ORIGINAL ARTICLE

The Effects of Severity of Autism and PDD-NOS Symptoms on Challenging Behaviors in Adults with Intellectual Disabilities

Johnny L. Matson · Tessa T. Rivet

Abstract Autism Spectrum Disorders (ASD) constitute a group of neurodevelopmental conditions that result in marked delays and impairments. The ASD can be defined by a good deal of heterogeneity and severity of specific behaviors within the general domains of communication, social behavior, and repetitive/stereotyped behavior. ASD also puts the afflicted individual at risk for other problems such as intellectual disability and challenging behaviors. This study assessed the relationship between severity of ASD core symptoms and the rate and types of challenging behaviors evinced in 298 adults with severe intellectual disabilities (ID). General categories of aggression/destruction disruptive behavior, and self-injury were studied. More severe core ASD symptoms were associated with higher rates of challenging behaviors. The implications of these findings are discussed.

Keywords Autism spectrum disorders · ASD-BPA · Challenging behaviors · Adults · ID · Severity

A high degree of consensus exists internationally regarding autism spectrum disorders (ASD), at least when compared to other mental health conditions (Matson *et al.* 2007b; Tidmarsh and Volkmar 2003). In addition to agreement on what constitutes the general symptom profile, the underlying cause of ASD is considered to be neurodevelopmental (Lam *et al.* 2006). Researchers believe that neurochemical or neuroanatomical events occur at a very early age and are typically detected as a full blown syndrome by 3–8 years of age or earlier, depending on the specific syndrome within the ASD (Lord 1995; Matson and Boisjoli 2007). Persons with ASD can be of normal intelligence, but around 70–75% of these people have intellectual disability (ID; Fombonne 2003; Gillberg and Coleman 1992), and about

J. L. Matson (✉) · T. T. Rivet
Department of Psychology, Louisiana State University, Baton Rouge, LA 70803, USA
e-mail: Johnmatson@aol.com

half have abnormal EEGs (Trottier *et al.* 1999). These problems may respond in part to intensive behavioral programs, but are known to persist into adulthood (Gaylord-Ross *et al.* 1984; Matson *et al.* 2007a).

Recent changes in diagnostic criteria have encompassed a broader set of characteristics than had previously been recognized (Volkmar and Schwab-Stone 1996). This development has led to distinctions even within the Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) and autism categories. More severe autism is often referred to in the literature as "classic Kanner-type autism"(Critchley *et al.* 2000). Thus, ASD appears to occur on a continuum of severity and the combination of specific symptoms within the broad context of communication, social, and ritualistic/stereotyped behaviors can occur in any combination at any level of severity (Wing 1988). Furthermore, it has been found that severity of intellectual disability, ASD, communication deficits, and challenging behaviors are highly correlated, and are part and parcel of severe ASD (McClintock *et al.* 2003). Furthermore, challenging behaviors in and of themselves are considered to add to the "severity" of the ASD condition, and these problems are known to occur in persons with ID at high rates as well (Hill and Furniss 2006; Holden and Gitlesen 2006). Thus, persons with ASD and ID are particularly at risk for challenging behaviors and the accompanying stigma, potential for physical harm, greater likelihood of restrictive living conditions, and other serious consequences (Akrami *et al.* 2006; Noone *et al.* 2006). However, no studies to date have specifically looked at the relationship of severe versus mild core symptoms of adults diagnosed with ASD and challenging behaviors. These data should have implications for etiology, assessment, and treatment of persons with mild versus more severe core symptoms of ASD.

Materials and Methods

Participants

Two-hundred ninety eight adults with profound (76.5%), severe (12.4%), moderate (5.7%), mild (0.7%), or unspecified (4.7%) ID served as participants in the study. All participants were residents of one of two developmental centers in central or south Louisiana, which varied in size from 350 to 550 residents. Age ranged from 21 to 88, with a mean age of 52.03 years (SD=12.78). Fifty-six percent of the sample was male and 43.3% was female. The majority of participants were nonverbal (61.7%) and were not prescribed psychotropic medications (85.1%). Additionally, 13.1% of participants had visual impairments, 7.7% had hearing impairments, and 24.9% had seizures. Approximately half (49.7%) of the participants met criteria for autistic disorder or PDD-NOS based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychological Association 2000) and International Classification of Diseases, Tenth Edition (ICD-10; World Health Organization 1992). Two independent raters (clinical psychology doctoral students) were required to agree on criteria based on an 11-item DSM-IV-TR/ICD-10 checklist completed via interviews with staff. Eighty-one of the 148 participants who met the checklist criteria also had previously established ASD diagnoses given by

licensed psychologists. The remaining 150 participants were a randomly chosen sample without an Axis 1 diagnosis or psychotropic medication prescription.

Test Instruments

Autism Spectrum Disorders—Diagnosis for Intellectually Disabled Adults (ASD-DA)

The ASD-DA is an informant-based rating scale designed to assist with the differential diagnosis of autism and PDD-NOS across the lifespan, and was developed with the notion that persons with ID can be differentiated from those with ASD (Matson *et al.* 2007c). This instrument consists of 31 items which can be scored as either 0 (not different; no impairment) or 1 (different; some impairment) based on a comparison of the individual being assessed to people his/her age who live in the community. Examples of ASD-DA items include: use of language in conversation with others, isolates self, prefers clothing of a certain texture, development of social relationships, and abnormal, repetitive hand or arm movements. Inter-rater reliability was fair at 0.30, and test-retest reliability was fair (approaching moderate) at 0.39 (Landis and Koch 1977). Internal consistency was very good at 0.94 (DeVellis 1991), which is also well above criteria suggested by Nunnally (1978) and Clark and Watson (1995). Factor analysis produced three factors corresponding to the triad of ASD symptoms (social impairment, impairment in communication, and restricted interests/bizarre sensory responses; Matson *et al.* 2007c). Internal consistency was 0.94 for the social impairment subscale, 0.90 for the communication impairment subscale, and 0.87 for the restricted interests/bizarre sensory responses subscale (Matson *et al.* 2007c). Cut-off scores have been established for differentiating ASD from controls and autism from PDD-NOS in adults with intellectual disability, demonstrating the diagnostic utility of the instrument (Matson *et al.* 2007a). Sensitivity was 0.86, with 74% correct classification with the cut-off score selected (Matson *et al.* 2007a).

Autism Spectrum Disorders—Behavior Problems for Adults with Intellectual Disabilities (ASD-BPA)

The ASD-BPA contains 19 items that measure challenging behaviors commonly associated with ASD (Matson and Rivet 2006). Each item is rated to the extent that it has been a recent problem, and is rated as either 0 (not a problem or impairment; not at all) or 1 (some problem or impairment). Examples of items on the ASD-BPA include: throwing objects at others, poking him/herself in the eye, and playing with own saliva. Reliability for the scale was very good at 0.812, and a factor analysis placed items into three categories; aggression/property destruction, disruptive behavior, and self-injurious behavior (Matson and Rivet 2006). Validity has also been established with the Behavior Problems Inventory (BPI-01; Rojahn *et al.* 2001; Matson and Rivet 2007).

Vineland Adaptive Behavior Scales (VABS) Interview Edition, Survey Form

TheVABS is designed to assess adaptive behavior from birth to adulthood and measures five domains: Communication, Daily Living Skills, Socialization, Motor Skills, and Maladaptive Behavior (Sparrow *et al.* 1984). Items are scored as either 2 (yes, usually); 1

(sometimes or partially); 0 (no, never); N (no opportunity); or DK (don't know). Reliability coefficients for internal consistency are high averaging in the 0.80s and 0.90s.

Procedures

The ASD-DA and ASD-BPA were individually administered by clinical psychology doctoral students to informants (direct care staff, home managers, educational facilitators, etc.) who had known the participant for at least 6 months. Administrators of the measures were trained by the authors prior to administration, and also had a minimum of 6 months of experience in conducting assessments with staff for individuals with ID. The interview took place in a private setting free from distraction either at the participants' homes or at one of several educational centers. Informants were asked whether each item had been a recent problem for the individual, and the response options were explained. Questions were encouraged and clarification was provided when necessary for the informant. Administration time varied depending on individual characteristics (e.g., severity of ASD symptoms, comorbid mental health issues, problem behaviors, etc.) of the participant. The VABS was administered in a similar format, but was obtained from each individual's most recent yearly psychological evaluation.

Analyses were conducted on two levels. First, analyses were conducted between groups of individuals with severe versus mild ASD symptomatology based on established cutoff scores for the ASD-DA (Matson *et al.* 2007a), and problem behaviors were compared across groups. Next, analyses were conducted using increasing severity of impairment in social interaction and communication, and restricted interests/repetitive behaviors to determine the relationships between the triad of ASD symptomatology and problem behaviors such as aggression/destruction, disruptive behavior, and SIB. VABS Communication, Daily Living Skills, and Socialization Domain raw scores were used as covariates to hold level of functioning and communication abilities constant. Measures of intellectual functioning and standard scores of adaptive behavior are not sensitive to individuals functioning in the more severe ranges of ID due to the limited number of items applicable to this group. Often standard scores cannot be obtained (for example, quotients below 36 on the Stanford–Binet or below 20 on the VABS). However, there is a great deal of heterogeneity even within the truncated number of adaptive behaviors for persons with profound ID; therefore, raw scores of adaptive behavior domains may prove to be more sensitive measures of severity of ID.

Results

Primary Analyses

A multivariate analysis of covariance (MANCOVA) was performed with the subscales of the ASD-BPA (Aggression/Destruction, Disruptive Behavior, and SIB) as the dependent variables. Adjustment was made for three covariates: VABS Communication, Daily Living Skills, and Socialization Domains. The independent variable was mild versus severe ASD symptomatology as measured by the ASD-DA.

Table 1 Differences in ASD-BPA subscales for participants with mild and severe ASD symptoms based on ASD-DA total scores with VABS domain scores as covariates

ASD-BPA subscale	Severe (n=189)	Mild (n=109)	df	F	p Value
Aggression/destruction					
M (SD)	0.85 (1.49)	0.75 (1.50)	1,293	0.48	0.490
Range	(0–6)	(0–7)			
Disruptive behavior					
M (SD)	1.43 (1.56)	0.61 (1.10)	1,293	16.53	0.000
Range	(0–7)	(0–5)			
Self-injurious behavior					
M (SD)	0.59 (0.88)	0.18 (0.45)	1,293	11.43	0.001
Range	(0–4)	(0–2)			

The multivariate test was significant for a main effect of ASD symptomatology (Hotelling's Trace=0.08, F [3, 291]=7.40, $p<0.001$), but was not significant for the covariates of VABS Communication, Daily Living Skills, or Socialization Domains (p's>0.05). Examination of the univariate analyses revealed that participants with severe ASD symptomatology had significantly higher endorsements of disruptive behavior, and self-injurious behavior than those with mild ASD symptomatology. No significant differences in endorsement of aggressive/destructive behavior were found related to severity of ASD symptoms. Table 1 lists means, standard deviations, and ranges for the severe and mild ASD symptom groups, along with degrees of freedom, F values, and p values for each of the ASD-BPA subscales.

Next, partial correlation coefficients were calculated between the ASD-DA and ASD-BPA subscale scores controlling for VABS subscale scores. Coefficients were computed separately for the mild and severe ASD symptomatology groups, as well as for the total participant sample. Table 2 lists correlation coefficients and

Table 2 Partial correlation coefficients for ASD-DA and ASD-BPA subscales controlling for VABS domain scores

ASD-DA subscale	ASD-BPA subscale			
	Aggression/destruction	Disruptive behavior	Self-injurious behavior	Total score
Severe ASD symptoms (n=189)				
Social interaction	0.14	0.13	0.10	0.16*
Communication	−0.02	0.03	−0.05	−0.01
Restricted/repetitive	0.04	0.25**	0.22**	0.21**
Total score	0.10	0.21**	0.15*	0.19**
Mild ASD symptoms (n=109)				
Social interaction	0.22*	0.17	0.211	0.23*
Communication	−0.04	0.09	0.05	0.02
Restricted/repetitive	0.26**	0.22*	0.29*	0.31**
Total score	0.18	0.19*	0.16	0.22*
Total (n=298)				
Social interaction	0.12	0.26**	0.21**	0.25**
Communication	0.00	0.18**	0.11	0.12*
Restricted/repetitive	0.11	0.33**	0.29**	0.30**
Total score	0.10	0.29**	0.23**	0.26**

*Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level

significance levels for each ASD-DA and ASD-BPA subscale for those with mild and severe ASD symptoms, as well as for the total sample. For participants with severe ASD symptoms, significant weak to moderate relationships were found for restricted interests/repetitive behaviors and total ASD symptoms with disruptive behavior, SIB, and total problem behaviors. A weak correlation was also found between impairments in social interaction and total behavior problems. For participants with mild ASD symptoms, significant weak to moderate relationships were found for restricted interests/repetitive behaviors and all behavior problem subscales. Significant weak to moderate correlations were also found between impairment in social interaction with aggressive/destructive behaviors and total challenging behaviors, and with total ASD symptoms and total challenging behaviors. For all participants independent of ASD symptoms, significant weak to moderate relationships were found between impairment in social interaction, restricted interests/repetitive behaviors, and total ASD symptoms with disruptive behavior, SIB, and total behavior problems. Communication impairment showed a weak relationship with disruptive behavior and overall behavior problems. Overall, ASD symptoms of restricted interests and repetitive behaviors showed a consistent

Table 3 Percentage endorsement of ASD-BPA items by subscale and Pearson chi-square values for participants with severe versus mild ASD symptoms

ASD-BPA subscales and items	Severe $(n=189; \%)$	Mild $(n=109; \%)$	χ^2 $(1, N=298)$	p value
Aggression/destruction subscale (A/D)				
3. Kicking objects (e.g., doors, walls)	10.1	8.3	0.26	0.609
9. Throwing objects at others	7.4	8.3	0.07	0.791
10. Banging on objects (e.g., doors, walls, windows, etc.) with hand	14.3	7.3	3.22	0.073
13. Aggression towards others	15.3	18.3	0.45	0.500
16. Ripping clothes	7.9	5.5	0.62	0.430
17. Yelling or shouting at others	15.9	16.5	0.02	0.885
18. Property destruction (e.g., ripping, breaking, tearing, crushing, etc.)	14.3	11.0	0.65	0.419
Disruptive behaviors subscale (DB)				
5. Removal of clothing at inappropriate times	17.5	6.4	7.25	0.007
7. Inappropriate sexual behavior	18.0	8.3	5.30	0.021
11. Smearing or playing with feces	8.5	4.6	1.62	0.204
12. Leaving the supervision of caregiver without permission (i.e., elopement)	20.1	10.1	5.05	0.025
14. Defecating or urinating in public	7.4	3.7	1.70	0.192
15. Pulling others' hair	3.7	2.8	0.19	0.660
19. Repeated and unusual vocalizations (e.g., yelling, humming, etc.)	29.6	12.8	10.84	0.001
20. Repeated and unusual body movements (e.g., handflapping, waving arms, etc.)	35.4	12.8	17.85	0.000
Self-injurious behavior subscale (SIB)				
1. Poking him/herself in the eye	6.3	0.9	4.89	0.027
2. Harming self by hitting, pinching, scratching, etc.	26.5	11.0	10.01	0.002
6. Unusual play with objects (e.g., twirling string, staring at a toy, etc.)	18.0	4.6	10.92	0.001
8. Playing with own saliva	8.5	1.8	5.36	0.021

relationship with disruptive and self-injurious behaviors for those with mild and severe ASD symptomatology. Only participants with mild ASD symptoms showed relationships between ASD symptoms and aggressive/destructive behavior.

Finally, each individual item of the ASD-BPA was evaluated for significant differences in participants with mild versus severe ASD symptomatology with Pearson chi-square tests. Table 3 lists percentage endorsement of ASD-BPA items by subscale for participants with severe and mild ASD symptomatology along with chi-square values and significance values. All items on the SIB subscale were significantly different between groups. Individuals with severe ASD symptoms had significantly more frequent endorsements of unusual play with objects, harming self, playing with saliva, and eye-poking than individuals with mild ASD symptoms. On the Disruptive Behavior subscale, participants with severe ASD symptoms had significantly higher percentages of endorsements of repeated and unusual body movements and vocalizations, clothing removal, inappropriate sexual behavior, and elopement. No items on the Aggression/Destruction subscale were significantly different between individuals with severe versus mild ASD symptoms.

Secondary Analyses

Standard multiple regression was employed to examine the ability of ASD symptoms to predict behavior problems. Separate regression analyses were conducted with each of the ASD-BPA subscales as the criterion variable, and the ASD-DA Social Interaction, Communication, and Restricted Interests/Repetitive Behaviors Subscale scores as the predictor variables. Table 4 provides R^2, the unstandardized regression coefficients (B), the standard errors of B, the standardized regression coefficients (β), and significance levels for each ASD-DA subscale predicting the ASD-BPA subscales.

ASD symptoms of social and communication impairments and restricted interests/repetitive behaviors were found to be significant predictors of aggression (F [3, 294]= 3.01, $p<0.05$), disruptive behavior (F [3, 294]=14.23, $p<0.001$), SIB (F [3, 294]=

Table 4 Multiple regression analysis results predicting ASD-BPA subscale scores from ASD-DA subscale scores

ASD-BPA subscales	R^2	ASD-DA subscales	B	SE	β
Aggression/destruction	0.03*	Social Interaction	0.05	0.03	0.18
		Communication	−0.13	0.06	−0.21*
		Restricted/Repetitive	0.05	0.06	0.09
Disruptive behavior	0.13**	Social Interaction	0.02	0.03	0.08
		Communication	−0.04	0.06	−0.06
		Restricted/Repetitive	0.20	0.05	0.33**
Self-injurious behavior	0.12**	Social Interaction	0.02	0.02	0.10
		Communication	−0.03	0.03	−0.09
		Restricted/Repetitive	0.11	0.03	0.32**
Total behavior problems	0.11**	Social Interaction	0.09	0.06	0.16
		Communication	−0.22	0.11	−0.16
		Restricted/Repetitive	0.37	0.11	0.30**

*Significant at $p<0.05$
**Significant at $p<0.001$

Table 5 Correlations, standardized canonical coefficients, canonical correlations, percents of variance, and redundancies between behavior problems and ASD symptoms and their corresponding canonical variate

| | First canonical variate | |
	Correlation	Coefficient
ASD-BPA (behavior problems)		
Aggression/destruction	−0.28	0.18
Disruptive behavior	−0.85	−0.67
Self-injurious behavior	−0.83	−0.58
Percent of variance	0.50	
Redundancy	0.09	
ASD-DA (symptoms)		
Social interaction	−0.81	−0.20
Communication	−0.61	0.13
Restricted/repetitive	−0.99	−0.93
Percent of variance	0.67	
Redundancy	0.12	
Canonical correlation	0.42	

13.57, $p<0.001$), and overall behavior problems (F [3, 294]=12.65, $p<0.001$). ASD symptoms of restricted interests and repetitive behaviors contributed significantly to the regression for disruptive behavior, SIB, and overall behavior problems. Communication contributed significantly to the regression for aggression/destructive behavior.

Next, canonical correlation was performed to determine the relationships between the set of ASD symptoms (social and communication impairment, and restricted interests/repetitive behaviors) and the set of behavior problems (aggression/destruction, disruptive behavior, and SIB). The first canonical variate accounted for significant relationships between ASD symptoms and behavior problems, χ^2 (9)= 62.37, $p<0.001$. Subsequent χ^2 tests were not statistically significant; therefore, only data for the first canonical variate were interpreted. Table 5 shows the correlations between the variables and the canonical variate, standardized canonical variate coefficients, within-set variance accounted for by the canonical variate (percent of variance), redundancies, and canonical correlation. The canonical correlation for the first canonical variate was 0.42, representing 18% overlapping variance for the first pair of canonical variates. The canonical variate for the set of behavior problem measures extracts 50% of the variance from the behavior problem variables and 9% of the variance from the ASD symptom variables. The canonical variate for the set of ASD symptom measures extracts 67% of the variance from ASD symptom variables and 12% of the variance from behavior problem variables. Variables correlated (above 0.30) with the canonical variate for the set of behavior problems included disruptive behavior and SIB, which both had correlations above 0.80. Variables correlated with the canonical variate for the set of ASD symptoms included restricted interests/repetitive behaviors, social interaction impairments, and communication impairments. Restricted interests and repetitive behaviors and impairments in social interactions were both correlated above 0.80, while communication impairment was correlated above 0.60. This pair of canonical variates indicates that ASD symptoms

of restricted interests/repetitive behaviors, social interaction impairments, and communication impairments were associated with disruptive behavior and SIB.

Discussion

Previously, researchers have demonstrated that children with autism were significantly more likely to evince self-injury, property destruction, and aggression (Ando and Yoshimura 1979). Furthermore, in a sample of 2,201 adults with ID, Bhaumik *et al.* (1997) found that these persons were particularly susceptible to autism and challenging behaviors. The present study extends and builds on these previous results in several ways.

First, this was the first study to look specifically at rates of challenging behaviors in an adult population with ASD and ID. Our data show similar patterns to childhood ASD studies and ID studies in that persons with ASD and ID are likely to present with a wide range of challenging behaviors such as aggression, self-injury, and various other disruptive behaviors.

Second, and central to our study, was the finding that more severe core symptoms of ASD are associated with a greater proclivity toward challenging behaviors. The comparison of a large sample with mild versus severe ASD symptoms clearly shows this effect, particularly with regard to disruptive behavior and SIB. Aggression and destructive behaviors showed a weaker relationship with ASD symptoms, with impairments in social interaction and restricted interests/repetitive behaviors being associated with aggression/destruction only in those participants with mild ASD symptoms. Canonical correlation analysis showed a relationship between ASD symptoms and behavior problems, with disruptive and self-injurious behavior significantly contributing to the problem behavior variate, and all three ASD symptom areas (social interaction and communication impairment, and restricted interests/repetitive behaviors) contributing to the ASD symptom variate.

Third, and related to our second point, was our effort to hold the factors of ID and communication constant across groups. Others have posited that ID, ASD, and communication disorders overlap to such an extent that it is unclear which of these factors is most important in the presentation of challenging behaviors (McClintock *et al.* 2003). These authors state that a need exists for research which takes into account the overlap in variables such as communication and ID so that relative contributions of each can be evaluated statistically. This approach was followed in the current study. In all analyses, ASD symptomatology was related to disruptive and self-injurious behavior above and beyond adaptive skills in the areas of communication, daily living, and socialization. Adaptive skills were only significant in the regression for SIB (with daily living skills significantly contributing to the regression), and still was a weaker predictor when compared to ASD symptoms.

From these data one can conclude that for self-injurious and disruptive challenging behaviors such as unusual play with objects, harming self, playing with saliva, eye-poking, repeated and unusual body movements and vocalizations, clothing removal, inappropriate sexual behavior, and elopement, severe core symptoms of ASD and these problems may be related. Future research into the relationship between core ASD symptoms and self-injurious and disruptive behaviors is warranted.

Future studies should examine the generalizability of these findings in other geographical locations. With other potential contributing factors for challenging behaviors held constant, a potential causative link may be suggested.

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