Comparing symptoms of autism spectrum disorders using the current *DSM-IV-TR* diagnostic criteria and the proposed *DSM-V* diagnostic criteria

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A B S T R A C T

The American Psychiatric Association has proposed major revisions for the diagnostic category encompassing Autism Spectrum Disorders (ASD), which will reportedly increase the specificity and maintain the sensitivity of diagnoses. As a result, the aim of the current study was to compare symptoms of ASD in children and adolescents ($N = 208$) who met criteria for ASD according to only the *DSM-IV-TR* to those who met criteria according to the forthcoming version of the *DSM* and to those that were typically developing. Participants comprising the *DSM-IV-TR* and *DSM-V* groups did not score significantly different from each other on overall autism symptoms, but both groups scored significantly different from the control group. However significant differences emerged between the *DSM-IV-TR* and *DSM-V* groups in the core domain of nonverbal communication/socialization. Implications of the results and the proposed changes to the ASD diagnostic category are discussed.

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1. Introduction

Autism Spectrum Disorders (ASD) are a group of neurodevelopmental disorders that have overlapping diagnostic criteria related to deficits in communication and socialization, and restricted interests and repetitive behaviors (Duffy & Healy, 2011; Lanovas & Sladeczek, 2011; Wouters & Spek, 2011). Controversy regarding the differences between the disorders comprising the spectrum is longstanding (Matson, Nebel-Schwalm, & Matson, 2007; Tantam, 1988); and the failure to find any consistency in differences between these disorders advises that they do not have discrete boundaries, but instead exist on a continuum ranging in symptom severity (Manijiviona & Prior, 1995). In addition, the lack of the identification of biological markers provides further debate in regards to the reliable distinction between subtypes of ASD (Palmen & van Engeland, 2004). Thus, can the variability in clinical phenotype that distinguishes the various ASDs be accepted without known variability in genotypes?

As a result, an aim of research has been on parceling out differences among the disorders encompassed under the umbrella term of ASD (e.g., Eisenmajer et al., 1996; Noterdaeme, Wriedt, & Höhne, 2010; Ozonoff, South, & Miller, 2000; Piven, Bailey, Ranson, & Arndt, 1997; Rinehart, Bradshaw, Moss, Brereton, & Tonge, 2001; Tonge, Brereton, Gray, & Einfeld, 1999). Researchers investigating dissimilarities between the disorders comprising the autism spectrum has spanned numerous areas including the overlapping symptoms of the disorders, neuroanatomical differences, and neuropsychological differences, to name a few. At best, distinctions between the disorders comprising the autism spectrum remain controversial and research findings regarding the differences tend to contradict each other.

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Due to the ambiguity surrounding the boundaries of the various disorders comprising the autism spectrum, proposed revisions for the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (*DSM-V*, American Psychiatric Association (APA, 2011) include dropping the subcategories of ASD and instead having one dimensional category (Kaland, 2011). This major revision proposed for the *DSM-V* should maintain the sensitivity of ASD diagnoses while increasing the specificity (APA, 2011). As such, individuals who present with less severe symptoms of ASD may no longer be diagnostically identified. Therefore, the aim of the current study was to compare ASD symptomatology in children and adolescents who only met diagnostic criteria for ASD according to the *DSM-IV-TR* (APA, 2000) to those who met criteria according to the proposed *DSM-5* and to those who were typically developing. It was hypothesized that children meeting diagnostic criteria according to the *DSM-V* would have significantly more autism symptomatology when compared to children and adolescents who only met the *DSM-IV-TR* diagnostic criteria (APA, 2000) and to those who were typically developing. It was also hypothesized that participants who only met the *DSM-IV-TR* diagnostic criteria would have significantly more impairments (i.e., symptoms of ASD) than the control group.

2. Methods

2.1. Participants

A total of 360 children and adolescents, ages 3 through 16 years, were initially eligible to participate in the current study and were recruited from community organizations, schools, and outpatient clinics across the United States. However, in an effort to make groups parsimonious and to exclude outliers (explained in more detail below), the final sample size consisted of 281 participants. Participants were partitioned into groups according to the *DSM-IV-TR* (APA, 2000) and *DSM-V* (APA, 2011) diagnostic criteria for ASD. The *DSM-IV-TR/ICD-10 checklist* was utilized to determine group membership. This checklist contains 19 items, consisting of criteria for ASD. The psychometric properties of this scale are stable. More specifically, inter-rater reliability ($r = 0.89$), test–retest reliability ($r = 0.97$), and internal consistency ($\alpha = 0.95$) all proved to be strong (González, 2008; Matson, González, Wilkins, & Rivet, 2008). On this checklist, respondents (i.e., parents, caretakers, or guardians) marked a "yes" if the symptom was applicable to their child or "no" if it was not.

All participants were first assessed according to the *DSM-IV-TR* diagnostic criteria (APA, 2000). At least three items had to be endorsed on this assessment for the participant to meet *DSM-IV-TR* diagnostic criteria for an ASD, two impairments in social interaction and one in either communication or repetitive, stereotyped, or restricted patterns (González, 2008; Matson et al., 2008). This cutoff was chosen when the checklist was developed as this allowed for the inclusion of children falling into the diagnostic category of PDD-NOS up through the more severe forms of ASD (González, 2008; Matson et al., 2008). A total of 180 participants met criteria for ASD according to the *DSM-IV-TR* and 166 did not meet criteria for ASD.

Second, all participants were assessed according to the *DSM-V* diagnostic criteria (APA, 2011). For participants to be partitioned into the *DSM-V* group, three impairments in socialization and two in restricted interests and repetitive behaviors needed to be endorsed. The *DSM-IV-TR/ICD-10 checklist* (González, 2008; Matson et al., 2008) includes all three of the social communication and social interaction symptoms listed as criteria in the *DSM-V*. In addition, it includes three of the four symptoms listed in the *DSM-V* under the domain of restricted, repetitive patterns of behaviors, interests, or activities. One of the criteria for restricted interests/repetitive behaviors listed in the *DSM-V* is not included on this checklist (i.e., hyper or hypo-reactivity to sensory input). As a result, some participants that may have met *DSM-5* diagnostic criteria might have been left unidentified. When examining participants in the database who met the socialization requirements and met one criterion for restricted interests/repetitive behaviors, 14 participants were identified. To control for this, the 14 participants identified were deleted from the database to ensure that their symptomatology would not be accounted for by being partitioned into one of the other groups. Using the *DSM-5*, 121 participants met criteria for ASD and 225 did not meet criteria. Important to note is that all 121 participants that met *DSM-5* diagnostic criteria also met *DSM-IV-TR* diagnostic criteria (APA, 2000), leaving 59 participants that only met *DSM-IV-TR* diagnostic criteria.

Participants who did not meet diagnostic criteria for ASD according to either the *DSM-IV-TR* (APA, 2000) or the *DSM-V* (APA, 2011) were excluded if they had a parent reported diagnosis of a disorder that shares overlapping symptom presentation to symptoms of ASD. Therefore, participants with diagnoses of attention-deficit/hyperactivity disorder, social phobia, intellectual disability, language disorders, or developmental delays were deleted from the database ($n = 42$) prior to running the analyses. In addition, outliers identified within each group through the use of box plots were removed before conducting the analyses (Field, 2005). A total of 23 cases were determined to be outliers and were removed from the dataset. Refer to Table 1 below for demographic information of participants utilized in the subsequent analyses.

2.2. Measure

The *Autism Spectrum Disorder-Diagnosis for Children (ASD-DC*; Matson & González, 2007) is an informant-based measure that assesses for symptoms of ASD. Forty items comprise this scale and these items are rated on a 3-point Likert scale. Responses include: 0 (not a problem or impairment), 1 (mild problem or impairment), or 2 (severe problem or impairment).

Four factors were empirically derived through factor analysis for the *ASD-DC*: nonverbal communication/socialization, verbal communication, social relationships, and insistence of sameness/restricted interests (Matson, Boisjoli, & Dempsey, 2009). The internal consistency of these four subscales ranged from $\alpha = 0.79$–0.92 and the internal consistency of the entire

Table 1
Demographic information of participants.

	Total sample	DSM-IV-TR	DSM-5	Control
	N = 208	n = 52	n = 78	n = 78
Age: Years				
Mean (SD)	8.28 (3.28)	8.34 (3.34)	8.70 (3.47)	8.19 (2.90)
Range	3–16	3–15	3–16	3–16
Gender				
Male	66.8%	71.2%	80.8%	50.0%
Female	33.2%	28.8%	19.2%	50.0%
Ethnicity				
Caucasian	65.4%	65.4%	47.4%	83.3%
African American	11.5%	13.5%	14.1%	8.0%
Hispanic	3.8%	3.8%	2.6%	5.1%
Other	19.2%	17.3%	35.9%	3.8%

scale was excellent, $\alpha = 0.99$. Furthermore, the *ASD-DC* has good interrater reliability ($K_W = 0.67$) and excellent test–retest reliability ($K_W = 0.77$; Matson et al., 2008). In addition, using a cutoff of 33, the sensitivity of the *ASD-DC* was 84.3%, specificity was 98.2%, and the overall rate of correct classification was 91.3%. Also, convergent validity of the *ASD-DC* was demonstrated with the *CARS* (Schopler, Reichler, & Renner, 1988) and *ADI-R* (Lord, Rutter, & LeCouteur, 1994) and significant correlations were reported between both the *ASD-DC* and *CARS*, and the *ASD-DC* and *ADI-R* (Matson, Hess, Mahan, & Fodstad, in press; Matson, Tureck, Turygin, Beighley, & Rieske, in press; Matson, Mahan, Hess, Fodstad & Neal, 2010).

2.3. Procedure

Informants for this study were recruited though advocacy groups, support groups, schools, and through an outpatient clinic. Informed consent was obtained for those interested in participating. Next, the *ASD-DC* and the *DSM-IV-TR/ICD-10 checklist* were completed by the parents or caregivers. The directions for each of these measures were printed directly on the questionnaires. This study was approved by the Louisiana State University Institutional Review Board.

2.4. Statistical analyses

For the analyses, participants were reclassified into three groups. The first group was comprised of participants meeting diagnostic criteria for ASD according to the *DSM-V* (APA, 2011) and was labeled the *DSM-V* group ($n = 120$). Participant's meeting only criteria for an ASD according to the *DSM-IV-TR* (APA, 2000) comprised group 2, the *DSM-IV-TR* group ($n = 52$). Participants not meeting diagnostic criteria for ASD according to either the *DSM-IV-TR* or the *DSM-5* were partitioned into the third group, the control group ($n = 109$). However, no one group could be 1.5 times larger ($n = 78$) than the smallest group in order to control for assumptions of the planned analyses (Field, 2005; Tabachnick & Fidell, 2007). Therefore, 31 participants were randomly deleted from the control group and 42 were randomly deleted from the *DSM-5* group, leaving a total of 208 participants for the analyses. Refer to Table 1 for the demographic information of participants.

A priori analyses were conducted to determine if the three groups differed from each other on demographic variables of gender, ethnicity, and mean age. Results from an analysis of variance (ANOVA) revealed that the mean age of the groups were not significantly different from one another. Chi square analyses indicated that the groups were not significantly different in regards to ethnicity, but were for gender, $\chi^2 = 17.24$, $p < 0.001$. Further preliminary analyses were employed to determine if gender was related to autism symptomatology. Gender was not significantly associated with symptoms of autism for any of the three groups. Taking this latter information into account, the fact that there is a higher male to female ratio in ASD (Fombonne, 2005; Kanner, 1971), and that the core symptoms of ASD do not significantly differ between males and females (Rivet & Matson, 2010, 2011), the demographic variable of gender was not controlled for in subsequent analyses.

Next, an ANOVA was conducted to determine if significant differences emerged between the three groups on the total score of the *ASD-DC* (Matson & González, 2007). Group membership (i.e., *DSM-IV-TR*, *DSM-V*, and control) was entered as the independent variable (IV) and the total score from the *ASD-DC* was utilized as the dependent variable (DV). Third, a multivariate analysis of variance (MANOVA) was conducted to examine how the *DSM-IV-TR* and *DSM-5* groups scored relative to each other on the core symptom domains of ASD. To conduct this analysis, group membership was entered as the IV and the subscales of the *ASD-DC* (Matson & González, 2007) were entered as the DVs. The significant main effect was followed-up with a Roy–Bargmann stepdown analysis. A stepdown analysis was chosen over conducting multiple ANOVAs because this test controls for the inflation of error and takes into account the correlations among the dependent variables (Tabachnick & Fidell, 2007). The correlations between the DV's utilized in the analyses ranged from 0.38 to 0.64, therefore, a stepdown analyses was more appropriate.

Research conducted on the core symptom domains of ASD and the newly proposed core symptom domains of ASD for the *DSM-V* (APA, 2011) were the basis for the predetermined order of entry of the DVs in the stepdown analysis. Social skills are considered the hallmark deficit associated with ASD (White, Keonig, & Scahill, 2007). In addition, social communication and

social interaction is a symptom domain category included in the *DSM-V* (APA, 2011). As such, social skills were assigned the highest priority for the analysis. Two DVs were related to social skills (i.e., nonverbal communication/socialization and social relationships). Nonverbal communication/socialization was entered first because this DV had a more direct overlap with the newly proposed symptom domain category for the *DSM-V.* Next, the other social skills factor of Social Relationships was entered. Lastly, the DV restricted interests/insistence of sameness was entered as the lowest priority DV. Prior to running the stepdown analysis, homogeneity of regression was examined for each step (Tabachnick & Fidell, 2007). Results of these analyses indicated that homogeneity of regression was confirmed for the first three steps; therefore, results are robust for the dependent variables of nonverbal communication/socialization, social relationships, and insistence of sameness/restricted interests. However, heterogeneity of regression was found at the last step when the DV verbal communication was entered. Therefore, this factor would not be interpretable and was eliminated from the analysis (Tabachnick & Fidell, 2007).

3. Results

First, an ANOVA was conducted to determine if children and adolescents comprising the three groups differed from each other on overall symptoms of ASD. The assumption of homogeneity of variances was violated, $F(2,205) = 32.88$, $p < 0.001$. Therefore, the variances between the groups were significantly different. Although the results of the ANOVA should be interpreted with some caution, the regression approach utilized by SPSS to conduct the ANOVA places less importance on this violation (Leech, Barrett, & Morgan, 2008). The main effect of group membership was significant, $F(2,205) = 357.73$, $p < 0.001$, indicating that the diagnostic groups significantly differed from each other on overall autism symptomatology. Post hoc analyses indicated that participants in both the *DSM-V* group ($M = 53.68$) and the *DSM-IV-TR* group ($M = 48.85$) scored significantly higher (i.e., indicating more symptoms of ASD) than participants in the control group ($M = 2.58$). However, no significant difference emerged between participants in the *DSM-5* and *DSM-IV-TR* groups.

Since the *DSM-V* and *DSM-IV-TR* groups did not significantly differ from each other on total symptoms of autism, a MANOVA was conducted to determine if they differed from each other on the linear combination of the core symptoms of autism. Using Wilks' criterion, the combined DVs were significantly affected by group membership, $F(3,126) = 2.82$, $p < 0.05$. A Roy–Bargmann stepdown analysis was performed on the three DVs utilized in the MANOVA. Only one DV contributed to predicting the differences between participants in the two groups. More specifically, when the factor nonverbal communication/socialization was entered into the analyses first, the following result emerged, stepdown $F(1,128) = 4.04$, $p < 0.05$. Participants in the *DSM-V* group scored significantly higher on this factor ($M = 21.1$), indicating more symptom severity, than participants in the *DSM-IV-TR* group ($M = 18.7$). After the pattern of differences measured by the nonverbal communication/socialization factor was entered into the analyses as a covariate, the factor social relationships did not contribute to predicting the differences between the two groups, stepdown $F(1,127) = 2.28$, $p = 0.133$. Lastly, after the pattern of differences measured by the nonverbal communication/socialization and social relationships DVs were controlled for, a nonsignificant difference emerged for the DV insistence of sameness/restricted interests, stepdown $F(1,126) = 2.06$, $p = 0.154$. In sum, when controlling for symptoms in the core domain area of nonverbal communication/socialization, the remaining core symptoms domains (i.e., social relationships and insistence of sameness/restricted interests) did not significantly contribute to predicting differences between the two groups. At the univariate level, both the nonverbal communication/socialization factor, $F(1,128) = 4.04$, $p < 0.05$, and the Social Relationships factor, $F(1,128) = 6.11$, $p < 0.05$ were significant; however the variance associated with the factor of social relationships was already accounted for by the higher priority DV in the stepdown analysis. Results of the univariate and stepdown analyses are presented in Table 2.

4. Discussion

The proposed revisions to the diagnostic category of ASD are significant. As such, the aim of the current study was to determine if the subset of children who will no longer meet diagnostic criteria for ASD have symptoms that align more closely with typically developing children, children that meet future criteria for ASD, or significantly different from both of these groups of children. In other words, although a certain percentage of children will no longer meet diagnostic criteria for ASD, will this subset of children still have significant symptoms of ASD?

It was hypothesized that children meeting only *DSM-IV-TR* diagnostic criteria (APA, 2000) for ASD would score significantly higher (i.e., indicating more symptom severity) than children who were typically developing and significantly lower than those who met future diagnostic criteria for ASD on a measure of autism symptoms (i.e., *ASD-DC*; Matson & González, 2007). This hypothesis was only partially supported. That is, participants meeting only *DSM-IV-TR* criteria for ASD scored significantly higher than the typically developing children, but not significantly different than

Table 2
Univariate and stepdown *F*.

Factor	Univariate *F*	Df	Stepdown *F*	Df
Nonverbal Communication/socialization	4.04[*]	1128	4.04[*]	1128
Social relationships	6.10[*]	1128	2.28	1127
Insistence of sameness/restricted interests	0.01	1128	2.06	1126

[*] Significance at $\alpha < 0.05$.

children meeting *DSM-V* diagnostic criteria (APA, 2011). Thus, children and adolescents that no longer met criteria still had significant symptoms of ASD when compared to children who were typically developing. Even more concerning is that children and adolescents who met current, but not future diagnostic criteria had similar symptom severity of ASD when compared to children and adolescents who continued to meet diagnostic criteria. Therefore, the subset of children who met *DSM-IV-TR*, but not *DSM-V* diagnostic criteria are experiencing significant impairments related to the core symptom domains of ASD. Thus, the proposed revisions may be decreasing sensitivity, suggesting that the broader symptom definition utilized in the current diagnostic manual (i.e., *DSM-IV-TR*, APA, 2000) may be a superior classification system.

When examining group differences on the core symptom domains of ASD, it was hypothesized that significant differences would emerge between the *DSM-IV-TR* and *DSM-V* groups on all core domains investigated (i.e., nonverbal communication/ socialization, social relationships, and insistence of sameness/restricted interests). This hypothesis was only partially supported. That is, the factor of nonverbal communication/socialization contributed to the significant difference between the *DSM-IV-TR* and *DSM-V* groups. Children and adolescents who met *DSM-V* diagnostic criteria (APA, 2011) had significantly more impairment in this area. These results coincide with the proposed diagnostic criteria changes as they will be more stringent in the *DSM-V* when compared to the *DSM-IV-TR* (APA, 2000). Additionally, symptoms related to nonverbal communication and socialization make up one of the two core symptom domains represented in the *DSM-V*.

Despite the significant difference between groups on the factor of nonverbal communication/socialization, children in the current study who no longer met criteria for ASD according to the *DSM-V* (APA, 2011) still exhibited significant overall symptoms of ASD. Concerning is that the proposed changes within the diagnostic category of ASD will likely produce some economic and/or educational consequences. Infants and toddlers that will no longer meet diagnostic criteria for ASD according to the *DSM-V* (APA, 2011) would possibly still qualify for early intervention services due to delays in meeting developmental milestones. However, what will happen to this subset of children as they age out of early intervention? What is yet to be established is what services are needed to maintain gains obtained during early intervention (Matson, Tureck, et al., in press). Ongoing research examining the impact of continued service delivery after early intervention services subside is urgent given the changing diagnostic categories and criteria of ASD proposed for the *DSM-5* (APA, 2011). However, if ongoing treatment is necessary, who will pay for these services? Interventions currently utilized to treat individuals diagnosed with various ASDs are largely consistent and similar treatment methodologies should remain despite the newly proposed diagnostic category. However, payment coverage for these children will likely become an obstacle. About a decade ago, the majority of insurance companies had exclusions for autism (Peele, Lave, & Kelleher, 2002), but most now cover services for those diagnosed. However, it is probable that insurance companies will not provide treatment coverage for children who still exhibit significant symptoms of ASD, but no longer meet diagnostic criteria under the *DSM-V* definition of the disorder.

Another implication of the proposed diagnostic changes will be apparent in incidence and prevalence rates of ASD. With the proposal to narrow the symptom definition, fewer children will meet diagnostic criteria upon the publication of the *DSM-V* (APA, 2011). Thus, a decreasing trend of incidence and prevalence rates should be observed once the *DSM-V* is utilized diagnostically. A decrease in prevalence rates for ASD was observed in the current study when utilizing the *DSM-V* diagnostic criteria compared to the *DSM-IV-TR* (APA, 2000). In the current study, the prevalence of ASD decreased by 32.3% when using the *DSM-V* instead of the *DSM-IV-TR*. Although lower rates of both prevalence and incidence are pleasing, it may come at the cost of providing services to those who still require them.

In closing, the proposed revisions to the diagnostic category of ASD are supposed to increase the specificity of the diagnosis. However, as observed in the current study, children and adolescents who met current, but not future criteria still exhibited significant symptoms. Thus, it will be critical to determine how this subset of individuals can best be supported if they will no longer hold an ASD diagnosis and may no longer be covered for treatment services. It appears that service delivery will remain important for the treatment of symptoms.

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