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An examination of the relationship between communication and socialization deficits in children with autism and PDD-NOS

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ABSTRACT

Autism Spectrum Disorders (ASDs) are characterized by pervasive impairments in repetitive behaviors or interests, communication, and socialization. As the onset of these features occurs at a very young age, early detection is of the utmost importance. In an attempt to better clarify the behavioral presentation of communication and socialization deficits to aid in early assessment and intervention, impairments in these areas were examined among infants and toddlers (17–36 months) with Autistic Disorder (AD), Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), and non-ASD related developmental delay. The *Baby and Infant Screen for Children with aUtIsm Traits-Part1* (*BISCUIT-Part1*) and the *Battelle Developmental Inventory, 2nd Edition* (*BDI-2*) were utilized to examine communication and socialization levels, respectively, among these groups. All groups significantly differed on level of socialization impairment with the Autism group displaying the greatest impairment and the non-ASD related developmental delay group evincing the least impairment. In regards to communication deficits, the non-ASD related developmentally delayed group differed significantly in comparison to the Autism and PDD-NOS groups; however, no significant differences were found between children with AD and PDD-NOS. While communication and socialization impairments were found to significantly correlate for all participants with the exception of those with PDD-NOS, these correlations were not found to significantly differ from one another across groups. The implications, limitations, and future directions of these results are discussed.

In the past decade there has been an increase in the public's interest in Autistic Disorder (AD), more commonly known as autism (Ban Itzchak, Lahat, & Zachor, 2011; Evans et al., 2001; Levy & Perry, 2011; Lord & Luyster, 2006; Matson, Wilkins, & Gonzales, 2008; Suzuki, 2011; Worley, Matson, Sipes, & Kozlowski, 2011). Autism is a neurodevelopmental disorder characterized by pervasive deficits in socialization and communication, as well as the presence of repetitive or restricted behaviors or interests (Horovitz & Matson, 2010; Lugnegård, Hallerbäck, & Gillberg, 2011; Matson, 1994, 2008; Matson, Dempsey, & Fodstad, 2009; Matson, Dempsey, & LoVullo, 2009; Matson, Fodstad, Hess, & Neal, 2009; Meindl & Cannella-Malone, 2011; Worley & Matson, 2011). For purposes of this study, the focus will remain on the former two impairments. Approximately, 25–50% of all children with an ASD diagnosis never develop a functional language (Dawson & Murias, 2009; Howlin, 2006; Rutter, 1978). Many are stigmatized socially as well, particularly those who exhibit stereotypic behavior (Cunningham & Schreibman, 2008; Matson, Shoemaker, et al., 2011; Matson, Kozlowski, et al., 2011; Rivet & Matson, 2011; Smith & Matson, 2010a). Therefore, optimizing skills in communication and socialization is of great importance (Matson, Kozlowski, et al., 2011; Matson, Sipes, et al., 2011).

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Deficits in the area of socialization can be detrimental to a child's quality of life for many reasons, as these children tend to isolate themselves from others and have impaired social relationships (Chan, Hu, Cui, Wang, & McAlonan, 2011; Ghuman, Leone, Lecavalier, & Landa, 2011; Mahan & Matson, 2011b; Matson, Fodstad, & Rivet, 2009; Matson, Matson, & Rivet, 2007; Smith & Matson, 2010c). The three most explicit social impairments of those with ASDs identified by Rutter (1978) include uncooperativeness while playing with other children, the inability to form friendships, and the failure to recognize others' feelings. Communication deficits also lead to negative consequences, such as elevated levels of problem behaviors (Barnes, Dunning, & Rehfeldt, 2011; Beitchman, 2006; Matson & LoVullo, 2008; Smith & Matson, 2010a, 2010b, 2010c; Sturmey, Laud, Cooper, Matson, & Fodstad, 2010a, 2010b). More importantly, Newborg (2005) hypothesizes that children with higher deficits in communication may also exhibit greater socialization deficits, particularly, because the inability to communicate with adults and/or peers can create social strain (Matson, Fodstad, et al., 2009; Matson & Wilkins, 2007; Matson, Wilkins, & Gonzales, 2008).

Over the past 30 years there reportedly has been a 16-fold increase in the diagnosis of autism, although this increase may not be completely attributed to a genuine growth in the disorder. Rather, other factors like greater diagnostic precision, more expansive diagnostic criteria, and more public attention to the disorder may be potential causes (Bertoglio & Hendren, 2009; Matson & Kozlowski, 2011). Nevertheless, more children are in need of services and accommodations, thus making early detection and intervention a top priority among today's diagnosticians (Matson & Boisjoli, 2007; Matson, Dixon, & Matson, 2005; Volkmar & Pauls, 2003). While much research has been conducted on the presence of communication and socialization impairments in this population, the amount of literature is much less for younger children, especially for children under the age of 3. This factor may be attributed to the fact that the average age for diagnosis of ASDs is approximately 3–4 years of age, although it is dropping (DeGiacomo & Fombonne, 1998; Matson, 2005). The current study serves as a means to provide such an analysis as all participants were 17–36 months of age. The majority of studies which have been conducted to analyze core ASD symptomatology among this very young population have done so through the utilization of retrospective analyses (e.g., inspecting old home videos; Brown, Dawson, Osterling, & Dinno, 1998; Osterling & Dawson, 1994). The current study is more robust since deficits in communication and socialization were examined using real time, objective measures.

In 2010, Horovitz and Matson found children 17 to 36 months of age with PDD-NOS possess significantly more communication deficits than those with non-ASD related developmental delays. Children with a diagnosis of Autistic Disorder were found to display significantly more deficits in communicative skills than children with PDD-NOS and non-ASD related developmental delay. The current study extends the Horovitz and Matson (2010) study and adds additional children to the sample. The updated sample included newly recruited participants and only children that have been administered the *Battelle Developmental Inventory, 2nd Edition* (*BDI-2*). Additionally, the present study examines not only the presence of communication deficits but the presence of socialization impairments and the relationship of the deficits seen in these two areas.

Since Kanner's (1943, 1944) original description, many researchers have conducted studies in an attempt to better define the three core features of ASD on an individual basis (Kanai et al., 2011; Sipes, Matson, Worley, & Kozlowski, 2011; Tseng, Fu, Cermak, Lu, & Shieh, 2011). However, understanding the relationship between the core features of autism is equally important when attempting to detect them among young children. For a diagnosis of AD, all three core features must be present to a large degree, which suggests there are strong associations between these symptoms (Dworzynski, Happé, Bolton, & Ronald, 2009; Kuenssberg & McKenzie, 2011; Matson, Matson, & Beighley, 2011). Some, however, have questioned these associations. For instance, family studies have found that relatives of those with autism often display milder forms of communication and socialization deficits without having repetitive and restricted behaviors and interests (Bishop et al., 2004; Piven, Palmer, Jacobi, Childress, & Arndt, 1997). More recently, Dworzynski et al. (2007) found significant correlations between communication and socialization impairments among children of this ASD population; however, there was no significant correlation between communication impairment and repetitive and restricted behaviors and interests. Elsewhere, Howlin and Moore (1997) state that communication and socialization deficits are the first signs suggesting a child is developing atypically.

The aim of the current study was to build upon these abovementioned findings. Fortunately, due to recently developed instruments, screening for autism and other developmental delays has proved to be less problematic than in the past. The *Baby and Infant Screen for Children with aUtIsm Traits-Part1* (*BISCUIT-Part1*) has recently been designed to aid in the early detection of ASDs among children from 17 to 37 months of age (Matson, Wilkins, Sevin, et al., 2008). Conversely, the *BDI-2* (Newborg, 2005) is intended to identify developmental skills of children from birth to 7 years 11 months. This study aimed to utilize two portions of these two measures (the communication domain of the *BISCUIT-Part 1* and the Personal-Social domain of the *BDI-2*) in establishing if a relationship exists, and if so determining where the correlation lies between the level of communication deficits and the level of socialization deficits among those with diagnoses of AD, PDD-NOS, and non-ASD related developmental delays.

First, it was hypothesized that the autism group would have significantly greater levels of impairment in communication and socialization than the PDD-NOS and non-ASD related developmental delay groups. Those with PDD-NOS were also expected to show significantly greater levels of deficits in these areas compared to the non-ASD related developmental delay group. Second, it was also thought that correlations between level of communication deficit and socialization impairment would be significant for the AD group; however, it was believed that non-significant differences would be found for the PDD-NOS and non-ASD related developmental delay groups. Finally, in comparison of these correlations for each diagnostic group, it was hypothesized that significant differences would be found between the communication–socialization (C–S)

correlations for those with autism and those with PDD-NOS and for those with autism and those with non-ASD related developmental delay. It was not believed, however, that the C–S correlations would significantly differ for the PDD-NOS group and the non-ASD related developmental delay group.

1. Method

1.1. Participants

Five hundred ninety-one children served as participants. Ranging from 17 to 37 months of age (M = 26.03; SD = 4.71) these infants and toddlers were recruited through the Early Steps program funded by the State of Louisiana. Early Steps is Louisiana's Early Intervention System housed under the Individuals with Disabilities Education Act, Part C. Infants and toddlers from birth to 36 months of age who had developmental delays or a medical condition likely to result in a developmental delay qualify for services. Participants were classified into one of these three conditions: Autism, PDD-NOS, or controls with non-ASD related developmental delay. These assignments were established by a licensed doctoral level psychologist who was blind to the *BISCUIT* scores (Matson, Boisjoli, Hess, & Wilkins, 2010). A portion of participants from the original sample recruited for this study ($n = 197$) also received diagnoses from a second doctoral level clinical psychologist, and inter-rater reliability between these independent diagnoses was found to be excellent ($k = .935$). The non-ASD related developmental delay group consisted of children who did not meet criteria for an ASD but their previous family pediatrician determined that they were either atypically developing, had a genetic disorder, or had a physical disability (Matson, Fodstad, et al., 2009).

Originally, a total of 2214 participants were recruited. All participants with missing or improperly coded data were removed from inclusion in this study ($n = 818$). Consequently, the PDD-NOS group was the smallest diagnostic group with 197 participants. Field (2009) suggests generating equal sample sizes among all groups to ensure robustness of statistical tests; thus, all three diagnostic groups were made equal, each with 197 participants. This process was conducted by utilizing the select random cases function in SPSS. Therefore, one participant was randomly deleted from the AD group and 804 participants were deleted from the non-ASD related developmentally delayed group to achieve group totals of 197 for each group.

The children within the autism group ranged in age from 18 to 36 months of age ($M = 26.59$; $SD = 4.75$). For this diagnostic group, 47.2% were Caucasian, 43.1% were of African American descent, 2.5% were of Hispanic ethnicity, and 7.1% were recorded as other. Additionally, 75.1% of the autism group was male. In regards to the PDD-NOS group, children from 17 to 35 months of age ($M = 25.54$; $SD = 4.48$) met inclusion criteria. The ethnicities of these children with a PDD-NOS diagnosis were recorded as Caucasian (48.7%), African American (44.7%), Hispanic (.5%), or other (6.1%). Within this group, 72.6% were male. Within the non-ASD related developmental delay group, the children were between the ages of 18 and 36 months ($M = 25.96$; $SD = 4.86$) with 66% being male. In regards to ethnicity, 51.3% were Caucasian, 44.2% were African American, 1.5% were Hispanic, and 3.0% were recorded as other. Demographic information is presented within Table 1.

To determine if the diagnostic groups differed significantly on demographic variables (i.e., gender, ethnicity, or age) *a priori* analyses were conducted (Matson, Rivet, Fodstad, Dempsey, & Boisjoli, 2009). The results from chi-square analyses revealed that the groups did not differ significantly in terms of gender or ethnicity. A one-way between-subjects analysis of variance (ANOVA) also found no significant differences between groups in terms of age. While non-significant differences among these variables exist, it is believed that this variability would not significantly affect the findings from this study.

1.2. Measures

1.2.1. Baby and infant screen for children with autism traits – Part 1

The *BISCUIT* has recently been designed to aid in the early detection of ASDs among children from 17 to 37 months of age (Matson et al., 2010; Matson, Wilkins, Sevin, et al., 2008). It is a battery of assessments designed to assess autism in young

Table 1
Demographic characteristics ($N = 591$).

Demographic characteristics	Diagnostic group		
	Autism ($n = 197$)	PDD-NOS ($n = 197$)	Non-ASD Developmentally Delayed ($n = 197$)
Age (in months)			
Mean (SD)	26.59 (4.75)	25.54 (4.48)	25.96 (4.86)
Range	18–36	17–35	18–36
Gender, %			
Male	75.1%	72.6%	66.0%
Female	24.9%	27.4%	34.0%
Race/ethnicity, %			
Caucasian	47.2%	48.7%	51.3%
African–American	43.1%	44.7%	44.2%
Hispanic	2.5%	0.5%	1.5%
Other	7.1%	6.1%	3.0%

children along with PDD-NOS, comorbid psychopathology, and challenging behaviors. The *BISCUIT-Part 1* is the section concerned with diagnostic criteria and consists of 62 questions. The parents and/or caregivers rate the child's impairments in comparison to typically developing children of the same age. Items are scored on a 3-point scale: 0 indicating no difference or no impairment; 1 indicating different or mild impairment; and 2 indicating very different or severe impairment in comparison to their peers. Inspection of these items with a factor analysis revealed three separate factors: socialization/nonverbal communication, repetitive behaviors/restricted interest and communication (Matson et al., 2010). The seven items that fall under the communication factor will be the focus of this study. These items include "use of language to communicate," "language development," and "communicates effectively." This communication domain has been determined to have good internal consistency (0.83) and item-scale correlations ranging from .34 to .90 (Matson et al., 2010).

Internal reliability for this 62 question component was found to be high .97 (Matson, Wilkins, Sevin, et al., 2008). Item content for autism and PDD-NOS was successfully established. Validity studies found that the *BISCUIT-Part 1* was able to effectively distinguish between those with and without ASDs. Furthermore, as previously mentioned when differentiating between those without a diagnoses and those with PDD-NOS the sensitivity and specificity was established as .847 and .864, respectively (Matson, Wilkins, et al., 2009). The sensitivity and specificity was found to be slightly lower (.844 and .833, respectively) when distinguishing between diagnoses of autism and PDD-NOS (Matson, Wilkins, et al., 2009). Lastly, the overall classification rate was found to be 88.8 for the *BISCUIT-Part 1* (Matson, Wilkins, et al., 2009).

1.2.2. Battelle developmental inventory, second edition

The *BDI-2* (Newborg, 2005) is a revision of the original *BDI*. The revisions include, but are not limited to, relocating the placement of some items into different domains, fewer subtrials on many items for efficiency purposes, and an easier-to-administer design of the interview. It is intended to identify developmental skills of children from birth to 7 years 11 months. Administration of the full *BDI-2* usually lasts approximately 1–2 h. The five domains that this 450-item assessment addresses are Adaptive (ADP), Personal–Social (P–S), Communication (COM), Motor (MOT), and Cognitive (COG). The items are scored on a 3-point Likert scale: a score of 0 indicates that the child has no ability in this skill; a score of 1 indicates that they possess an emerging ability; and a score of 2 indicates that they have ability with this skill. A total developmental quotient (DQ) is calculated by combining the scores of each of the five domains. This combined score has a mean of 100 and a standard deviation of 15. Using a sample of 2500 children between the ages of birth to 7 years, 11 months, acceptable levels of test retest reliability and excellent internal consistency were found along with appropriate content and criterion validity (Newborg, 2005).

For the purposes of this study, the score for the Personal–Social domain was used as the dependent variable. This particular domain consists of 100 items that assess the child's ability to interact with adults and peers and their self-concept and self role (Newborg, 2005). The test is made up of 3 subdomains: Adult Interaction (AI), Peer Interaction (PI), and Self-Concept and Social Role (SR). The AI subdomain includes 30 items that are administered to only children younger than 6 years of age. Attachment to and interaction with adults during infancy is assessed along with initiation and maintenance of social contact and the use of adults to assist themselves with solving problems. The assessment of the 25-item PI subdomain begins at 2 years of age and ends at 6 years of age. Behaviors including, but not limited to, forming friendships, interacting with peers, responding to and initiating social contact with peers, playing well in a small group, and cooperation are among the abilities assessed in this subdomain. The SR subdomain consists of 45 items that are administered to all ages that the *BDI-2* assesses (birth to 7 years, 11 months). The child's self-awareness, self-worth, morals, sensitivity to the feelings of others, and coping skills are among the skills addressed in this subdomain. The quality and frequency of the abilities mentioned above are also measured for each item on each subdomain.

Good internal reliability has been found for the *BDI-2* total score and for the Personal–Social Domain, .99 and .96, respectively (Newborg, 2005). All subdomains within the P–S domain also reached adequate levels in regards to internal reliability. The test–retest was calculated using a sample of 126 two-year-old children. The stability coefficient for the P-S domain and the total DQ were both very high, .90 and .93, respectively (Newborg, 2005). Inter-rater reliability was also found to be quite high. Consistency between scorers ranged from 94% to 99% agreement (Newborg, 2005). Convergent validity was also established with a number of different scales measuring development in young children. *BDI-2* scores were also able to effectively distinguish between typically developing children with children with autism evidenced by sensitivity and specificity levels of .91 (Newborg, 2005).

1.3. Procedure

Parental interviews and child observations were conducted by individuals whose training qualified them to screen children that might benefit from services provided by EarlySteps. Physical therapy, occupational therapy, social work, education, speech–language pathology, and psychology were the various disciplines represented (Matson, Wilkins, et al., 2009). In addition to their prior training, the assessors received education on ASDs, the measures used throughout the screening process, and the correct standardized administration methods. The screening process involves an entire battery of assessments which include the *BISCUIT* and the *BDI-2*. The parents or legal guardians of the children participating in this study served as the informants on all measures and have provided informed consent for participation. Furthermore, the Louisiana State University Institutional Review Board and Louisiana's Office for Citizens with Developmental Disabilities provided prior approval for this study.

2. Results

2.1. Main analyses

All statistical analyses were carried out using SPSS 16.0. A 3 × 2 MANOVA was conducted to test for differences among the three groups (Autism, PDD-NOS, and non-ASD related developmental delay) on communication and socialization scores (i.e., the overall communication score on the *BISCUIT-Part 1* and the developmental quotient on the P–S domain of the *BDI-2*, respectively). Determined to be robust in cases of equal sample sizes (Field, 2009), the Pillai–Bartlett trace statistic indicated significant differences between the three diagnostic groups in regards to communication and socialization scores, $F(4, 1176) = 71.69$, $p < .001$.

Significant results of the MANOVA were followed by 2 one-way between subjects ANOVAs to determine if these significant group differences lie among the P–S domain score of the *BDI-2* or the overall communication score of the *BISCUIT-Part 1*. Again, the diagnostic groups served as the independent variable. Separate univariate ANOVAs on the outcome variables were significant across diagnostic group effects on communication, $F(2, 588) = 117.22$, $p < .001$, and socialization, $F(2, 588) = 86.08$, $p < .001$.

To account for the inflation of type-I errors, Tukey *post hoc* tests were conducted following significant ANOVAs. In regard to communication, the Autism group did not differ significantly when compared to the group with PDD-NOS, $p = .062$. Significant differences were found for communication, however, between the Autism group and the non-ASD related developmental delay group, $p < .001$, and between the PDD-NOS group and the non-ASD related developmental delay group, $p < .001$. See Fig. 1 for a depiction of the mean scores on the communication domain of the *BISCUIT-Part 1* for all diagnostic groups.

For socialization, all comparisons (i.e., Autism vs. PDD-NOS; Autism vs. non-ASD related developmental delay; and PDD-NOS vs. non-ASD related developmental delay) were found to differ significantly, $p < .001$, universally. See Fig. 2 for a depiction of the mean scores for children with autism, PDD-NOS, and non-ASD related developmental delay on the P–S domain of the *BDI-2*.

The next set of analyses involved identifying the relationship between communication and socialization differs significantly between diagnostic groups. Pearson's correlation coefficients were obtained for the overall communication score on the *BISCUIT-Part 1* and the developmental quotient of P–S domain on the *BDI-2* to determine whether or not relationships between communication and socialization level existed. These analyses resulted in three correlation coefficients, with one for each of the diagnostic groups (i.e., Autism, PDD-NOS, and non-ASD related developmental delay), and of the three correlations analyzed, two were found to be significant. The overall communication score on the *BISCUIT-Part 1* was strongly correlated with the *BDI-2* P–S domain developmental quotient for the Autism group, $r = -.207$, $p < .01$, and for those with non-ASD related developmental delays, $r = -.187$, $p < .01$. There was a weaker relationship, however, between communication and socialization for the PDD-NOS group at the .02 level, $r = -.137$, $p = .05$. It should be noted that all correlations were found to be negative as a higher score on the *BISCUIT-Part 1* indicates a greater impairment and a higher score on the *BDI-2* indicates fewer deficits.

These three correlations were then compared with one another to test for any significant differences. To control for the inflation in the type-I error rate, a significance level of .05 divided by the number of simultaneous tests ($n = 3$) was chosen.

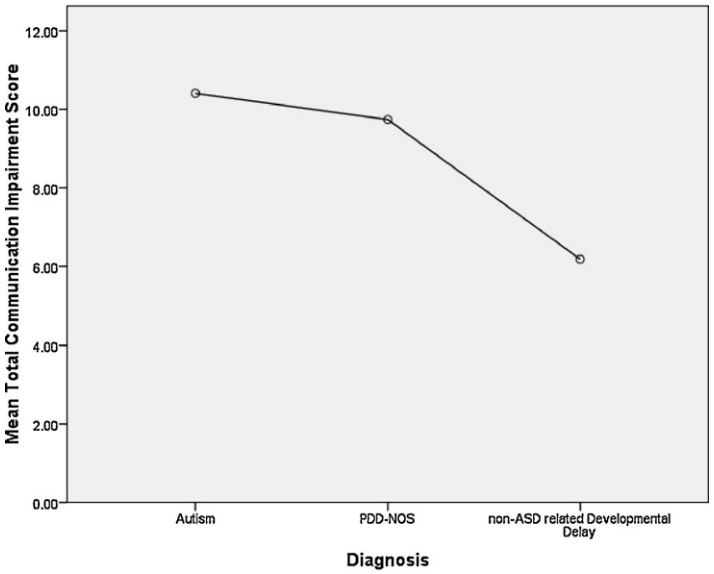

Fig. 1. Mean score on the communication domain of the *BISCUIT-Part 1* for autism, PDD-NOS, and non-ASD related developmental delay.

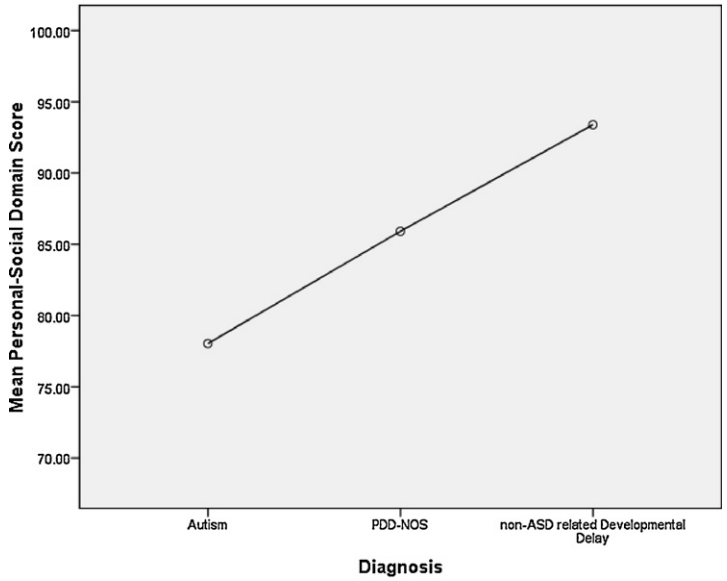

Fig. 2. Mean score on the P-S domain of the *BDI-2* for autism, PDD-NOS, and non-ASD related developmental delay.

Therefore, $\alpha = .02$ was used for all correlation comparisons. When comparing the Autism and PDD-NOS groups, the relationship between communication and socialization was not significantly stronger in either group; thus, significant differences were not found, $z = -.711$, $p = 0.48$. Non-significant differences were found when comparing the correlations for communication and socialization for the Autism and non-ASD related developmental delay groups, $z = -.205$, $p = 0.84$, as well. Finally, significant differences were not found for the communication/socialization relationship when comparing the PDD-NOS and non-ASD related developmental delay group, $z = .506$, $p = 0.61$.

3. Discussion

Although ASDs have recently been receiving great attention among researchers in the scientific community (Evans et al., 2001; Lord & Luyster, 2006; Mahan & Matson, 2011a), few studies examine symptomotology prior to age 3 (Kishore & Basu, 2011; Matson, Wilkins, & Gonzales, 2008). Given that the general consensus among researchers is that ASDs are present from birth, infancy and toddlerhood is a crucial developmental period to study (Kanner & Eisenberg, 1957; Matson, Reiske, & Tureck, 2011; Nyden, Hagberg, Gousse, & Rastam, 2011; Rogers, 2000). This current study compared the socialization and communication deficits in infants and toddlers with AD, PDD-NOS, and non-ASD related developmental delay using real time measures of assessment through four major sets of analyses.

First, children with autism were not found to have significantly more communication impairments than the children with PDD-NOS in this current study. This is not surprising as some researchers argue that communication impairments are the main deficit of ASDs and tend to be the most pervasive (Rutter, 1968; Rutter & Bartak, 1971). Also, deficits in communicative abilities have previously been found to be the most common first concern of parents who seek assessment of an ASD for their young child (DeGiacomo & Fombonne, 1998; Goin-Kochel & Myers, 2004; Howlin & Moore, 1997; Kishore & Basu, 2011; Kozlowski, Matson, Horovitz, Worley, & Neal, 2011; Volkmar & Pauls, 2003). Furthermore, the non-significant findings between the Autism group and the PDD-NOS group in regard to communication deficits need to be interpreted with care. With no distinct cut-offs (i.e., diagnostic criteria) delineating between a diagnosis of Autistic Disorder and PDD-NOS, the diagnostic picture can become quite unclear for clinicians (Walker et al., 2004). Researchers have begun to gain headway in determining the line that distinguishes communicative abilities for these two disorders. Many researchers have found a significantly greater number of deficits among those with a diagnosis of autism in relation to those with PDD-NOS (Anderson et al., 2007; Matson, Fodstad, et al., 2009; Myhr, 1998). Walker et al. (2004) attempted to better define PDD-NOS and determined that this diagnosis is most often given for the presence of atypical autism. The authors, however, suggest that "atypical autism" be used to describe children with the presence of communication and socialization impairments but lacking repetitive and restricted behaviors and interests. This implies that children with a diagnosis of PDD-NOS will often possess impairment in both communicative abilities and social skills, providing a rationale for the non-significant findings between these two groups.

Communicative impairments were also found to be significantly greater in children with a diagnosis of PDD-NOS or AD than children with non-ASD related developmental delays. These results are in agreement with the findings of Horovitz and Matson (2010). In line with the rationale for the previous finding, communication impairments are thought by some to be the main deficit for all ASDs (Rutter, 1968; Rutter & Bartak, 1971). While problems in this area are not required for a diagnosis

of PDD-NOS, researchers can be certain that all informed assessments of ASDs will include an examination of the child's communicative abilities. These results suggest that deficits in communication can aid in differentiating between not only those with ASDs and typically developing children but also between children with ASD and non-ASD related developmental delays prior to age 3. However, it proves to be more difficult to distinguish between those with autism and those with PDD-NOS when only taking into account communication deficits.

Secondly, socialization deficits were found to be greatest in the AD group and were least evident in the non-ASD related developmental delay group, with the PDD-NOS group falling in between. These findings implicate and reaffirm that socialization deficits are integral to the diagnosis of ASDs. Future research and future diagnostic conceptualizations of this disorder should continue to consider impairments in this area a primary factor, and the treatment of ASDs should place emphasis on this deficit when trying to attain a higher level of functioning.

Third, the relationship between communicative and social impairments was examined in each of these three diagnostic groups (i.e., AD, PDD-NOS, and non-ASD related developmental delay), and these relationships were compared to test for significant differences. It should be noted that these correlations do not imply causality as there may be a third variable influencing both communication and socialization simultaneously, or if these two constructs are causal, the direction of this causality is still unknown (Field, 2009). The strong correlation between communication and socialization for children with a diagnosis of Autistic Disorder substantiates prior research which found close relationships between these two constructs for this population (Dworzynski et al., 2007). As a result, these findings support not only the diagnostic presentation for Autistic Disorder (i.e., a presence of both communication and socialization deficits), but also supports this diagnostic presentation in children prior to age 3, when most ASD diagnoses are made. The strong correlation between communication and socialization problems for children with non-ASD related developmental delays can be explained by the fact that children with developmental delays may have low levels of impairment in both areas which would result in a significant correlation even though deficits were not clinically significant. The weaker relationship between socialization and communication for children with a PDD-NOS diagnosis was expected as a diagnosis of PDD-NOS does not require the presence of impairment in both of these areas (APA, 2000). However, if the child does present with communication and socialization deficits, problems in one of these areas may be subthreshold (Walker et al., 2004), weakening the link between these two areas of impairment.

Fourth, the correlation between communication and socialization impairment was not found to be significantly different in children with autism, PDD-NOS, and non-ASD related developmental delay. These findings suggest that while some diagnostic groups may have a significant relationship between communication and socialization impairments and others do not, these relationships are still too similar to distinguish between Autistic Disorder, PDD-NOS, and non-ASD related developmental delay. Therefore, researchers should proceed with caution when studying diagnostic differences between these groups as many similarities exist. More research in this area is needed, possibly on a more micro level looking at specific abilities.

One should consider the possible limitations of this current study while interpreting the results. The inability to account for intelligence is one limitation. Researchers have shown that level of ID affects adaptive functioning, including communication and socialization abilities (Matson & Shoemaker, 2009). However, the participants recruited for this study consisted of infants and toddlers 17–37 months of age, and intelligence has been found to be difficult to assess and unstable at this young age (Ho, Foch, & Plomin, 1980). Another limitation involves the nature of the *BDI-2*. The domain important to this study was the Personal-Social Domain which consists of three subdomains: Adult Interaction, Self-Concept and Social Role, and Peer Interaction. While the two former subdomains were administered to all participants, the Peer Interaction subdomain was only administered to children between the ages of 24 and 71 months (Newborg, 2005). This subdomain assesses the child's ability to develop appropriate friendships, to effectively interact with others, to cooperate, and to initiate social interaction. There were 193 children in the sample for this study between the ages of 17 and 23 months who were lacking this third subdomain of the Personal–Social subdomain of the *BDI-2*. It was decided to include these participants in the analyses since Newborg (2005) found the overall Personal–Social Domain Developmental Quotient score to have excellent reliability for children 17 months of age ($r = .96$) and for children 18–23 months of age ($r = .95$).

These data help diagnosticians and parents understand the behavioral presentation of young children with an ASD. Communication and socialization deficits were clearly distinguishable between those with and without an ASD diagnosis and partially distinguishable between those with Autistic Disorder and PDD-NOS even prior to age 3. These findings support and strengthen the argument for early detection and diagnosis of ASDs (Baird et al., 2001; Matson, Wilkins, & Gonzales, 2008). Although many support earlier detection of behavioral symptoms because there currently are no biological markers for ASDs, little research has been done to substantiate this argument (Barbaro & Dissanayake, 2009). Nevertheless, researchers have shown that the earlier intensive behavioral intervention is implemented, the better the prognosis (Matson, 2007; Matson, Wilkins, & Gonzales, 2008). Early identification, diagnosis, and treatment can improve the long-term functioning of children with an ASD including social skills, communication skills, adaptive behaviors, and even IQ (Manning-Courtney et al., 2003; Matson, 2007; Martinez-Pedraza & Carter, 2009; Wainer & Ingersoll, 2011). Ben Itzchak and Zachor (2007) noted that approximately half of their participants in early behaviorally based interventions were able to perform considerably better on standardized tests, adequately function in mainstream classes, and may even become impossible to tell apart from their peers of typical development. This current study has supported the cause for researchers to develop measures, identify early symptoms, and ultimately diagnose children with ASDs at an earlier age.

In regards to future directions of study, researchers should also examine the presence of restricted and repetitive behaviors and interests among infants and toddlers and its relationship with other core features of ASDs. It is not suitable to

base an ASD diagnosis solely on inspection of communication and socialization impairments; therefore, it is essential to also study this third core diagnostic feature of ASDs. Since restricted or repetitive behaviors and interests are not typically among the first noticed in infancy or toddlerhood (Kishore & Basu, 2011), it is important to outline when these behaviors first manifest and in what form. This data will assist in identifying young infants and toddlers with ASDs, which will ultimately allow parents to seek the recommended interventions as soon as possible. Secondly, since social skills, specifically negative ones, possess a strong positive relationship with problem behaviors among adults diagnosed with an ASD (Matson, Fodstad, & Rivet, 2009), future studies could also examine how the interaction of socialization and communication impairments affects challenging behaviors. While challenging behaviors are not a diagnostic feature of ASDs, they are very common (Kozlowski & Matson, 2012); therefore, this type of study would allow for treatment plans to be better modified for the population as a whole and better individualized for each specific child with autism allowing for better outcomes. Lastly, to build upon the findings of this study, researchers should consider the relationship of communication and socialization impairments across the lifespan, which may instruct the scientific community on if this relationship either strengthens or diminishes as these young children age.

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