Identifying and Differentiating PDD-NOS: A Comparison with Autism and ADHD

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ABSTRACT

Identifying and Differentiating PDD-NOS: A Comparison with Autism and ADHD

Purpose: We aimed to investigate differential features of pervasive developmental disorder- not otherwise specified (PDD-NOS) in terms of presenting symptoms, developmental history, and comorbidity with respect to autism and attention deficit hyperactivity disorder (ADHD).

Method: The study involved 188 children (PDD-NOS n=94; ADHD n=47; autism n=47) (male n=150, female n=38) who were 5.5(±2.5) years old on average (range 2-11 yrs.). Preliminary PDD-NOS screening scale (PPSSS) was developed based on the 'presenting' symptoms of PDD-NOS that were systematically collected in a pilot group of children. The clinical diagnoses and comorbidities were based on the comprehensive mental status examination, Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version-Turkish Version (K-SADS-PL-T), and the consensus between two child and adolescent psychiatry specialists.

Results: The prevalence rates of the most common presenting symptoms in the PDD-NOS and autism groups have shown a similar pattern of distribution from most common to the least, even when the results were corrected for age. However, almost all of these symptoms are reported significantly less in prevalence in the PDD-NOS group. Using subjects in all diagnostic groups (n=188), a principal axis factor analysis with Promax rotation revealed ten factors; seven were found to be discriminative. In addition, another factor analysis revealed three factors: (1) "autism spectrum," (2) "disruptive behaviors spectrum," and (3) "anxiety spectrum." The first two factors were found to discriminate between the diagnostic groups.

Discussion and Conclusion: The results suggest that PDD-NOS may be assumed as a quantitative partial subtype of autism, and it represents a less severe form that lies on a continuum of social-communication skills.

Keywords: PDD-NOS, nosology, differential diagnosis, autism spectrum, ADHD

ÖZET

YGB-BTA'yı Tanımlamak ve Ayırt Etmek: Otizm ve DEHB ileYapılan Bir Karşılaştırma

Amaç: Bu çalışmada, otizm ve dikkat eksikliği hiperaktivite bozukluğu (DEHB) ile karşılaştırıldığında, yaygın gelişimsel bozukluk- başka türlü adlandırılmayan (YGB-BTA) tanısı konan çocukların başvuru yakınmaları, gelişim öyküsü ve komorbidite özellikleri açısından ayırt edici özelliklerinin araştırılması amaçlanmıştır.

Yöntem: Bu çalışmada yaş ortalaması 5.5 (±2.5) (2-12) olan 188 çocuk (YGB-BTA n=94; DEHB n=47; otizm n=47) (erkek n=150, kız n=38) yer almıştır. YGB-BTA tanısı olan çocukların yer aldığı bir pilot çalışma grubunda başvuru yakınmalarının sistematik olarak toplanmasına dayanarak bir öncül YGB-BTA tarama ölçeği (ÖYTÖ) geliştirilmiştir. Klinik tanılar ve komorbid psikiyatrik bozukluklar ayrıntılı ruhsal durum muayenesi, Okul Çağı Çocukları İçin Duygulanım Bozuklukları ve Şizofreni Görüşme Çizelgesi-Şimdi ve Yaşam Boyu Şekli-Türkçe (ÇDŞG-ŞY-T) ve iki çocuk psikiyatrisi uzmanının ortak görüşüne dayalı olarak belirlenmiştir.

Bulgular: Yaş farklılığı düzeltildiğinde de görüldüğü gibi, en sık belirtilen yakınmaların görülme

sıklığı en sık olandan en az olana doğru YGB-BTA ve otizm grubunda çok benzer bir dağılım örüntüsü ortaya koymuştur. Neredeyse tüm belirtiler YGB-BTA grubunda anlamlı olarak daha az belirtilmiştir. Ana eksen Promax döndürme ile yapılan faktör analizi on faktör ortaya koymuştur ve yedi tanesi gruplar arasında anlamlı düzeyde ayırt edici bulunmuştur. ÖYTÖ'de yer alan 27 maddenin yapısal özelliklerini incelemek amacıyla, tüm tanı gruplarını içererek (n:188) yapılan faktör analizleri şu üç faktörü ortaya koymuştur: (1) "otizm spektrumu", (2) "yıkıcı davranım spektrumu", ve (3) "anksiyete spektrumu". İlk iki faktör gruplar arasında anlamlı düzeyde ayırt edici bulunmuştur.
Tartışma ve Sonuç: Bu çalışmanın sonuçları YGB-BTA'nın otizmin niceliksel olarak farklı bir alttipi olduğunu ve sosyal-iletişimsel beceri alanındaki doğrusal düzelmde yer alan daha hafif belirtilere sahip olduğunu desteklemektedir.
Anahtar Kelimeler: YGB-BTA, nozoloji, ayırıcı tanı, otizm spektrumu, DEHB

INTRODUCTION

Pervasive Developmental Disorders (PDD), also called Autism Spectrum Disorders (ASD), is defined in terms of abnormalities in social and communication development in the presence of marked repetitive behaviour and narrow interests (APA 1994). The accuracy of early diagnosis, as well as developmental pathways that are observed in young children with ASD has both theoretical and practical importance (Luyster et al. 2005). It is now well recognized that children with PDD vary in the number and severity of symptoms (Szatmari et al. 2002). In DSM-IV, a diagnostic category within PDD, which is called "pervasive developmental disorder-not otherwise specified" (PDD-NOS), defines children with symptoms such as restricted social interaction, poor verbal and non-verbal communication skills, strict and/or stereotypical behaviors but without full diagnostic criteria of autism (APA,1994). One or more of the following conditions may lead to PDD-NOS diagnosis (1) onset of the disorder after 3 years of age, (2) atypical symptoms with regard to the 12 criteria of autism specified in DSM-IV, (3) fewer than 6 criteria and thus subtreshold (Walker et al. 2004).

Diagnostic agreement for PDD-NOS is generally considered to be weak (Tanguay 2004). Walker and colleagues presented compelling evidence, both from the literature and from their study, that attempting to improve the DSM-IV criteria for PDD-NOS can be quite frustrating (Walker et al. 2004). Methods for differentiating PDD-NOS from the non-PDD disorders, such as attention deficit hyperactivity disorder (ADHD), are not well established. Several investigators concluded that it is difficult to make a distinction between ADHD and PDD by using the present diagnostic criteria in DSM-IV (Bryson et al 2008, Gökler et al. 2004). In addition, deficits in social reciprocity or communication, as well as the presence of restricted or repetitive behaviors, should be considered in terms of the child's overall level of cognitive and language skills. Many of the symptoms of PDD-NOS can occur in non-PDD conditions, such as severe mental retardation or language delay, and they may present with similar developmental history (Bishop et al 2006). Furthermore, clinical presentation of PDD-NOS may resemble presenting symptoms in high functioning autism, Asperger's disorder, reactive attachment disorder, and psychotic disorders, and the differential diagnosis may be highly complicated.

A categorical system like DSM-IV can be very useful for diagnosing prototypic manifestations of a disorder, but it is less useful in encompassing what may be, in its broader manifestations, a "spectrum disorder" (Tanguay 2004). An assumption of the autism-spectrum model is that autism conditions lay on a continuum of social-communication skills (Baron-Cohen et al 2001, Wakabayashi et al 2007). A continuum view shifts us away from categorical diagnosis and towards a quantitative approach.

To identify ASD subgroups, several investigators used cluster and factor analysis based on social functioning, intelligence, developmental milestones, and so forth. Various clusters were reported (Eaves and Eaves 1994, Prior et al 1998, Sevin et al 1995, Waterhouse et al 1996, Wing and Gould 1979). But these findings were not replicated and the clusters identified were not adopted or replicated in later studies. Despite several studies with ASD, clinical validity and differential features of PDD-NOS are yet to be consistently established.

Defining certain diagnostic subgroups and investigating common features of the children who are diagnosed with PDD-NOS may be beneficial, because children with similar symptoms may have a common etiopathology, similar prognosis, and similar treatment response. In addition, as presumed for the distinction between PDD-NOS and autism, the two diagnostic categories may share a common etiopathology,

a similar clinical profile and developmental outcome, but one is a milder form with respect to other. In that case, among the patients with ASD, exploring the underlying factors that lead to a better outcome would help scientists propose more efficacious treatment strategies. However, as the diagnostic validity of PDD-NOS is still open to question, and to explore proposed underlying factors, we have to assign cases based on a valid clinical assessment. Therefore, we still need to investigate further the clinical features of children with PDD-NOS that distinguish them from children with autism and other non-PDD conditions.

In this study, in order to explore whether PDD-NOS encompass a distinct cluster of symptoms and clinical profile or not, we aimed to investigate differential features of PDD-NOS such as presenting symptoms, developmental history, and comorbidity with respect to autism and ADHD.

METHODS

Participants

In our child psychiatry outpatient clinic all patients who were diagnosed with PDD-NOS (n=94) in a 12-month period were recruited into the study. The control group (n=94), obtained by consecutive case ascertainment from the same setting, was composed of children who were diagnosed with ADHD (n=47) and autism (n=47). To minimize extraneous factors that may confound our research questions, we excluded children older than 11 years old and/or who were diagnosed with chronic neurologic, pulmonary, cardiac, nephric, and/or systemic disease. The full sample in this study consisted of 188 children (male n=150, female n=38), who were 5.5 (±2.5) years old on average (range 2-11). Gender distribution, age on first clinical admission, presence of any co-morbid diagnosis and developmental history of each group are presented in the Results. All participants were Turkish Caucasian, and the sample had no ethnic diversity.

Materials

First Clinical Admission Questionnaire and Clinical Assessment Form. These instruments were developed in our clinic to be used in the clinical assessment of all patients. The First Clinical Admission Questionnaire is completed by parents before the first clinical interview and it includes most sociodemographic, medical, and developmental variables required for psychiatric assessment in childhood, such as psychiatric complaints, family relations, medical problems, and developmental history. The Clinical Assessment Form is a semi-structured instrument that is completed by the child and adolescent psychiatry specialist. It is used to collect additional information related to the psychiatric assessment including mental status examination. These two instruments were used in this study systematically to explore and analyse the psychiatric complaints and the developmental history of the participants.

Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime Version-Turkish Version (K-SADS-PL-T). (Gökler et al 2004, Kaufman et al 1997). K-SADS-PL-T is a structured diagnostic assessment schedule based on DSM-IV criteria of major psychiatric disorders. It is effective for diagnosing all major childhood psychiatric disorders. The validity of K-SADS-PL-T was found to be excellent for elimination disorders, good for attention deficit hyperactivity disorder and tic disorders, fair for affective disorders, anxiety disorders, and oppositional defiant disorder (Gökler et al 2004). The interrater reliability was observed to be excellent for elimination disorders and tic disorders, good for attention deficit hyperactivity disorder and anxiety disorders (Gökler et al 2004). The test-retest reliability was observed to be excellent for elimination disorders, tic disorders, attention deficit hyperactivity disorder and anxiety disorders (Gökler et al 2004). In this study, to explore psychiatric diagnosis and comorbidity, we used K-SADS-PL-T in addition to comprehensive psychiatric clinical assessment.

Preliminary PDD-NOS symptom screening scale (PPSSS). This is a preliminary scale that was developed by the authors of this study to systematically collect and assess the psychiatric symptoms, and perform further analysis (e.g., factor analysis). The items of the scale were obtained by including the presenting symptoms that were reported by at least 2/30 (6.6%) of the parents in a pilot sample. Thus, PPSSS is composed of the most prevalent 27 symptoms of the pilot group of children who were diagnosed with PDD-NOS (n=30). The PPSSS has 27 items that are rated either 0 (symptom not present) or 1 (symptom present).

The internal consistency of this preliminary scale was 0.61 (Cronbach α). A principal axis factor analysis with varimax rotation, which was conducted to assess the underlying structure for the twenty-seven items of PPSSS, revealed three factors. Cronbach α scores for these factors were (1) autism sprectrum, .73; (2) disruptive behaviors spectrum, .67; and (3) anxiety spectrum, .50. The distribution of the items of PPSSS for each group, and the results of the factor analysis are presented in the Results.

Procedure

In a pilot study, a group of patients with PDD-NOS (N=30) was analyzed in terms of presenting symptoms. Based on this investigation, we developed the Preliminary PDD-NOS Symptom Screening Scale (PPSSS), described above. The presenting complaints that parents reported on the First Clinical Admission Questionnaire and the symptoms that were reported on the Clinical Assessment Form were evaluated collectively. In this study, the clinician scored the items on PPSSS as "present" if that symptom was one of the "presenting" symptoms and/or "reported" by the parent in the first clinical admission. Thus, all findings of this study represent assessments from the first psychiatric clinical admissions.

As structured diagnostic interviews, such as Autism Diagnostic Interview (ADI) were unavailable in Turkish when this work was being done, the clinical diagnoses were based on the comprehensive mental status examination, and the consensus between two child and adolescent psychiatry specialists (first two authors of this article), who clinically assessed all children together. The clinical diagnoses were based on DSM-IV criteria. In addition to comprehensive mental status examination and clinical interviews, the K-SADS-PL-T was used to explore psychiatric comorbidity.

Data analysis

Distributions of variables were assessed with histograms and Kolmogorov-Smirnov tests and non-parametric tests were used where the distribution was not normal. Significant differences between diagnostic groups were tested by chi-square, Student t tests and one-way ANOVA where the distribution was normal, and Mann-Whitney U tests or Kruskal Wallis tests were used as non-parametric tests when the distribution was non-normal. Tukey or Mann-Whitney U tests were used in post-hoc analysis for significant ANOVAs, and Bonferroni correction was applied. To minimize Type I error, due to multiple comparisons (27 items of PPSSS) we set alpha at p≤.001 (i.e., .05 divided by 27).

Table 1. Gender distribution, age on first clinical admission, presence of any comorbid diagnosis and developmeal history of diagnosis groups

		PDD-NOS (1)	AUTISM (2)	ADHD (3)	p	Source of significance
Gender (n [%])	Male	71 (75.5)	40 (85.1)	39 (83.0)	N.S.	-
	Female	23 (24.5)	7 (14.9)	8 (17.0)		
Comorbid Diagnosis (n [%])	Present	50 (53.2)	25 (53.2)	28 (59.7)	N.S.	-
	Absent	44 (46.8)	22 (46.8)	19 (40.4)		
Mental retardation† (n [%])	Present	14 (23.0)	37 (78.7)	2 (8.0)	**<.001**	1:2; 2:3
	Absent	47 (77.0)	10 (21.3)	23 (92.0)		
Age (years) on first psychiatric admission (mean ± SD)		5.4 ± 2.4	4.1 ± 2.0	7.2 ± 2.4	**<.001**	1:2; 1:3; 2:3
Developmental History (months) †						
	Walking time (mean ± SD)	14.8 ± 4.9	14.3 ± 4.3	12.4 ± 2.6	**.01**	1:3
if speaks	First words (mean ± SD)	21.9 ± 11.5	26.1 ± 14.5	14.3 ± 5.9	**<.001**	1:3; 2:3
	First sentence (mean ± SD)	41.0 ± 14.5	46.2 ± 15.1	24.6 ± 11.4	**<.001**	1:3; 2:3

† the cases without reliable documentation of mental and/or developmental history are excluded
N.S.: not significant

Including all diagnosis groups (n:188), factor analyses were conducted to assess the underlying structure for the twenty-seven items of the PPSSS. Principal components analysis is most useful if one simply wants to reduce a relatively large number of variables into a smaller set of variables that still captures the same information (Leech et al 2005), especially where the variables correlate highly with one another (D'Agostino 2004). Principal axis factor analysis (PAFA) was selected because it is highly similar mathematically to principal component analysis (Leech, et al 2005). In addition, in PAFA the correlation matrix is modified such that the correlations of each item with itself are replaced with a "communality"—a measure of that item's relation to all other items (usually a squared multiple correlation) (Leech et al 2005). As age differences could confound the results, in a further analysis, age differences were corrected via a consecutive case exclusion.

FINDINGS

The gender distribution, age on first clinical admission, presence of any co-morbid diagnosis and developmental history for the PDD-NOS (n=94), the autism (n=47) and the ADHD (n=47) groups are presented in the Table 1.

In our study, ADHD was also explored as a co-morbid diagnosis; 38.3% of the children in the PDD-NOS group and 53.2% of the children with autism fullfilled ADHD criteria (p>.05). Compared with children in the PDD-NOS group, children in the ADHD group had significantly higher rates of co-morbid disruptive behavior disorders (27.6% vs. 9.6%), learning disorders (14.9% vs. 5.3%), elimination disorders (12.8% vs. 2.1%), tic disorders (8.5% vs. 2.1%), social anxiety disorder (8.5% vs. 2.1%) and lower rates of co-morbid obsessive compulsive disorder (2.1% vs. 23.4%). The rates of other co-morbid disorders, such as depression,

Table 2. Preliminary PDD-NOS Symptom Screening Scale (PPSSS) item distributions of patients in each diagnosis group

	Presence of the symptoms (percentages)				
Preliminary PDD-NOS Symptom Screening Scale (PPSSS) Items	**PDD-NOS (1)**	**Autism (2)**	**ADHD (3)**	Overall significance (p value)	Source of significance
1.poor social interaction	59.6	97.9	8.5	**<.001**	1:2; 1:3; 2:3
2.hyperactivity	56.4	80.9	89.4	**<.001**	1:2; 1:3
3.not speaking/ language retardation	53.2	97.9	6.4	**<.001**	1:2; 1:3; 2:3
4.aggressiveness	33.0	46.8	61.7	N.S.	
5.stubbornness	31.9	46.8	44.7	N.S.	
6.inattentiveness	30.9	66.0	91.5	**<.001**	1:2; 1:3; 2:3
7.obsessions	29.8	27.7	14.9	N.S.	
8.not responsive to social stimuli	25.5	95.7	40.4	**<.001**	1:2; 2:3
9.stereotypies	24.5	59.6	6.4	**<.001**	1:2; 1:3; 2:3
10.impatience and/or impulsiveness	23.4	48.9	78.7	**<.001**	1:2; 1:3; 2:3
11.fastidiousness, choosyness	23.4	10.6	10.6	N.S.	
12.echolalia	22.3	14.9	-	N.S.	
13.highly interested in television	20.2	46.8	17.0	**<.001**	1:2; 2:3
14.conduct problems	21.3	36.2	40.4	N.S.	
15.articulation and/or prosody problems	18.1	8.5	4.3	N.S.	
16.lack of eye contact	14.9	59.6	-	**<.001**	1:2; 1:3; 2:3
17.multiple fears	14.9	8.5	17.0	N.S.	
18.sleep problems	14.9	10.6	27.7	N.S.	
19.tactile oversensitivity	12.8	25.5	6.4	N.S.	
20.confusing pronouns	11.7	12.8	-	N.S.	
21.shyness	11.7	6.4	17.0	N.S.	
22.emotional lability	11.7	-	27.7	**<.001**	1:3; 2:3
23.tics	10.6	4.3	10.6	N.S.	
24.poor appetite	7.4	25.5	21.3	N.S.	
25.inappropriate laughing	4.3	17.0	2.1	N.S.	
26.persistence with sameness	2.1	12.8	6.4	N.S.	
27.frequent startles	1.1	10.6	8.5	N.S.	

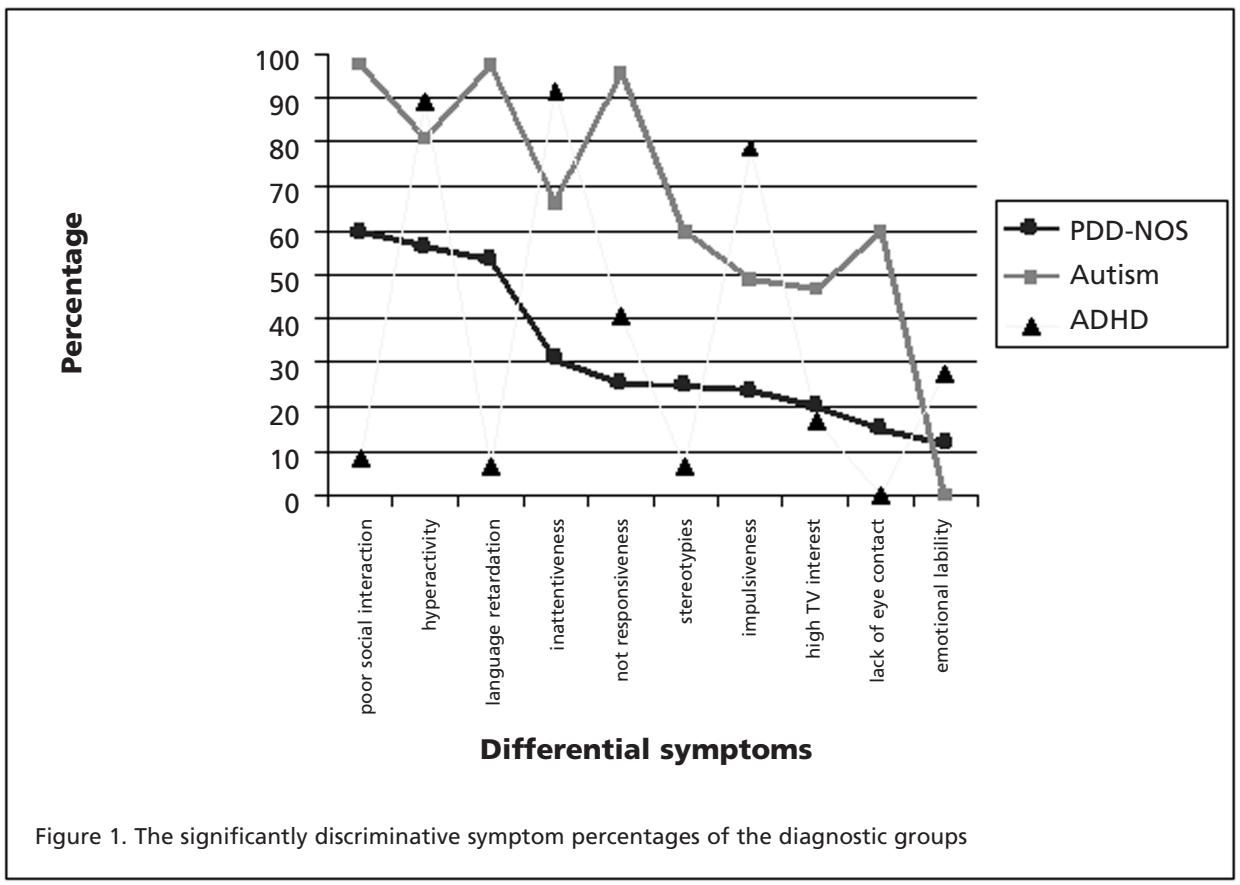

Figure 1. The significantly discriminative symptom percentages of the diagnostic groups

language disorders, and sleep disorders, were found to be similar across diagnostic groups.

Preliminary PDD-NOS Symptom Screening Scale (PPSSS) item distributions of patients in each diagnosis group are shown in the Table 2, and Figure 1 illustrates the significantly discriminative symptom percentages for the diagnostic groups.

Including all diagnosis groups (n:188), a factor analysis was conducted to assess the underlying structure for the twenty-seven items of the PPSSS. We retained all components with eigenvalue (a measure of explained variance) greater than unity. Ten factors had eigenvalues greater than 1.0, which is a common criterion for a factor to be useful.[17] When ten factors were requested, Kaiser-Meyer-OIkin (KMO) measure was adequate (.66), and Bartlett's Test of Spherity was significant (p<.001). These measures mean that the variables are correlated highly enough to provide a reasonable basis for factor analysis. We employed both varimax and Promax rotations to obtain the simple structure solutions. We considered all variables with factor loadings 0.3 or larger in the appropriate factor matrices to define the underlying factor and we took these variables as a cluster of variables for the factor. The two rotation procedures produced similar results. When there were differences, we took the Promax solution as the preferred one. After rotation, ten factors accounted for 66.3% of the variance. Table 3 displays the items and factor loadings for the rotated ten factors. The item is adopted into the factor where the factor loading is the highest.

We found significant differences in the toal number of symptoms between three diagnostic groups in the factors 1 (p<.001), 2 (p<.001), 3 (p<.001), 4 (p=.004), 5 (p<.001), 7 (p=.026), and 8 (p=.006). The scores in the factors 1, 2, 3, and 8 were significantly higher in the autism group compared to the PDD-NOS group. The scores in the factors 1, 2, 5, and 7 were significantly higher in the PDD-NOS group compared to the ADHD group. Inversely, the scores in the factors 3, 4, and 8 were significantly higher in the ADHD group compared to the PDD-NOS group (Figure 2).

In accordance with the study questions, based on the assumption that the items were predicted to index three constructs: symptoms related to autism, ADHD, and PDD-NOS, in a further analysis three factors were requested. Kaiser-Meyer-OIkin (KMO) measure was adequ-

ate (.66), and Bartlett's Test of Spherity was significant (<.001). We considered all variables with factor loadings 0.3 or larger in the appropriate factor matrices to define the underlying factor and we took these variables as a cluster of variables for the factor. After rotation, ten factors accounted for 30.0% of the variance, the first factor accounted for 12.15% of the variance, the second factor accounted for 10.67%, and the third factor accounted for 7.18%. Table 4 displays the items and factor loadings for the rotated three factors.

The first factor, which seems to index core autism spectrum, is associated with high loadings from the

Table 3. PPSSS items and factor loadings for the rotated ten factors

	Factor Loading										
Item	1	2	3	4	5	6	7	8	9	10	Communality
1.lack of eye contact	.69										.43
2.stereotypies	.57										.37
3.inappropriate laughing	.52										.26
4.frequent startles	.46					.35					.41
5.highly interestedness in TV	.41						-.33				.29
6.tactile oversensitiveness	.35										.24
7.poor social interaction		.85									.48
8.language retardation		.51	.31								.42
9.not responsive		.48									.33
10.emotional lability		-.42									.26
11.inattentiveness			.68								.34
12.hyperactivity			.53								.29
13.impatiente, impulsiveness			.48	.30							.39
14.aggressiveness				.76							.30
15.conduct problems				.58							.32
16.confusing pronouns					.75						.27
17.echolalia			-.32		.46						.28
18.articulation/ prosody problems					.39						.17
19.several fears						.66					.27
20.shyness						.53					.22
21.fastidiousness, choosyness							.54				.20
22.obsessions							.54	.35			.35
23.poor appetite								.53			.28
24.stubbornness								.51			.29
25.persistence with sameness								.30			.28
26.sleep problems								.31	.92		.32
27.tics										.74	.20
Eigenvalues	3.28	2.88	1.94	1.65	1.37	1.36	1.31	1.41	1.11	1.05	
% of variance	12.15	10.67	7.18	6.12	5.07	5.03	4.84	4.22	4.10	3.90	

Note. Loadings <.30 are omitted. Adopted items into the factors are shown bold.

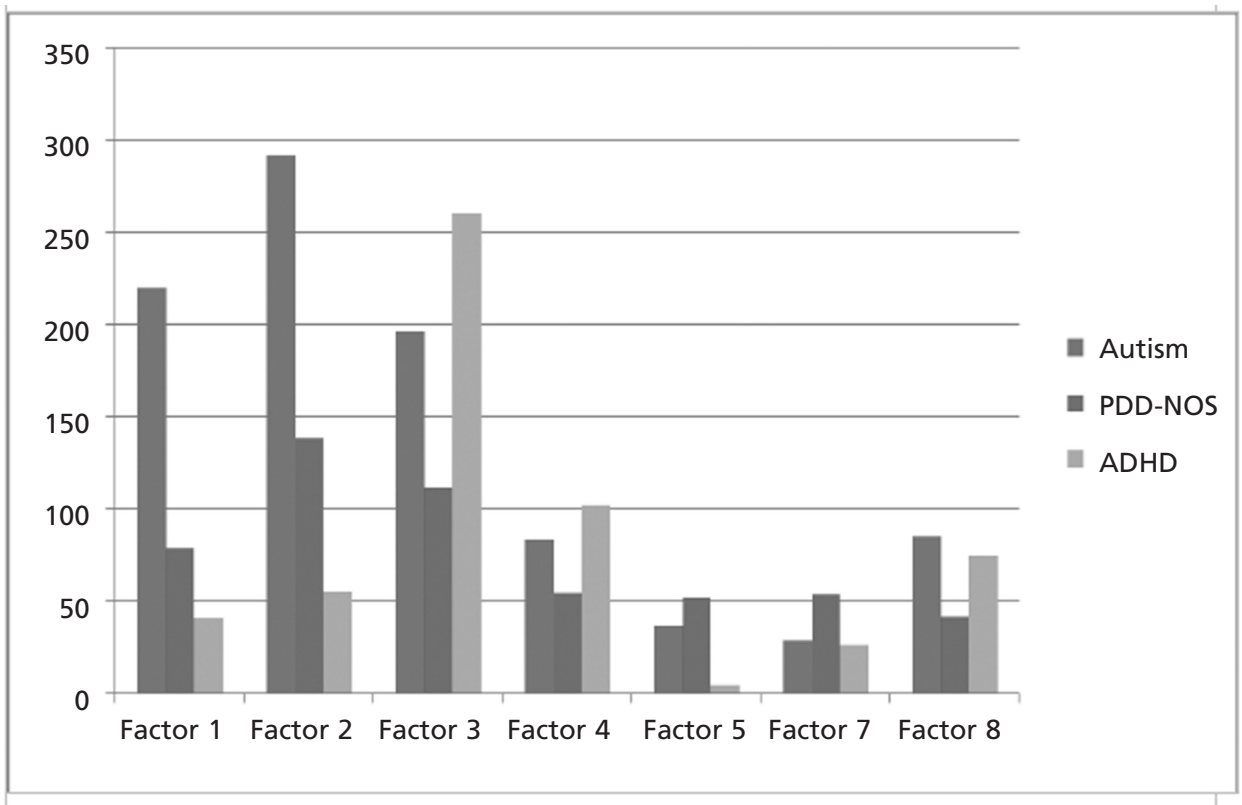

Figure 2. The significantly discriminative factors of the diagnostic groups

first eight items, with loadings in the first column in Table 4. The second factor, which seemed to index disruptive behaviors spectrum, was composed of the eight items with loadings in column 2 of the table. The third factor, which seemed to index symptoms to be interpreted as anxiety spectrum, comprised the seven items with loadings in the third column. Four items do not seem to load with any of the factors (three had inverse correlations, one had no loading over .30) and only one item (tactile oversensitivity) had a cross-loading to different factors over .30.

We did not find significant correlations between the total numbers of the symptoms in the factors (p>.05). When the total number of the symptoms in each factor were compared between the diagnostic groups, the *core autism spectrum* and the *disruptive behavior spectrum* factors revealed significant differences between the groups (p<.001). Post-hoc analysis showed that in the *core autism spectrum factor*, the autistic group had significantly more symptoms than the PDD-NOS group (4.87 vs. 2.14) (p<.001), and the PDD-NOS group had significantly more symptoms than the ADHD group (2.14 vs. 0.81) (p<.001). On the other hand, on the *disruptive behavior spectrum* factor, the ADHD group had not significantly more symptoms than the autistic group (4.55 vs. 3.62) (p=0.03, Note: Bonferroni correction). Both the ADHD (3.62 vs. 2.19) (p<.001) and the autistic groups (4.55 vs. 2.19) (p<.001) had significantly more symptoms than the PDD-NOS group. The anxiety spectrum factor did ot reveal a significant difference between diagnostic groups.

When the symptom distributions were corrected for age, with respect to the PDD-NOS group, the autism group had significantly more "poor social interaction," "language retardation," "inattentiveness," "impulsiveness," "non-responsiveness," "stereotypies," and "lack of eye contact" (p<.001) among the presenting symptoms. The ADHD group had significantly more "inattentiveness" and "impulsiveness" (p<.001) than the PDD-NOS group, and the PDD-NOS group had significantly more "poor social interaction" and "language retardation" (p<.001) than the ADHD group.

DISCUSSION

The findings of this study reveal that the PDD-NOS group had a high number of features in common with the autism and the ADHD groups, in terms of presenting and/or reported symptoms and developmental history. Similar to previous studies (Volkmar, et al 1993),

gender distribution was similar for all groups (in each group more than 75% of the patients were male). Several features of the children in the PDD-NOS group were partially distinctive and the results help us to characterize and conceptualize this diagnostic category in more detail. For instance, while patients in the ADHD group were reported to be walking and talking significantly earlier than the patients in the PDD-NOS and the autism groups, we did not find a significant difference in such developmental milestones between the patients in the PDD-NOS and the autism groups. First admission to a child psychiatry clinic was earliest in the autism gro-

Table 4. PPSSS items and factor loadings for the rotated three factors

Factor Loadings for the Rotated Factors	Factor Loading			
Item	1	2	3	Communality
Lack of eye contact	**.72**			.43
Stereotypies	**.66**			.37
Poor social interaction	**.66**			.48
Not speaking or language retardation	**.65**			.42
Not responsive to social stimuli	**.55**			.33
Highly interested in television	**.53**			.29
Inappropriate laughing	**.41**			.26
Confusing pronouns	**.35**			.27
Emotional lability	-.31			.23
Tics				.20
Impatience, impulsiveness		**.65**		.39
Hyperactivity		**.62**		.28
Conduct problems		**.61**		.32
Aggressiveness		**.57**		.30
Inattentiveness		**.55**		.34
Echolalia		-.40		.28
Stubbornness		**.38**		.29
Sleep problems		**.38**		.32
Articulation/ prosody problems		-.37		.17
Poor appetite		**.35**		.28
Several fears			**.63**	.27
Frequent startles			**.55**	.41
Fastidiousness, choosyness			**.49**	.20
Obsessions			**.46**	.35
Persistence with sameness			**.46**	.28
Shyness			**.46**	.22
Tactile oversensitivity	.35		**.36**	.24
Eigenvalues	3.28	2.88	1.94	
% of variance	12.15	10.67	7.18	

Note. Loadings <.30 are omitted. Adopted items into the factors are shown bold.

up and latest in the ADHD group.

As shown in Table 2 and Figure 1, the prevelance rates of the most common presenting symptoms in the PDD-NOS and autism groups had a similar pattern of distribution from more to less common. However, almost all of these symptoms were reported significantly less in children diagnosed with PDD-NOS than children with autism. The autism and the PDD-NOS shared a common clinical symptom profile on the first clinical admission. On the other hand, the children with ADHD had a distinct set of symptoms. A recent study compared the behavioral symptomatology in 26 children and adolescents with autism and 25 children and adolescents with PDD-NOS (Pearson et al 2006). Relative to individuals with PDD-NOS, those with autism had more symptoms of depression, social withdrawal, atypical behavior, and immature social skills, and fewer family problems. These differences remained even when group differences in intellectual ability were controlled statistically. No group differences emerged in somatization, anxiety, or hyperactivity. Their findings suggested that, although both groups demonstrated considerable evidence of behavioral and emotional problems, those with autism were at particularly high risk for co-morbid behavioral and emotional disabilities (Pearson et al 2006).

The symptoms of ASD may change with development (Luyster et al 2005). PDD-NOS have been assumed significantly less stable as a diagnosis (Lord et al. 2006). Nevertheless, diagnoses of autism and PDD-NOS by experienced clinicians on the basis of multiple measures were valid and reliable over time (Lord et al 2006). If a child is given an ASD diagnosis (either autism or PDD-NOS) at age 2 years, it is highly likely to apply at age 9, although there may be some shifting within the range of ASD diagnostic categories (Lord et al 2006). Generally, it appears that the overall picture of development for autism and PDD-NOS is similar, with most children experiencing continued impairment. Based on these two studies, there does not appear to be evidence for qualitatively discrete groups (i.e., autism versus PDD-NOS), but differences appear to be quantitative (Lord et al 2006, Turner et al 2006). In our study, because the mean ages of the groups were significantly different and this difference may confound the interpretation of the results, we also explored the symptom profiles of the diagnosis groups after correcting for age. When the symptom distributions were corrected for age, the autism group had significantly more "poor social interaction," "language retardation," "inattentiveness," "impulsiveness," "nonresponsiveness," "stereotypies," and "lack of eye contact" as compared with the PDD—NOS group. In addition, the ADHD group had significantly more disruptive behavior than the PDD-NOS group, and the PDD-NOS group had significantly more core autistic symptoms than the ADHD group.

A recent study examined one year of data from the database maintained by 26 community mental health centers. Children with autism were compared to children with other ASDs. The researchers reported that the children with ASDs other than autism were also significantly more likely to be diagnosed with attention deficit hyperactivity disorder, oppositional defiant disorder, depressive disorders, and bipolar disorder (Bryson et al 2008). Because the diagnostic agreement for PDD-NOS was generally considered to be weak (Tanguay 2004, Walker et al 2004), and differentiation of PDD-NOS from the non-PDD disorders, such as ADHD was not well-defined, we conducted a factor analysis including the data from all three diagnosis groups. A factor analysis revealed three symptom clusters, *core autistic spectrum, disruptive behavior spectrum, and anxiety spectrum.* As would be expected, the children with autism had higher rates of symptoms in the *autistic spectrum* factor and the children with ADHD had higher rates of symptoms in the *disruptive behavior spectrum* factor. The PDD-NOS group had lower rates of symptoms on both factors.

A previous study performed a factor analysis on a sample of variant categories of PDD, and two factors emerged. One factor represented autistic symptoms and another represented level of functioning (Szatmari et al 2002). More recent studies used a factor analytic approach based on particular diagnostic instruments, such as the Autism Diagnostic Interview-Revised (ADI-R) and the Autism Diagnostic Observation Schedule (ADOS) (Tadevosyan-Layfer et al., 2003, Tanguay 2004). The results suggested that there is a developmental continuum from affective reciprocity to emotional joint attention to verbal joint attention and to intuitive social knowledge (Tanguay 2004) Tadevosyan-Layfer et al. (2003) found six factors: spoken language, compulsions, developmental milestones, savant skills, sensory aversion, and social intent.

Similar to previous reports (Allen et al 2001, deBruin et al 2006, Matson, et al 2007, Szatmari et al. 2002), in our study mental retardation was significantly more prevalent in the autism than in the PDD-NOS or ADHD groups. Several investigators suggested that exploring the presence of mental retardation may be more useful in terms of planning treatment and predicting outcome than a classification based on symptom number alone (Szatmari et al 2002). However, IQ

may be a poor measure of level of functioning, based as it is on performance in a highly artificial setting (Szatmari et al 2002). Allen et al (2001) compared 18 preschool children with PDD-NOS to 176 children with autistic disorder and 311 non-autistic children with developmental language disorders (DLD) (N= 201) or low IQ (N= 110). The children with PDD-NOS did not differ significantly from either the children with autism or the children with DLD in verbal and adaptive skills. They suggested that the similarity of PDD-NOS children to autistic children in maladaptive behaviors and an intermediate position between autistic and DLD groups on virtually all measures helped to explain the difficulty clinicians encounter in classifying children with PDD-NOS (Allen et al 2001).

As described in DSM-IV (APA 1994), any child with symptoms such as restricted social interaction, poor verbal and non-verbal communication skills, strict and/or stereotypic behaviors but without full diagnostic criteria of autism may be diagnosed PDD-NOS. Many children with PDD-NOS would fulfill the criteria of other psychiatric disorders such as ADHD. In addition, there is substantial comorbidity with ADHD (Bishop and Baird 2002). This leads to a complex discussion in terms of diagnostic hierarchy and comorbidity. We prefer considering ADHD diagnosis and any subgroup of PDD seperately and identifying the comorbidity if present. Hattori et al (2006) investigated the relationship between patients with ADHD and those with PDD, using the High-Functioning Autism Spectrum Screening Questionnaire (ASSQ) and ADHD Rating Scale-IV. The PDD and the ADHD group did not differ in the domains of communication problem and restricted repetitive behavior. The PDD group had a higher score than the ADHD group only in the social interaction domain. On the ADHD Rating Scale-IV, both groups were significantly higher than the control group for Total score, inattention score, and hyperactivity/impulsivity score. Hattori et al (2006) concluded that it is difficult to make a distinction between ADHD and PDD by using the present diagnostic criteria in the DSM-IV.

Comorbidity in the assessment of autism spectrum disorder (ASD) is a topic that has infrequently been addressed (Bryson, et al 2008, Ghaziuddin, et al 2002, Matson and Nebel-Schwalm 2006). Rates of comorbid psychiatric conditions in children with PDD-NOS are hardly available, although these conditions are often considered as more responsive to treatment than the core symptoms of PDD-NOS (deBruin et al 2007). In our study, considering the difficulties in diagnosing co-morbid psychiatric disorders with autism, we particularly focused on comorbidity in the ADHD and PDD-NOS groups. In our sample, 53.2% of the children with PDD-NOS had at least one co-morbid psychiatric disorder, including disruptive behavior disorders (40.4%), and anxiety disorders (18.0%). With respect to the PDD-NOS group, the ADHD group had significantly higher rates of co-morbid disruptive behavior disorders, learning disabilities, tic disorders, elimination disorders, and social anxiety disorder. On the other hand, the PDD-NOS group had significantly higher rates of co-morbid obsessive compulsive disorder with respect to the ADHD group. In a recent study, DeBurin et al. (2007) explored the comorbidity in ninety-four children with PDD-NOS, aged 6-12 years. At least one co-morbid psychiatric disorder was present in 80.9% of the children; 61.7% had a co-morbid disruptive behavior disorder, and 55.3% fulfilled criteria of an anxiety disorder. Compared to those without co-morbid psychiatric disorders, children with a co-morbid disorder had more deficits in social communication. They concluded that co-morbid disorders occur very frequently in children with PDD-NOS, and therefore clinical assessment in those children should include assessment of co-morbid DSM-IV disorders.

Study Limitations. Limitations include the fact that the diagnoses assigned must include some unknown amount of error, and diagnostic reliability was unknown. Both the parent reports and the symptoms obtained by the psychiatrist entailed somewhat subjective ratings. At the same time, studies of co-occuring symptoms that are not part of the autism spectrum are very uncommon. As such, this study adds to the limited existing literature (Gadow et al 2004, Lecavalier 2006, Tonge 2002) and helps to build a picture of psychological symptoms likely to occur in children with ASDs.

CONCLUSION

The overall results suggest that children with PDD-NOS have a high number of common features with patients having autism and ADHD. The symptoms of all three diagnostic groups appeared to form three clusters, “autistic spectrum”, “ADHD spectrum”, and “anxiety spectrum”. Many features including language and motor development, “presenting” and/or “reported” symptom distribution, and gender distribution were found to be similar in the PDD-NOS and the autism groups. Mental retardation rate and symptom severity (e.g., “poor social interaction”, “lack of eye contact”, “stereotypies”) were significantly higher in the autism group with respect to the PDD-NOS group. In addition, most of the previous

studies supported quantitative discrimination rather than assuming that PDD-NOS and autism are qualitatively discrete groups. Therefore, PDD-NOS may be assumed as a partial subtype of autism and that it lies on a continuum of social-communication skill deficits. Based on the results of this study, longitudinally-designed studies are indicated that would investigate the clinical reliability and validity of less severe forms of PDD. These might attend to less severe forms of PDD and autism, which may lead to a better understanding of the pathophysiology of PDD and development of more promising modalities for treating them.

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