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ORIGINAL CONTRIBUTION

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Autistic disorder versus other pervasive developmental disorders in young children: same or different?

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Abstract Eighteen preschool children diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders Third Edition Revised (DSM III-R) as having Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) were compared to 176 children with DSM III-R Autistic Disorder (AD), and to 311 non-autistic children with developmental language disorders (DLD) (N = 201) or low IQ (N = 110). All children were partitioned into "high" and "low" cognitive subgroups at a nonverbal IQ of 80. Within cognitive subgroups, the 18 PDD-NOS children did not differ significantly from either the DLD or the AD children in verbal and adaptive skills and obtained scores intermediate between those of these groups. The PDD-NOS did not differ from the AD children in maladaptive behaviors. Both the PDD-NOS and AD children had many more of these behaviors than the non-autistic comparison groups. Children in the "high" and "low" cognitive subgroups of AD, but not of PDD-NOS, differed substantially on most measures, with the children with lower cognitive scores significantly more impaired on all measures. Similarity of PDD-NOS children to AD children in maladaptive behaviors and an intermediate position between autistic and non-autistic groups on virtually all measures explains the difficulty clinicians encounter in classifying children with PDD and raises questions about the specificity of these diagnostic subtypes of the autistic spectrum.

Key words Autism – subgroups – diagnosis – specificity – cognition

Abbreviations

DSM	Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association
DSM III	The third (1980) edition of the DSM
DSM III-R	The revision (1987) of DSM III
DSM IV	The fourth (1994) edition of the DSM
AD	Autistic disorder according to the DSM III-R or DSM IV criteria
PDD	Pervasive developmental disorder. Refers to the entire spectrum of disorders with autistic symptomatology

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PDD-NOS Pervasive developmental disorder-not otherwise specified. Refers to children with PDD who do not fulfill DSM criteria for one of the other disorders on the spectrum

Non-standard abbreviations

DLD Developmental language disorder, a group of children (N = 201) selected according to uniform criteria

H-PDD-NOS High PDD, a group of 9 PDD-NOS children according to DSM III-R criteria who had nonverbal IQs of 80 or more

HAD High AD, a group of AD children (N = 51) selected according to DSM III-R criteria who had nonverbal IQs of 80 or more

L-PDD-NOS Low PDD, a group of 9 PDD-NOS children according to DSM III-R who had nonverbal IQs below 80

LAD Low AD, a group of AD children (N = 125) selected according to DSM III-R criteria who had nonverbal IQs below 80

NALIQ Non-autistic low IQ, a group of non-autistic children (N = 110) whose nonverbal IQ was below 80

NVIQ Nonverbal IQ equivalent (see text)

WADIC Wing Autistic Disorder Interview Checklist

Introduction

Autism, a behaviorally-defined disorder with many biologic causes, is quite possibly the most widely investigated developmental disorder in this age group. It is indexed in infancy or very early childhood by severe impairments in three behavioral domains: sociability; language, communication and play; and range of interests and activities. Despite extensive research and clinical interest in autism, there is still a lack of agreement as to its diagnostic boundaries and its relationships with other disorders manifest in early childhood.

The third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM III) (2) of the American Psychiatric Association introduced the umbrella term Pervasive Developmental Disorder (PDD) to encompass the broad range of individuals with deficits in these three behavioral domains. This and subsequent editions (DSM III-R (3) and DSM IV (4), as well as in the International Classification of Diseases, the most recent tenth edition (ICD 10 (39) of which corresponds quite closely to DSM IV), used number and distribution of behavioral descriptors as criteria for discriminating classical autism (autistic disorder-AD) from less typically affected individuals. The present study examines the validity of the distinction between DSM III-R AD and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), the only other disorder on the autistic spectrum retained in DSM III-R. In a previous investigation of the same children in the present study, we showed that the number of children captured by the descriptors in the subsequent DSM editions varied greatly, a sign of their overlapping boundaries (37). Biological considerations regarding the variable behavioral phenotypes to be expected in largely genetically caused complex developmental disorders (18) legitimizes the fuzzy boundaries found in that study.

The term PDD-NOS has been retained in DSM IV and ICD 10, without specified diagnostic criteria, for individuals who do not fit other subtypes of PDD. There has been widespread discussion about the meaningfulness of diagnostic boundaries between Autistic Disorder and other so-called "non-autistic PDDs" (36), but few systematic comparative studies of the similarities and differences between DSM III-R AD and PDD-NOS in well-defined populations (21, 26). The purpose of the present study was to determine whether preschool children captured by a uniform instrument, the Wing Autistic Disorder Interview Checklist (WADIC) ((38) in (24), Appendix 1), and interviewed by experienced psychiatrists using DSM III-R criteria (DSM IV was not available when the study was carried out) as having AD differed in kind from those with PDD-NOS when the groups were matched for nonverbal IQ. Comparisons were also made with two non-autistic contrast groups screened for an autistic spectrum disorder with the WADIC: children with developmental language disorders and those with low IQ uncomplicated by autism. We hypothesized that there would be substantial overlaps between PDD-NOS and AD subgroups matched for nonverbal IQ and that both of them would differ substantially from their non-autistic nonverbal IQ-matched counterparts.

Methods

Subjects

The children in the present study were originally recruited between 1985 and 1988 for a large multi-center program project, *Nosology of Higher Cerebral Function Disorders in Children* (24). The purpose of the parent project was to devise an internally valid

classification system for developmentally handicapped preschool children uniformly selected and assessed. The study included 194 children diagnosed as having DSM III-R PDD, and a comparison cohort of 311 non-autistic developmentally disordered children (201 children with developmental language disorders [DLD] and 110 non-autistic children with a low IQ [NALIQ]). Methodological details of the parent project are described in Rapin (24). The study was not designed as an epidemiological study, as children were selected specifically to meet certain inclusionary criteria, in particular criteria for DSM III-R AD. Children who did not meet inclusionary criteria were either reclassified if they met inclusionary criteria for another group or were excluded from the study (see (24) for a detailed discussion of these issues).

Children were recruited 1) by clinical referral to the clinicians/researchers among the investigators, and 2) by solicited participation of schools and programs for special needs children. Recruitment occurred at five different sites where the investigators' institutions were located: Boston, Massachusetts; Bronx, New York; Manhasset, New York; Cleveland, Ohio; and Trenton, New Jersey.

Exclusionary criteria for all of the children in the study were a) a hearing threshold worse than 25 dB at any frequency in either ear; b) a family in which English was not the primary language; c) a major neurologic problem or structurally defined brain lesion resulting in a gross motor deficit or frequent seizures requiring high doses of anticonvulsants, or an identified condition, such as tuberous sclerosis or Rett syndrome; d) a craniofacial anomaly; or e) high doses of behavior-altering medications (less that 15% of children in any group were taking behavior modifying drugs at the time of testing, methylphenidate in virtually all cases). Inclusionary criteria for the contrast groups are fully described in Rapin (24).

Inclusionary criteria for the PDD cohort

The children screened for inclusion in the PDD cohort had been identified by a clinical or educational professional as exhibiting deficits in socialization and behavior of the sort described in DSM III-R or other published autism descriptors. The parents of all the children referred for possible inclusion in the study, whether potentially fulfilling criteria for AD, DLD, or NALIQ, filled out the 21-item WADIC, a predecessor of DSM III-R criteria for AD. It is divided into three areas: A) reciprocal social interaction, B) communication, verbal and nonverbal language, and symbolic development, and C) restricted repertoire of behaviors during self-selected activities. To be potentially netted into the AD cohort, children's parents had to endorse at least three items, one in each area, or two items in area A. All children with two or more checks on the WADIC were interviewed by an experienced child psychiatrist at each site who had been trained to reliability at the inception of the study, using both live children and videotapes, to apply DSM III and DSM III-R criteria to endorse or exclude a diagnosis of PDD. These psychiatrists also determined whether the children fulfilled DSM III criteria for Infantile Autism or DSM III-R criteria for AD, or another PDD diagnosis. Doubtful cases were brought up at periodic meetings of the investigators to resolve uncertain diagnoses.

Of the 194 referred to the project 176 children (91%) (147 boys [83.5%] and 29 girls [16.5%]) were classified by a child psychiatrist as having AD according to DSM III-R criteria. The other 18 (14 boys [77.8%] and four girls [22.2%]) failed to meet DSM III-R criteria for AD, but did meet DSM III-R criteria for PDD-NOS. None of the 18 PDD-NOS children met DSM III criteria for Infantile Autism but were classified as having some other form of PDD (see Table 1). These 18 children were excluded from the parent study but are the subjects of the present study.

In order to match the nonverbal IQs of children with PDD to those of the DLD and NALIQ contrast groups, the 176 subjects in the AD group were divided into two sub-groups: 1) AD children with a nonverbal IQ equivalent of 80 or more were called the high autistic disorder (HAD) group (N = 51, 29%); 2) AD children with a nonverbal IQ equivalent below 80 were called the low autistic disorder LAD group (N = 125, 79%).[1] The contrast groups consisted of 311 non-autistic children: 201 children with developmental language disorders (DLD), all of whom had nonverbal IQ equivalents of 80 or above, and 110 non-autistic mentally deficient (NALIQ) children, all of whom had nonverbal IQ equivalents of less than 80. None of the DLD or NALIQ children fulfilled criteria for AD or PDD-NOS, either because they had less than two behaviors endorsed on the WADIC or because the psychiatrist determined that they did not fulfill DSM III-R criteria for these disorders.

For purposes of comparisons with the subjects from the parent project, the 18 PDD-NOS subjects in the present study were likewise divided into the same two nonverbal IQ groups. The PDD-NOS group was comprised of nine children with NVIQ 80 or above (called the H-PDD-NOS subgroup) who were compared with the HAD and DLD contrast groups. Nine with NVIQ below 80 (called the L-PDD-NOS subgroup) were compared with the LAD and NALIQ contrast groups.

[1]The somewhat higher number of children in the LAD group than the traditionally quoted 2/3 of children with autism and mental deficiency is attributable to the cut at NVIQ 80 rather than 70 in this study.

Table 1 DSM III-R PDD-NOS Subjects

Subject number	Sex	Age (mos.)	NVIQ	WADIC# of checks	DSMIIIDx
H-PDD					
1	M	54	131	12	APDD
2	M	43	100	6	APDD
3	F	75	99	16	COS
4	M	45	91	12	APDD
5	M	80	88	6	APDD
6	M	50	86	12	APDD
7	M	59	86	8	COPDD
8	M	43	84	8	APDD
9	M	55	82	12	APDD
L-PDD					
10	M	61	79	10	APDD
11	M	65	66	11	COPDD
12	M	41	54	10	APDD
13	M	89	51	17	APDD
14	F	79	51	16	APDD
15	M	74	43	14	COPDD
16	M	74	41	8	COPDD residual state
17	F	45	40	17	APDD
18	F	62	16	12	APDD

Abbreviations: APDD = atypical pervasive developmental disorder; COPDD = childhood-onset PDD; COS = childhood-onset schizophrenia; DSM-III = Diagnostic and Statistical Manual, 3rd Edition, (APA,1980); DSM-III-R = DSM-III Revised (1987); Dx = diagnosis; F = female; M = male; mos. = months; NVIQ = nonverbal IQ equivalent (see text); PDD-NOS = pervasive developmental disorder-not-otherwise-specified; # = number; WADIC = Wing Autistic Disorder Interview Checklist

Behavioral and cognitive measures

We administered to all subjects in the parent project a broad battery which included a comprehensive developmental and family history, behavioral ratings, standardized neurological and psychiatric examinations, standardized neuropsychological and language tests, and assessments of spontaneous language and play abilities (see Rapin (24) for a complete description of these measures). The behavioral measures retained for the present study included the scores obtained from the following instruments: 1) the DSM III and DSM III-R diagnoses assigned by the psychiatrists who interviewed the children, 2) the number of checks parents assigned on the WADIC (out of a potential total of 21 checks), 3) standard scores on three domains (Communication, Daily Living, and Socialization) as well as the composite score on the Revised Vineland Adaptive Behavior Scales (29), and 4) the total scores assigned on the Social Abnormality Scales I and II which were developed for the parent project (Allen in (4) Appendix 2).

The cognitive measures retained for the present study included evaluation of performance and verbal abilities. The children's level of nonverbal competence was assessed with the Stanford-Binet 4th Edition (31) Abstract Visual Reasoning standard score. This instrument was selected because it spans ages two years to adulthood and we planned to study our sample longitudinally. For 47 children untestable with the Stanford-Binet, we administered the Bayley Scales of Infant Development – Mental Scale (6) and used the Kent scoring of visual-spatial items to derive a nonverbal mental age equivalent. We divided the nonverbal mental age from either the Stanford-Binet or the Bayley by the child's chronological age to derive a nonverbal intelligence ratio score (NVIQ equivalent).

Verbal comprehension was evaluated with the Peabody Picture Vocabulary Test-Revised (11) and verbal cognition with the Verbal Reasoning subtest standard scores of the Stanford-Binet 4th Edition.

Analyses of variance (ANOVAs) were run to compare differences of IQ and behavioral scores of children in each of the six subgroups. Separate Tukey post-tests were performed to determine the significance of differences among means. The relevant comparisons are those between subgroups within the "high" (NVIQ $\geq$ 80) and low (NVIQ $<$ 80) cognitive groups, although some comparisons among subgroups across these two cognitive levels are also presented.

Results

Behavioral classification

The gender, age, nonverbal IQ, and psychiatric DSM III classifications of each of the 18 DSM III-R PDD-

NOS children are shown in Table 1. Subject numbers 1–9 constitute the "high" (NVIQ ≥ 80) H-PDD-NOS subgroup; subject numbers 10–18 constitute the "low" (NVIQ < 80) L-PDD-NOS subgroup. The range of NVIQ (16 to 131) across the 18 DSM III-R PDD-NOS clinical diagnoses belies the commonly-held notion that PDD-NOS is a "milder" variant of the autistic condition, at least with regard to cognition, as the psychiatrists applied this diagnosis to significantly mentally deficient children as well as to children with normal to superior intelligence. The psychiatrists' DSM III diagnoses span both cognitive groups as well. Also shown in Table 1 are each child's number of checks on the WADIC. Although the mean number checks on the WADIC, an index of the severity of autism, was somewhat lower in the H-PDD-NOS (10.2) than in the L-PDD-NOS (12.8) children, this difference failed to discriminate ($p = 0.68$) between the two cognitive subgroups.

Age and NVIQ

In view of clinical and diagnostic overlaps between children on the autistic spectrum with children with language disorders and mental deficiency, we present comparisons between these three groups, stratified by NVIQ, in Tables 2–5. Table 2 summarizes the ages and NVIQs of all the children in the study. The significantly lower age of the DLD children is due to their enrollment between ages 3.0 and 5.11, whereas, to enhance the number of AD and NALIQ testable children, age was extended from 3.0 to 7.11 years. None of the NVIQ comparisons among the "high" cognitive subgroups was significant, all being in the average range. In the "low" functioning group, all subgroups had significantly sub-normal mean NVIQ scores, with the LAD, but not the L-PDD-NOS, significantly lower ($p < 0.01$) than the NALIQ subgroup. NVIQ differences between subgroups of the "high" and "low" groups were predictably highly significant ($p < 0.001$).

Communication skills

Verbal measures are presented in Fig. 1, the most relevant comparisons being those within the "high" and "low" cognitive groups. The question was whether the PDD-NOS subgroups were most similar to the non-autistic children or to autistic children with similar nonverbal skills. Compared to normative scores, all subgroups were impaired on all verbal measures, with the exception of the DLD and H-PDD-

Table 2 Pairwise comparisons within nonverbal IQ groups: age and nonverbal IQ equivalent (means and standard deviations)

Measures	"High" Group (NVIQ ≥ 80)				"Low" Group (NVIQ < 80)			
	H-PDD-NOS (N=9)	HAD (N=51)	DLD (N=201)	Comparisons Between "High" Subgroups	L-PDD-NOS (N=9)	LAD (N=125)	NALIQ (N=110)	Comparisons Between "Low" Subgroups
Age (months)	56.0(13.3)	57.8(15.2)	49.0(10.9)	H-PDD-NOS=HAD H-PDD-NOS=DLD HAD > DLD***	66.0(15.5)	59.6(16.4)	55.9(13.3)	L-PDD-NOS= LAD=NALIQ
Nonverbal IQ Equivalent (Stanford Binet/Bayley)	94.1(15.2)	102.5(23.1)	102.4(17.1)	H-PDD-NOS= HAD=DLD	49.0(17.6)	45.9(19.4)	55.5(18.0)	L-PDD-NOS=LAD L-PDD-NOS=NALIQ LAD < NALIQ***

Differences within NVIQ groups: (ANOVA with Tukey post-test pairwise comparisons); *** = p<.001; all other comparisons not statistically significant. Abbreviations: ANOVA = analysios of variance; DLD = developmental language disorder; H-PDD-NOS = high pervasive developmental disorder-not otherwise specified; HAD = high autistic disorder (AD); L-PDD-NOS = low PDD-NOS; LAD = low AD; NALIQ = non-autistic low IQ; N = number; NVIQ = nonverbal IQ equivalent (see text)

Table 3 Pairwise comparisons within nonverbal IQ groups: verbal Measures (means and standard deviations)

Language measures	"High" Group (NVIQ ≥ 80)				"Low" Group (NVIQ < 80)			
	H-PDD-NOS (N = 9)	HAD (N = 51)	DLD (N = 201)	Comparisons Between "High" Subgroups	L-PDD-NOS (N = 9)	LAD (N = 125)	NALIQ (N = 110)	Comparisons Between "Low" Subgroups
Verbal reasoning (Stanford Binet)	87.6 (18.3)	81.4 (13.0)	91.4 (12.4)	H-PDD-NOS = HAD H-PDD-NOS = DLD HAD < DLD***	73.3 (14.9)	65.8 (14.6)	74.8 (14.1)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD<NALIQ**
Verbal comprehension (PPVT)	85.3 (15.9)	73.2 (19.0)	86.3 (17.9)	H-PDD-NOS = HAD H-PDD-NOS = DLD HAD < DLD***	60.4 (15.5)	50.9 (17.1)	63.5 (18.9)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***
Vineland Communication SS	82.3 (11.6)	79.5 (20.2)	79.0 (12.2)	H-PDD-NOS = HAD = DLD	59.2 (8.0)	53.2 (13.9)	63.2 (12.3)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***

Differences within NVIQ groups: (ANOVA with Tukey post-test pairwise comparisons): ** = p<.01; *** = p<.001; all other comparisons not statistically significant. Abbreviations: ANOVA + analysis of variance; DLD = developmental language disorder; H-PDD-NOS = high pervasive developmental disorder not otherwise specified; HAD = high autistic disorder (AD); L-PDD-NOS = low PDD-NOS; LAD = low AD; NALIQ = non-autistic low IQ; N = number; NVIQ = nonverbal IQ equivalent (see text); PPVT = Peabody Picture Vocabulary Test-Revised; SS = scaled score

Table 4 Pairwise comparisons within nonverbal IQ groups: vineland scores (means and standard deviations)

Vineland domain	"High" Group (NVIQ ≥ 80)				"Low" Group (NVIQ < 80)			
	H-PDD-NOS (N = 9)	HAD (N = 51)	DLD (N = 201)	Comparisons between "High" subgroups	L-PDD-NOS (N = 9)	LAD (N = 125)	NALIQ (N = 110)	Comparisons between "Low" subgroups
Communication SS	82.3 (11.6)	79.5 (20.2)	79.0 (12.2)	H-PDD-NOS = HAD = DLD	59.2 (8.0)	53.2 (13.9)	63.2 (12.3)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***
Daily Living SS	72.3 (7.7)	70.1 (15.0)	84.8 (14.7)	H-PDD-NOS = HAD H-PDD-NOS = DLD HAD < DLD***	64.6 (14.1)	51.8 (15.9)	64.3 (15.1)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***
Socialization SS	75.9 (12.2)	69.8 (13.4)	85.0 (13.0)	H-PDD-NOS = HAD H-PDD-NOS = DLD HAD < DLD***	60.6 (5.0)	56.0 (9.4)	68.9 (11.7)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***
Adaptive SS (composite)	73.0 (7.9)	68.9 (13.8)	78.9 (12.8)	H-PDD-NOS = HAD H-PDD-NOS = DLD HAD < DLD***	58.4 (7.6)	49.6 (11.1)	59.5 (10.6)	L-PDD-NOS = LAD L-PDD-NOS = NALIQ LAD < NALIQ***

Differences within NVIQ groups: (ANOVA with Tukey post-test pairwise comparisons): ** = p<.01; *** = p<.001; all other comparisons not statistically significant.Abbreviations: ANOVA = analysis of variance; DLD = developmental language disorder; H-PDD-NOS = high pervasive developmental disorder-not otherwise specified; HAD = high autistic disorder (AD); L-PDD-NOS = low PDD-NOS; LAD = low AD; NALIQ = non-autistic low IQ; N = number; NVIQ = nonverbal IQ equivalent (see text); SS = scaled score

Table 5 Pairwise comparisons within nonverbal IQ groups: behavioral scores (means and standard deviations)

Scores	"High" Group (NVIQ ≥ 80)				"Low" Group (NVIQ < 80)			
	H-PDD-NOS	HAD	DLD	Comparisons Between "High" Subgroups	L-PDD-NOS	LAD	NALIQ	Comparisons Between "Low" Subgroups
WADIC A (sociability)	5.6 (2.2)	7.3 (1.7)	0.8 (1.7)	H-PDD = HAD H-PDD > DLD*** HAD > DLD***	6.6 (1.8)	7.5 (1.8)	1.9 (2.6)	L-PDD = LAD L-PDD > NALIQ*** LAD > NALIQ***
WADIC B (communication and play)	3.1 (1.5)	4.1 (1.0)	0.7 (1.2)	H-PDD = HAD H-PDD > DLD*** HAD > DLD***	3.8 (1.0)	3.4 (1.2)	1.2 (1.5)	L-PDD = LAD L-PDD > NALIQ** LAD > NALIQ***
WADIC C (narrow behavioral repertoire)	1.6 (1.1)	2.8 (1.7)	0.3 (0.9)	H-PDD < HAD(*) H-PDD > DLD* HAD > DLD***	2.4 (1.6)	2.9 (1.6)	0.8 (1.2)	L-PDD = LAD L-PDD > NALIQ** LAD > NALIQ***
WADIC Total	10.2 (3.4)	14.2 (3.1)	1.8 (3.2)	H-PDD < HAD* H-PDD > DLD*** HAD > DLD***	12.8 (3.3)	13.8 (3.7)	3.9 (4.5)	L-PDD = LAD L-PDD > NALIQ*** LAD > NALIQ***

Differences between NVIQ subgroups: (ANOVA with Tukey post-test pairwise comparisons): (*) p = <0.54; * = p<.05; ** = p<.01; *** = p<.001; all other comparisons not statistically significant. Abbreviations: ANOVA = analysis of variance; DLD = developmental language disorder; H-PDD = high pervasive developmental disorder not otherwise specified (PDD-NOS); HAD = high autistic disorder (AD); L-PDD = low PDD-NOS; LAD = low AD; NALIQ = non-autistic low IQ; N = number; NVIQ = nonverbal IQ equivalent (see text); WADIC = Wing Autistic Diagnostic Interview Checklist

NOS children on Verbal Reasoning (Table 3). None of these measures discriminated between the AD and PDD-NOS subgroups with equivalent NVIQs. With only one exception, the AD subgroups were more verbally impaired than their non-AD comparison subgroups, with the PDD-NOS subgroups obtaining intermediate scores. The cognitive and language scores in this study emphasize the blurred distinction between "high" PDD-NOS and DLD. This fuzziness explains why clinicians may confuse PDD-NOS with DLD unless they are aware of the children's aberrant behaviors.

Adaptive skills

The Vineland is a well standardized instrument for assessing the competence of children in everyday life. Figure 2 depicts the mean standard scores of the children on the Daily Living Skills and Socialization domains of the Vineland, as well as their Composite Vineland Adaptive mean scores. Mean scores of all six subgroups were at least 15 points below norms (Table 4). The pattern of standard scores assessing developmental level of Daily Living Skills and Socialization is similar to that of the language measures: scores of the PDD-NOS subgroups fell between those of the AD and their non-autistic controls and did not differ significantly from either group. Children meeting AD criteria (both HAD and LAD) had lower scores in development of Daily Living skills and Socialization than non-autistic controls.

Maladaptive behaviors

Maladaptive social and communication behaviors, as well as restricted and repetitive interests were assessed with the WADIC (Fig. 3). Not surprisingly, the subgroups of children meeting AD criteria had significantly more maladaptive behaviors and restricted and repetitive interests than the IQ matched non-autistic controls (Table 5). Importantly, the PDD-NOS children also had more maladaptive and aberrant behaviors than the controls. In the area of social and communicative behaviors, neither of the PDD-NOS subgroups differed from IQ matched autistic children. Although the H-PDD-NOS subgroup approached significance (p = 0.054) in having fewer endorsements on the restricted and repetitive interests scale than the HAD subgroup, the L-PDD-NOS children did not differ in this area from the LAD. Neither PDD-NOS subgroup differed from the corresponding AD subgroup on the Social Abnormalities Scales.

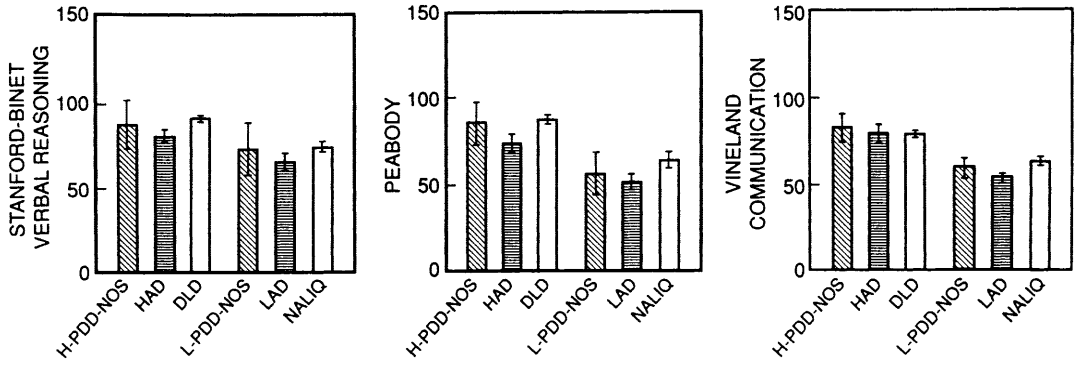

Fig. 1 Comparisons between scores (means and standard deviations) on verbal measures among PDD-NOS, autistic disorder, and non-autistic children divided into cognitively "high" and "low" groups on the basis of a nonverbal IQ at or above 80 (**three** bars on the left of each figure) or below 80 (**three** bars on the right). *H-PDD-NOS* high pervasive disorder-not otherwise specified; *HAD* high autistic disorder; *DLD* developmental language disorder; *L-PDD-NOS* low-PDD-NOS; *LAD* low autistic disorder; *NALIQ* non-autistic low IQ

Discussion

The autistic spectrum vs. categorical subtypes

Three findings in this study illustrate why it is often difficult to partition preschool children on the PDD spectrum into AD and PDD-NOS groups. First, the 18 DSM III-R PDD-NOS children obtained scores for measures of language and adaptive functioning that failed to differ significantly from those of 176 children who met full criteria for AD nor from those of 311 non–autistic controls matched for nonverbal IQ. Second, on virtually all of the measures of language and adaptive function, the mean scores of the PDD-NOS sample were intermediate between those of the AD and non-autistic groups which, as expected, differed significantly from one another, with the one exception that the three cognitively "high" subgroups had equivalent language skills in everyday life, as judged by the Vineland parent interview. Third, when it came to maladaptive behaviors, although PDD-NOS scores were still intermediate between those of AD and non-autistic controls, the PDD-NOS children were similar to the AD children, with both groups exhibiting many more maladaptive behaviors than the non–autistic children. In this respect, the only difference between the PDD-NOS and AD groups was that the "high" PDD-NOS subgroup had somewhat fewer restricted and maladaptive behaviors than its "high" AD counterpart. In short, the aberrant behaviors shared by the AD and PDD-NOS children set them dramatically apart from non-autistic children.

A limitation of this study is that it sought to enroll children with DSM III-R AD, rather than attempting to capture the entire autistic spectrum. The small number of inadvertently captured children with PDD-NOS limits the power of its conclusions. A second limitation is that no child was given a diagnosis of Asperger syndrome, a subtype that had not been defined in DSM III-R when the study was carried out. Therefore the study cannot address the question of whether Asperger syndrome and PDD-NOS are

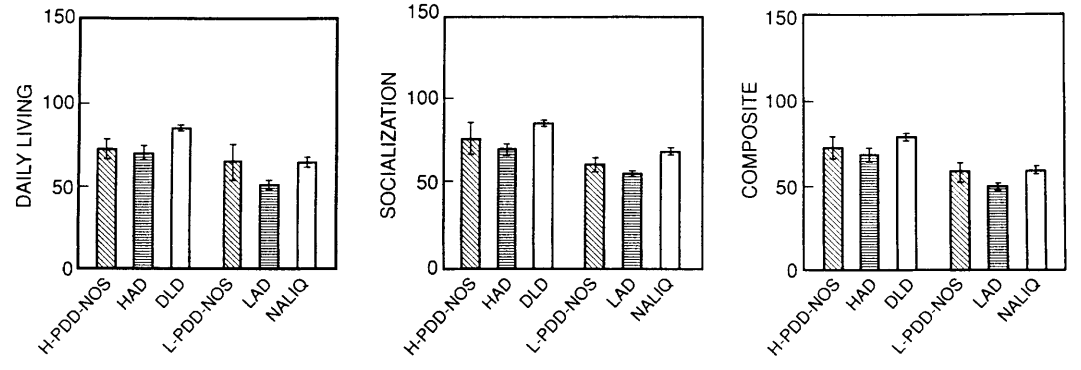

Fig. 2 Comparisons between scores (means and standard deviations) on adaptive function as measured by the Vineland among PDD-NOS, autistic disorder, and non-autistic children divided into cognitively "high" and "low" groups on the basis of a nonverbal IQ at or above 80 (**three** bars on the left of each figure) or below 80 (**three** bars on the right). *H-PDD-NOS* high pervasive disorder-not otherwise specified; *HAD* high autistic disorder; *DLD* developmental language disorder; *L-PDD-NOS* low-PDD-NOS; *LAD* low autistic disorder; *NALIQ* non-autistic low IQ

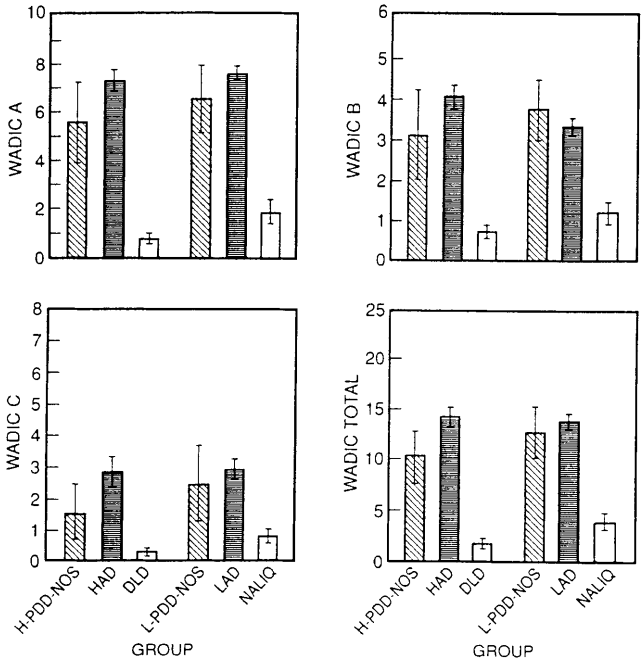

Fig. 3 Comparisons between numbers of aberrant behaviors (means and standard deviations) from the Wing Autistic Disorder Interview Checklist (WADIC) among PDD-NOS, autistic disorder, and non-autistic children divided into cognitively "high" and "low" groups on the basis of a nonverbal IQ at or above 80 (**three** bars on the left of each figure) or below 80 (**three** bars on the right). *H-PDD-NOS* high pervasive disorder-not otherwise specified; *HAD* high autistic disorder; *DLD* developmental language disorder; *L-PDD-NOS* low PDD-NOS; *LAD* low autistic disorder; *NALIQ* non-autistic low IQ

categorically distinct, another contentious issue. Other investigators have found that there are more overlaps than differences between AD and PDD-NOS (e.g., 7, 23), as contrasted to differences between PDD disorders and non-autistic developmental disorders.

The intermediate position of PDD-NOS language and adaptive behavior scores between those of the AD and non-autistic groups with comparable NVIQs, also found by Mayes et al. (21), makes it clear why clinicians often find it difficult to make the diagnostic distinction between AD and PDD-NOS, especially when the child has a nonverbal IQ above 80. The distinction between a diagnosis of PDD-NOS and AD in DSM-IV (or DSM III-R) is the number and distribution of endorsed autistic behaviors elicited by history and observation. Buitelaar et al. (7) examined the power of DSM-IV/ICD-10 criteria, and their relation to clinical and DSM III-R diagnoses and found that PDD-NOS is"...basically a lesser variant of autism with impairment in social interaction as a key characteristic." The implication is that PDD is a disorder with a spectrum of severity and its subtypes are quantitative rather than categorical. Dividing this behavioral spectrum into operationally defined subtypes has brought with it many scientific and practical advantages, despite their fuzzy borders. One of the ways to determine whether the boundaries separating AD and other PDD subgroups are meaningful will be to examine their prognostic value in longitudinal studies.

Other studies support the concept of a spectrum of autistic behavioral symptomatology (1, 17). In an exhaustive review of PDD-NOS, Towbin (32) found that interrater reliability was low for diagnosing this disorder within the continuum of PDD. Volkmar and Cohen (35), who played a key role in the field trials to determine the sensitivity and specificity of the behavioral descriptors chosen as criteria for a DSM IV diagnosis of PDD subtypes, found that most disagreements among raters were for fine-grained distinctions between AD and other PDD disorders. Although Buitelaar et al. (7) provide an algorithm for making a DSM IV diagnosis of PDD-NOS, they state that it is too early to determine whether this diagnosis merely represents the upper tail of the autistic spectrum. Mahoney et al. (20) reported that clinicians had difficulty differentiating atypical autism (PDD-NOS) from AD but were much better at differentiating Asperger syndrome from AD, and PDD from "non-autistic" disorders. Kurita's study (19), however, questions the specificity of Asperger syndrome as distinct from the upper end of the autistic spectrum (individuals with an IQ > 90) and an ICD 10 diagnosis of atypical autism (which corresponds to DSM IV PDD-NOS).

Importance of cognition

Current DSM and ICD criteria for subtyping PDD rely on behavioral criteria (sociability, communication, play, and stereotypic, rigid, perseverative characteristics). Asperger syndrome is currently the only diagnosis in DSM IV and ICD 10 for which cognitive and adaptive levels (usually interpreted as an IQ above 70, the cut-off for mental retardation) are defining features. Cognitive level may provide a strong additional criterion to the behavioral criteria in current use for defining other PDD subtypes. There is discussion in the literature regarding the relationship between cognitive ability and social/behavioral deficits within the overall PDD population (5, 12, 13, 25, 28, 33, 37). A number of investigators have suggested that "high" and "low" IQ groups be considered subtypes of PDD (5, 9, 10, 13, 33). The NVIQ cut-point for most of these studies was 70 (10 points lower than the lower limit for our "high-functioning" groups). In most studies there was a lack of comparison with other developmentally disordered groups with similar IQ levels. In instances in which such groups were used, the IQ levels of the AD subjects tended to be very low and the control groups were matched for

mental age, but therefore not chronologic age (8, 21, 34). This study differs in that comparisons were made between diagnostic subgroups with similar chronologic ages *and* nonverbal IQs.

We had previously applied an empirical taxometric classification method to partition the 194 AD and PDD-NOS children in this study (12, 25). By this approach 95% of the children were divided into two subgroups, high and low, with a cut off at NVIQ 65, which is five points lower than in most other studies. Of the 18 PDD-NOS children, 78% were classified into one or the other of these two empirical AD subgroups, which lends further support to the fact that the majority of these PDD-NOS children did not differ substantially from the DSM III-R autistic group.

Prognosis

Prognosis is a potent way to determine the power of the current behavioral boundaries used to partition PDD-NOS from AD groups are meaningful, or whether also taking NVIQ into consideration might be better. Stevens et al. (30) followed at seven or nine years or both the 116 available PDD children in this study. Unfortunately this included only nine of the 18 PDD-NOS group, making it impossible to determine whether these nine children had a better prognosis than their "high" and "low" AD counterparts. What the longitudinal indicated is that preschool behavioral and social measures were less reliable predictors of outcome at schoolage than cognitive variables, although NVIQ alone was also inadequate. This suggests that both NVIQ and behavioral social measures are required for a more reliable prognosis.

Implications for the provision of services

Classifications and/or diagnostic perspectives derive from different disciplines and serve many different purposes: educational, medical, and research, for example. Access to educational services should not be based on diagnostic labels inasmuch as a same diagnosis does not imply identical educational/vocational needs (see 26). Nonetheless, in many states across the United States, autism is now recognized as a fundable developmental disability, whereas PDD-NOS and Asperger syndrome are not. This is not the case for New York State where a recent evidence-based review of the literature revealed that the distinction between DSM IV/ICD 10 AD, Asperger disorder, and PDD-NOS is blurred, at least in children under three years. According to this guideline the distinction does not provide a basis for discrimination in delivery of services (22).

Many parents and professionals use the terms PDD and PDD-NOS interchangeably to refer to children who have autistic behaviors but do not fit their conceptions of autism. They seem unaware that PDD is a generic umbrella term that refers to the entire autistic spectrum, whereas PDD-NOS is but one of the subtypes of PDD (26). Many children carry the PDD-NOS diagnosis which, by definition, states that they are "not autistic", i.e., do not have autistic disorder (AD). Parents and educators are understandably confused by a clinical diagnosis that implies that a child who exhibits autistic behaviors but seems otherwise intelligent is "definitely not autistic but may have PDD or PDD-NOS". PDD and PDD-NOS (and Asperger syndrome) are often used synonymously to stand for a milder form of autism. This may not be justified, as in the present study there was a wide range of aberrant behaviors and of NVIQ scores in the PDD-NOS sample. Therefore this study provides *no* support for the terms PDD and PDD-NOS to be synonymous with "high functioning autism." Children with a diagnosis of PDD-NOS or Asperger syndrome are often classified as "emotionally disturbed" or "language impaired" in order to be eligible for special education services. Intermediate language and adaptive scores between AD and non-autistic subgroups, shared aberrant behaviors with AD children, and cognitive heterogeneity illustrate why PDD-NOS does not stand out as a distinct diagnostic entity. Whether outcome will discriminate PDD-NOS from AD with matched NVIQ level would require a much larger longitudinal sample than this one, but taking cognition as well as behavior into consideration seems to improve cognitive accuracy and may provide a stronger basis for subtyping PDD.

There is a current trend among many clinicians to replace the term PDD by non-categorical terms such as autistic continuum (38) and autistic spectrum disorders (1, 14, 16, 27). We would argue that the concept of a behaviorally defined autistic spectrum speaks to the fact that all individuals share the core deficits in socialization, communication, and imagination, despite their many different etiologies (15). The specific manner in which these core deficits are expressed singly and in combination results in a wide range of clinically observable behavioral profiles that are strongly modulated by an individual's level of cognitive function and by the adequacy and precocity of educational intervention.

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