rotem, I., & Rosenheck, R. A. (2004). Changes in outpatient psychiatric diagnosis in privately insured children and adolescents from 1995–2000. *Child Psychiatry and Human Development*, *34*(4), 329–340.
- Hutton, A. M., & Caron, S. L. (2005). Experiences of families with children with autism in rural New England. *Focus on Autism and Other Developmental Disabilities*, *20*(3), 180–189.
- Individuals with Disabilities Education Act of 1990, 20 U.S.C. § 1400 et seq. (1990)(amended 1997).
- Klin, A., Sparrow, S. S., Marans, W. D., Carter, A., & Volkmar, F. R. (2000). Assessment issues in children and adolescents with Asperger syndrome. In A. Klin, F. R. Volkmar, & S. Sparrow (Eds.), *Asperger syndrome* (pp. 309–339). NY: Guilford.
- Kovacs, M. (1992). *Children's depression inventory*. North Tonawanda, NY: Multi-Health Systems, Inc.

- Lord, C., Rutter, M., DiLavore, P. C., & Risi, S. (2002). *Autism diagnostic observation schedule manual*. Los Angeles, CA: Western Psychological Services.
- Mandell, D. S., Listerud, J., Levy, S. E., & Pinto-Martin, J. A. (2002). Race differences in the age at diagnosis among medicaid-eligible children with autism. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41(12), 1447–1453.
- McConachie, H., Couteur, A. L., & Honey, E. (2005). Can a diagnosis of Asperger syndrome be made in very young children with suspected autism spectrum disorder? *Journal of Autism and Developmental Disorders*, 35(2), 167–176.
- Noland, R. M., & Gabriels, R. L. (2004). Screening and identifying children with autism spectrum disorders in the public school system: The development of a model process. *Journal of Autism and Developmental Disorders*, 34(3), 265–277.
- Palmer, R., Blanchard, S., Jean, C. R., & Mandall, D. S. (2005). School district resources and identification of children with autistic disorder. *American Journal of Public Health*, 95(1), 125–130.
- Region One Education Service Center Disaggregation of PEIMS Data-Student. (2005). *Region I: Public education information management system data for region I* [Data File]. Retrieved August 2, 2006.
- Reynolds, C. R. (2000). *Revised children's manifest anxiety scale (RCMAS)*. Los Angeles, CA: Western Psychological Services.
- Reynolds, W. M. (2002). *Reynolds Adolescent Depression Scale-2*. Lutz, FL: Psychological Assessment Resources, Inc.
- Rhodes, R. L., Ochoa, S. H., & Ortiz, S. O. (2005). *Assessing culturally and linguistically diverse students: A practical guide*. NY: Guilford.
- Roberts, G. E., & Gruber, C. (2005). *Roberts-2*. Los Angeles, CA: Western Psychological Services.
- Rutter, M. (2005). Autism research: Lessons from the past and prospects for the future. *Journal of Autism and Developmental Disorders*, 35(2), 241–257.
- Rutter, M., Le Couteur, A., & Lord, C. (2003). *Autism diagnostic interview revised WPS edition manual*. Los Angeles, CA: Western Psychological Services.
- Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (1984). *Vineland Adaptive Behavior Scales*. Circle Pines, MN: American Guidance Service, Inc.
- Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (2005). *Vineland-II: Vineland Adaptive Behavior Scales*. Circle Pines, MN: American Guidance Service, Inc.
- Tantam, D. (2000). Adolescence and adulthood of individuals with Asperger syndrome. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 367–399). NY: Guilford.
- Trillingsgaard, A., Sorensen, E. U., Nemeč, G., & Jorgensen, M. (2005). What distinguishes autism spectrum disorders from other developmental disorders before the age of four years? *European Child & Adolescent Psychiatry*, 14(2), 66–72.
- Tryon, P. A., Mayes, S. D., Rhodes, R. L., & Waldo, M. (2006). Can Asperger's disorder be differentiated from autism using the DSM-IV criteria? *Focus on Autism and Other Developmental Disabilities*, 21(1), 2–6.
- U.S. Census Bureau. (2001). *The Hispanic population: Census brief*. Retrieved October 8, 2006 from www.census.gov/prod/2001pubs/c2kbr01-3.pdf.
- U.S. Department of Education. (2002). Twenty-fourth annual report to congress on the implementation of the individuals with disabilities education act. Washington, DC: Author.
- Werner, E., & Dawson, G. (2006). Validation of the phenomenon of autistic regression using home videotapes. *Archives in General Psychiatry*, 62, 889–895.
- Werner, E., Dawson, G., Munson, J., & Osterling, J. (2005). Variation in early developmental course in autism and its relation with behavioral outcomes at 3–4 years of age. *Journal of Autism and Developmental Disorder*, 35(3), 337–350.
- Wing, L. (2005). Reflections on opening Pandora's Box. *Journal of Autism and Developmental Disorders*, 35(2), 197–203.