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An examination of the relationship between communication and socialization deficits in infants and toddlers with autism and pervasive developmental disorder-not otherwise specified (PDD_NOS)

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AN EXAMINATION OF THE RELATIONSHIP BETWEEN COMMUNICATION AND
SOCIALIZATION DEFICITS IN INFANTS AND TODDLERS WITH AUTISM AND
PERVASIVE DEVELOPMENTAL DISORDER – NOT OTHERWISE SPECIFIED (PDD-
NOS)

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By

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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 (17-37 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. A regression analysis examining which communication items on the *BISCUIT-Part1* predicted socialization impairment on the *BDI-2* found that the two significant predictors were *use of language in conversation with others* and *communicates effectively (e.g., using words, gestures or sign language)*. The implications, limitations, and future directions of these results are discussed.

Introduction

In the past decade there has been an increase in the public's interest in Autistic Disorder (AD), more commonly known as autism (Evans et al., 2001; Lord & Luyster, 2006; Matson, Wilkins, & Gonzales, 2008). 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. For purposes of this study, the focus will remain on the former two impairments.

It is important to first address the significance of repetitive or restricted behaviors or interests and rationale for the current study concentrating on the other two core characteristics of ASDs. In addition to self-injurious behaviors and sensory sensitivities, behaviors that belong to this diagnostic category can be categorized into three groups: behavioral (i.e., stereotyped motor movements), communicative (i.e., echolalia), and cognitive (e.g., insistence on sameness; Chowdhury, Benson, & Hillier, 2010). Approximately 44% of children with AD have one type of stereotypy (Goldman et al., 2009). Nevertheless, parents of children with autism most often recognize symptoms of communication deficits (e.g., speech or language delays; Goin-Kochel & Myers, 2004; Kishore & Basu, 2011) and socialization deficits (e.g., lack of pretend play, not responding to one's name; Bertoglio & Hendren, 2009; Charman et al., 1997; Rutter, 1978). While studying and treating repetitive or restricted behaviors or interests is important, focusing on communication and socialization deficits is integral in regards to early detection of ASDs. Furthermore, Cunningham and Schreibman (2008) state that stereotypic behavior is "socially stigmatizing" (p. 471); thus, optimizing these children's social skills is just as essential. Since socialization and communication are often related, if not overlapping, studying their relationship was the focus of the current study.

Deficits in the area of socialization can be detrimental to a child's quality of life for many reasons. Children with this deficit tend to isolate themselves from others and have impaired social relationships. The three most explicit social impairments identified by Michael Rutter (1978) include uncooperativeness while playing with other children, the inability to form friendships, and failing to recognize others' feelings. Communication deficits also lead to negative consequences, such as elevated levels of problem behaviors (Beitchman, 2006). 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 will create social strain (Matson, Fodstad, Hess, & Neal, 2009).

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-Part 1 (BISCUIT-Part 1)* 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). The *Battelle Developmental Inventory, 2nd Edition (BDI-2)*; Newborg, 2005) is intended to identify developmental skills of children from birth to 7 years 11 months. This study aims 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 examining the presentation of and relationship between impairments in communication and socialization among those with Autistic Disorder (AD; autism), Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS), and non-ASD related developmental delay.

It is hypothesized that individuals with autism will exhibit significantly higher levels of impairment in communication and socialization. Those with PDD-NOS will display a significantly lesser amount of impairment in these areas in comparison to those with autism but

will show significantly greater deficits in relation to those with non-ASD related developmental delay. Those with non-ASD related developmental delay will evince the least amount of impairment in both areas across all groups. It is also hypothesized that correlations between level of communication deficit and socialization impairment will be significant for the AD group; however, it is believed that non-significant differences will be found for the PDD-NOS and Atypically Development groups. In comparison of these correlations for each diagnostic group, it is hypothesized that significant differences will 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 is not believed, however, that the C-S correlations will significantly differ for the PDD-NOS group and the non-ASD atypically developing group. Support for these hypotheses is discussed in the Purpose section of this study. The history and a description of ASDs are outlined below along with current research in communication and socialization deficits in children with an ASD.

Autism Spectrum Disorders

History

Leo Kanner's 1943 paper entitled "Autistic Disturbances of Affective Contact" laid the foundation for all future research in the area of ASDs. He presented a detailed description of 11 children (8 males and 3 females) who exhibited a collection of symptoms that could not be classified under any existing psychological disorder. The children were all between the ages of 2 and 8 years old. At varying degrees of severity and appearance (Ben-Itzhak & Zachor, 2007), the characteristics involved language deficits, inability to relate to others, and the persistence of sameness throughout their daily routines. This later evolved into what Kanner titled "early infantile autism" which is described in his 1944 follow-up paper.

Prior to this time, this symptomatology would most closely follow the diagnostic criteria for childhood schizophrenia with the exception of history, age of onset, and the course of the disorder (Kanner, 1944). These disparities are what best distinguishes autism from childhood schizophrenia allowing it to be established as a diagnosis independent from all others. Kanner described the way in which the children are unable to relate to others. He stated that nearly all of the children's parents noted that their child did not assume the anticipatory position when being picked up to be held as an infant. As observed in the clinic, the children insisted on and were content with isolating themselves from others which seemed to be ingrained in them at birth. For example, one mother described her child as preferring to play alone as he tended to avoid his peers and did not attend to nearby adults except when demanding stories to be read to him (Kanner, 1971). The children also did not engage in conversation with others, although, some were able to respond to simple instructions. These children were disconnected from the world around them. As Kanner described, there is from the start an "extreme autistic aloneness which,

whenever possible, disregards, ignores, shuts out anything that comes to the child from the outside” (1944, p. 211). Kanner concluded that this is distinct from socialization problems seen in childhood schizophrenia because these children fail to ever form personal relationships with others, whereas, those with schizophrenia withdraw from relationships after the onset of the disorder.

In regards to communication, all 11 children demonstrated either a language impairment or delay. Three of the 11 were unable to ever acquire linguistic abilities. The remaining eight children developed unusual and unique verbal communication. Often times, their speech failed to convey meaning and was irrelevant to others. For instance, some of the children engaged in repetitive words or phrases. These repetitions were either of previously heard phrases, which are referred to as echolalia, or lists of rhymes or names. Other verbal abnormalities included delayed echolalia, spontaneous speech, and pronominal reversal. An example of pronominal reversal is seen in one of the children in the following example. When he desired a sweet snack, the child would say, “You want candy” as opposed to “I want candy” (Kanner, 1943, p. 228).

Kanner (1944) also elaborated on their persistence to maintain sameness throughout their daily routines. An insistence on a predictable environment was of the utmost priority to many of these children. Obsessively, many feel the need to follow the same path every day, play in the same manner, or place familiar items in the same area. For instance, one child would line blocks up in a row and would become very distressed if this activity was interrupted. Additionally, many children restricted their interests to certain objects. These objects would consume their attention and interference would once again lead to much distress.

Surprisingly, another account of autistic-like symptomatology was described at nearly the same time Kanner wrote his paper of the children with early infantile autism. In Austria, a

graduate student named Hans Asperger gave a detailed description of similar findings in his 1944 thesis titled “Autistic Psychopathy in Childhood” (1991). Asperger’s account did not attain the same level of fame as Kanner’s did as his thesis was not translated into English until 1991 by Uta Frith.

Eugen Bleuler (1913), a Swiss psychiatrist, coined the term “autism” in 1908. It was initially used to refer to a group of symptoms seen in those with schizophrenia. Bleuler used the term as a reference to a withdrawal from the world and from interaction and relationships with others. Once Bleuler and Kanner’s accounts of the term autism were both available to the public for interpretation, much confusion was sparked. Bleuler’s initial usage of the term conflicted with Kanner’s representation. Bleuler’s usage referred to a “withdrawal” from relationships; whereas, Kanner’s description stated that the children were never able to fully form relationships at all. Additionally, Bleuler implied that those with these symptoms displayed a vivid fantasy, while, Kanner’s depiction entailed the inability to possess imaginative thought (Rutter, 1978). The final and most unfortunate result from this confusion involved Bleuler’s illustration of “autism” as essentially a subset of schizophrenic symptoms. This led to many psychiatrists assigning the following diagnoses in an interchangeable fashion: childhood schizophrenia, child psychosis, and autism (Rutter, 1978).

In 1972 and 1978, Michael Rutter outlined distinctions between autism and schizophrenia to clarify this confusion. He states that childhood schizophrenia was helpful in capturing the public’s eye on psychoses during childhood but it fails to longer provide usefulness to the field and the term should be purged of further scientific research. It was argued that by classifying multiple conditions, including “infantile autism, the atypical child, symbiotic psychosis, dementia praecocissima, dementia infantilis, schizophrenic syndrome of childhood, pseudo-

psychopathic schizophrenia, and latent schizophrenia” (Rutter, 1972) under this one broad term, future progress was thus being stunted (Eisenberg, 1966).

The dissimilarities between childhood schizophrenia and autism explained by Rutter (1968, 1978) include, but are not limited to the following. Schizophrenic children exhibit the initial development of and then withdrawal of personal relationships. This is contrasted by the failure to ever fully develop social relationships with others seen in autism. Unlike autism, delusions and hallucinations are typically seen in childhood schizophrenia. Additionally, schizophrenia is known to have cyclical periods of remissions and relapses which are not seen among those with AD. Autism often co-occurs with a diagnosis of intellectual disability (ID) which is not characteristic of childhood schizophrenia. There is a much higher prevalence rate of autism among males, while schizophrenia is nearly evenly distributed. Finally, the age of onset for those with autism was during infancy and for schizophrenia it was during early adolescence (Rutter, 1978; Rutter & Bartak, 1971). For these reasons and others, autism was established as a separate and distinct disorder.

In addition, Rutter (1968, 1978) also illustrated the differentiation between autism and intellectual disability (ID). Initially, Kanner (1943) assumed full mental capacity among the 11 children he examined due to their superior rote memory, including past events and irrelevant lists, and their normal physical appearance. However, it was later argued that intellectual disability often accompanies a diagnosis of autism suggesting that his original assumptions were incorrect (Matson & Shoemaker, 2009). Nonetheless, ID should not be assumed to be a co-occurring disorder with autism, given that between one fifth to one third of children diagnosed with autism perform within normal limits on standardized intelligence quotient (IQ) tests (Rutter and Lockyer, 1967; Rutter & Schopler, 1988; Rutter & Bartak, 1971). Prior research, mostly

during the 1970's, has found that the mean IQ score for those with autism typically falls within the range of 45-55 (Ben-Izchak & Zachor, 2007). ID and autism are also distinct from one another in the fact that IQ functions the same way in those with and without autism in the sense that it remains stable over time and serves to be a reliable predictor of later educational achievements (Rutter, 1968, 1978). Therefore, children with autism may or may not possess any degree of ID. Today, research indicates that 50% to 75% of all children with an ASD also possess an ID diagnosis (Matson & Shoemaker, 2009; Rutter & Schopler, 1988). Furthermore, autism is coupled with specific disabilities within the language and central coding processes of their ID unlike children with solely an ID diagnosis (Rutter, 1978).

Supplementary to outlining the differences between autism with schizophrenia and intellectual disability, others have also felt it necessary to highlight its dissimilarities with neurosis and developmental language disorders (Rutter, 1978). These distinctions in sum have confirmed autism as a solitary diagnosis. Now Rutter's primary goal was to clearly define and delineate the boundaries that this diagnosis is subject to. In agreement with Kanner's original description, Rutter defined the key features of the disorder as being impaired social development, delayed language development, and an insistence on sameness. He also stated that the onset of these symptoms must occur before 30 months of age. Today's criteria that must be met to indicate the presence of an ASD will be discussed further.

Current Diagnostic Criteria

Due to America's involvement in World War II, a significant amount of psychological problems had become more evident in citizens and veterans affected by the war including major mental illnesses, minor personality problems, combat fatigue, and reactions to stress during war (Shorter, 1997). Physicians of the time were in need of a way to easily classify the many

disorders making the process of diagnosis easier and more accurate. To alleviate this national problem, the American Psychiatric Association (APA) established a task force of well-educated medical professionals to aid in the publication of the *Diagnostic and Statistical Manual, First Edition (DSM-I)* in 1952. The *DSM* provides a system for classifying and diagnosing psychological disorders.

The year of 1968 marked the release of the second edition of this naming system (American Psychiatric Association [APA]). It portrayed the many popular beliefs of the time including the now nonexistent diagnosis of homosexuality and an overall impression of Freudian psychoanalysis throughout the book (Shorter, 1997). The significant influence of Rutter's work was made evident when it was published in the *Diagnostic and Statistical Manual, 3rd Edition (DSM-III; APA, 1980)*. The revised version of the *DSM-III*, published in 1987, was translated into over 20 languages in the 1990's proving its worldwide importance and impact as well as redirecting the field along a more scientific path (APA, 1987; Shorter, 1997). It was in this third edition that "infantile autism" was subsumed under the category of Pervasive Developmental Disorders (PDDs). Today, this category is also referred to as Autism Spectrum Disorders. This term insinuates that these diagnoses all lie on a continuum and vary in degrees of severity. This attests to the interconnectedness of these disorders, all related by atypicality of communication, socialization, and repetitive behaviors (Inglese & Elder, 2009a). Although some today use the term ASD to only include autism, Asperger's Disorder, and PDD-NOS (Inglese & Elder, 2009a; Leonard et al., 2010), these two terms (i.e., ASD and PDD) will be used interchangeably throughout this paper. In the revised version of this edition of the *DSM*, "infantile autism" was newly termed "Autistic Disorder," and "PDD-Not Otherwise Specified (NOS)" became the new term for what was formerly called "Atypical Autism." "NOS" is a term used as an adjunct to

many diagnoses to describe a set of symptoms that do not fully meet the diagnostic criteria for that disorder. The category of PDD has evolved over the multiple editions of the *DSM*. In the current *DSM-IV-TR*, PDD, a class of disorders that affect every aspect of a child's life, now encompasses the following diagnoses: AD, Asperger's Syndrome, Rett's Disorder, Childhood Disintegrative Disorder, and PDD-NOS (APA, 2000).

The growth of mental disorders has seemed almost exponential with each passing publication of the *DSM*. The *DSM-II*, *DSM-III*, *DSM-III-R*, and *DSM-IV* expanded from 180 different disorders to 265 to 292 and to 297, respectively (Shorter, 1997). Today, the *DSM-IV-TR* provides a multi-axial approach to the diagnosis of psychological disorders (APA, 2000). This classification method was introduced in the third edition of the *DSM* and is still in effect today. Another prominent, yet less popular, classification manual is the *International Classification of Diseases, Tenth 10th Edition (ICD-10)* published by the World Health Organization (WHO) in 1992. For the purposes of this paper, the focus will remain on the diagnostic criteria labeled in the *DSM-IV-TR*. The aforementioned core deficits (social skills, communication, and stereotyped behavior, interests, and activities) are evident in all of the disorders included in PDDs. Each disorder has its own more specific qualifications distinguishing itself from the rest. A brief but comprehensive summary of the current diagnostic criteria for AD and PDD-NOS will follow as these are the two diagnoses relevant to this current study.

Autistic Disorder. To receive a diagnosis of autism the child must meet at least six of the following requirements, and the child's symptomatology must not be better explained by another mental disorder, specifically Rett's Disorder or Childhood Disintegrative Disorder. At least two symptoms must be from the first grouping of social impairments. These include: (a) nonverbal

behavior impairments such as “eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction;” (b) the inability to form social relationships; (c) failure to engage in spontaneous sharing with others; or (d) a lack of social or emotional reciprocity (APA, 2000, p. 75). At least one of the individual’s symptoms must stem from the following communication deficits: (a) impairment in, or a lack of, verbal communication; (b) an inability to initiate and carry on a conversation with others; (c) stereotyped or idiosyncratic language characteristics; or (d) lack of imitative or imaginative play appropriate for the child’s developmental level. Finally, at least 1 of the individual’s symptoms must derive from one of the following repetitive/restricted behaviors, interests and activities: (a) an enveloping fixation with one or more restricted patterns of interests; (b) an unyielding desire to follow specific routines or rituals; (c) stereotyped or repetitive motor movements; or (d) an unrelenting obsession with parts of objects. Abnormal functioning must be present in one of the following areas before 3 years of age: social interaction; language use; or symbolic or pretend play.

Pervasive Developmental Disorder – Not Otherwise Specified. Also known as “atypical autism” (Inglese & Elder, 2009a), PDD-NOS is often seen as “midway between the autism and [Asperger’s Disorder] groups on IQ, measures of adaptive behavior, and language milestones” (Walker et al., 2004, p.178). To date there are no explicit criteria that must be met in order to diagnose one with PDD-NOS. Stated in the *DSM-IV-TR*, the client must have “a severe and pervasive impairment in the development of reciprocal social interaction or with the presence of stereotyped behavior, interests, and activities” to receive this diagnosis (APA, 2000, p. 84). Additionally, the child’s symptoms must not be better explained by another mental disorder, specifically Schizophrenia, Schizotypal Personality Disorder, Avoidant Personality Disorder, or another PDD. Examples that may justify this diagnosis include a later age of onset,

a composition of symptoms that fails to reach the threshold level for autism, or an atypical set of symptoms failing to meet the criteria for another ASD.

Core Features

Socialization. Socialization, often considered to be the main deficit in ASDs (Rutter, 1968; Sevin, Knight, & Braud, 2007), is crucial in a young child's life as they begin to encounter new situations and people. In 2008, Parke, Leidy, Schofield, Miller, and Morris defined socialization as "the process by which an individual's standards, skills, motives, attitudes, and behaviors change to conform to those regarded as desirable and appropriate for his or her present and future role in any particular society" (p. 224). Kanner described the atypicality seen in autism as a "disability to relate themselves in the ordinary way to people and situations from the beginning of life" (1944, p. 211). Parents notice differences in their child when compared to other typically developing children as early as infancy. They may claim that their child does not like being held, simply prefers to be alone, or fails to respond to the caregiver. This often sparks great concern among parents thinking that their child initially may be suffering from deafness (Eveloff, 1960).

The appearance of these deficits can take several different forms. Dawson and Murias (2009) identified some as the absence of social and emotional reciprocity; inability to make appropriate eye contact, facial expressions, and gestures; difficulty in relating to or taking interest in others; and an inability to share their interests with others (APA, 2000). Also, it is common for typically developing children to play and cooperate with others their age and have imaginative play. Young children with an ASD lack these abilities and often prefer to play alone (Rutter & Bartak, 1971). The distinguishing feature of the desire to be isolated is often the most palpable symptom of ASDs (Eveloff, 1960). Nonverbal communication often impedes their

social skill growth as they may not be able to make eye-to-eye gaze or point. Verbal communication may also have the same effect on socialization as young children with an ASD may engage in inappropriate verbalizations, such as asking an obese women why she is “fat” (Inglese & Elder, 2009a). Other impairments that Rutter & Bartak (1971) identified include the inability to feel empathetic and/or sympathetic towards others.

Additionally in regards to socialization, one theoretical approach to autism is the “theory of mind” approach. This theory states that those with an ASD diagnosis fail to possess an intersubjectivity characteristic which allows them to place themselves into another person’s position. This inability hinders their capability to understand different attitudes, beliefs, thoughts, intentions, feelings, and mental states, thus leading to problems with social interaction (Baron-Cohen, 1991; Volkmar & Pauls, 2003). However, other research has refuted this theory as some high functioning children with autism are able to complete tasks that require the theory of mind skill yet they still bear socialization deficits (Robertson, Tanguay, L’ecuyer, Sims, & Waltrip, 1999; Volkmar & Pauls, 2003).

Although social withdrawal tends to diminish as the child ages (Kanner, 1971; Rutter, 1968), these social obstacles can create further difficulties in academics and later vocational achievements, should the deficits persist into later development (Krasny, Williams, Provencal, & Ozonoff, 2003). As these many difficulties are separate and distinct from one another, their interaction with each other pose major problems for a young child and often results in “a failure to form enduring relationships” (Rutter, 1968, p.4).

Many reported cases of children with an ASD also had parents, specifically mothers, who lacked the warmth and comfort which is representative of most parents. Some once hypothesized that this deficit in providing emotional support to a young child is what triggers

autism. Although this notion is commonly discarded today, mothers with this cold condition were even once referred to as “refrigerator mothers” (Bettelheim, 1967). Social and emotional reciprocity is important when forming a secure attachment between two people which is also identified as being another pervasive impairment associated with ASDs (Dissanayake & Sigman, 2001). Rutter (1978) stated that children with an ASD usually have difficulty playing cooperatively with peers resulting in a failure to develop meaningful relationships. Despite these arguments, recent findings suggest that children with ASDs can, in fact, form secure bonds with others. Because ASDs are not diagnosed until 30 months of age, little research exists on this topic. In 2001, the attachment styles between parents and children with autism and typically developing children were compared (Dissanayake & Sigman). It was concluded that, despite their inability to have a complete affective connection with others, children with an ASD diagnosis and their parent were able to have attachments of marked security.

Communication. Contrary to the previous mention, some aver that this second hallmark of ASDs is its primary deficit (Rutter & Bartak, 1971). Communication is defined as “the process of understanding and sharing meaning” (Pearson & Nelson, 2000, p. 6). Handicaps in this area almost always entail the child possessing a delay in the development of language which is not offset or compensated with non-verbal language (i.e., pointing or waving “goodbye”) (Charman, 2008). In addition, 15 to 30% of children with an ASD experience a regression in many skills that has already been achieved (Charman, 2008), which often includes communication, around 14 – 36 months of age (Bertoglio & Hendren, 2009; Charman, 2008; Dawson & Murias, 2009; Matson, Wilkins, & Gonzalez, 2008). As language capabilities, along with IQ, are two of the best predictors of future outcome, it is important to note that

approximately 25% - 50% of children with an ASD diagnosis never develop language skills whatsoever (Dawson & Murias, 2009; Howlin, 2006; Rutter 1978).

Even if language skills are extant, children with ASDs are noted to “ignore” parents or caregivers in their efforts to speak, interact, or play with them. However, Eveloff (1960) clarified that these children are more “unaware” of these attempts made by others and are not, in fact, choosing not to respond as many think. The *DSM-IV-TR* states that individuals with an ASD diagnosis may not even be aware of others around them (i.e., other children playing nearby, the needs of others, or the emotions of others; APA, 2000). Some children with an ASD diagnosis also are unable to comprehend much spoken language. The extent to what they can understand typically does not exceed simple instructions coupled with gestural directions as well (Rutter, 1978).

Another communication deficit is usually a lack of conversation skills. The child may be unable to initiate or maintain conversation with others (Bertoglio & Hendren, 2009). Repetitive or idiosyncratic language use is also common to children with ASD including immediate and delayed echolalia (Eveloff, 1960). This could take the form of repeating what others have just said to them, perhaps out of misunderstanding or desire for confirmation, or repeating the dialogue of a television show viewed or a book read in the past. Inappropriate vocal characteristics (i.e., volume, pitch, intonation, stress, rate, or rhythm) also cause more complications with speech and play a large role in the communication deficits. A failure to understand humorous or nonliteral speech is quite characteristic as well (APA, 2000; Eveloff, 1960). It is common to find children with an ASD have a challenging time grasping abstract concepts and ideas (e.g., jokes), resulting in only focusing on concrete thoughts (Bertoglio & Hendren, 2009).

Repetitive Behaviors and Interests. The last symptom of the ASD triad was first described by Kanner as “an anxiously obsessive desire for the maintenance of sameness” (Kanner, 1943, p. 245). In 1978, Rutter outlined this further into five main forms as described below. First, these children abide by strict rules of play lacking in imagination (e.g., a desire to line up toys in a row during every play session rather than engaging in pretend play; Cunningham & Schreibman, 2008; Rutter 1978). If these “rules” are interfered by another person, the child’s emotions can escalate to a violent rage (Kanner, 1951). Kanner stated that the child becomes upset because they believe that “the whole must be preserved in its entirety” (1951, p. 24).

Secondly, the child may feel a strong attachment to certain toys or objects. For example, they may only be satisfied playing with the same blue shovel everyday or reading the same book every night at bedtime (Bertoglio & Hendren, 2009; Eveloff, 1960). These attachments may become so intense that the child must carry around the preferred object with them at all times. Not only may children with an ASD prefer certain objects over other objects, they may prefer objects instead of people. Kanner observed one of his subjects as having a closer attachment to pictures of familiar people rather than the person, themselves (1943). This form may even extend into the child interacting with another person as if that person is an object themselves. This is apparent in one of Kanner’s clients who insisted on positioning certain body parts of other people in a fashion that satisfied the child. For instance, if someone would cross their legs, then he would become obviously upset since “feet belonged on the floor, and arms alongside the trunk” (Kanner, 1951, p. 25).

The third form typically develops in middle childhood or later. This involves having odd and very specific preoccupations including following the same path when walking to and from

school or work every day or asking stereotyped questions in hopes of receiving very specific answers (Kanner, 1951; Kanner & Eisenberg, 1957; Rutter, 1978). In 1943, Kanner reported one of his 11 subjects as insisting that his mother respond with “All right” when he asked her the same exact question every day after he woke from his nap. Following prescribed sequences, such as following the same routine at bath time, is just as important to the child as is maintaining sameness with objects (i.e., arranging toys in a line; Kanner, 1951).

The manifestation and/or function of these behaviors do not maintain a fixed route as the child ages but changes with development (Rutter, 1978; Rutter & Bartak, 1971). Therefore, fourth, Rutter further stated that these preoccupations could develop into obsessions in adolescence, leading to things like repetitive counting, touching, or tapping. Examples of this can be seen in some of Kanner’s original cases and even in some of the close relatives of the children. One of the 11 children showed early signs of obsessive traits as he would insist on disposing of the first bite of every meal (Kanner, 1944). Finally, there is an insistence on keeping their environments unchanged. Some children with an ASD become highly upset if they find a familiar item out of place and can only be soothed by “fixing” the irregular surroundings (Kanner, 1943; Rutter, 1978).

Today, the *DSM-IV-TR* more specifically identifies these as a persistent fixation with one or more restricted patterns of interests, an uncompromising desire to adhere to specific routines or rituals, stereotyped or repetitive motor movements, and an insistent obsession with parts of objects (APA, 2000). Since these behaviors are the focus of many behavioral interventions, it is important to understand their function. Research suggests that the stereotypical behaviors are maintained by an immediate reinforcer, sensory stimulation (Lovaas, Newsom, & Hickman 1987). Others, however, feel that too many treatment plans automatically assume this is the

function of the behavior; therefore, there is a need to examine different possible functions more rigorously (Cunningham & Schreibman, 2008).

Although it was not highlighted upon in Rutter's explanation, repetitive motor movements receive much more attention presently. Rutter and Bartak previously contended at the time that these unusual motor movements should not be incorporated into the diagnostic criteria because of their high frequency in children with intellectual disabilities and blindness (1971). Typically, repetitive movements are defined as hand flapping, body rocking, toe walking, spinning objects, sniffing, echolalia, and moving objects across one's line of sight (APA, 2000; Cunningham & Schreibman, 2008; Eveloff, 1960; Howlin, 2006). These behaviors are often referred to as "stimming" and can be found in the *DSM-IV-TR* today (Bertoglio & Hendren, 2009).

Prevalence

Though Kanner's 1943 description of "early infantile autism" sparked much interest in further examinations into the disorder, the issue of prevalence still remains ambiguous and of great controversy today (Matson & Kozlowski, 2011). From 1951 to 1959 more than 52 articles concerning infantile autism were published (Kanner, 1965) proving to the public its newfound existence and importance. It was estimated in 1957 that infantile autism was 4 times more prevalent in boys than girls (Kanner & Eisenberg, 1957), and this statistic is still accurate today (Bertoglio & Hendren, 2009; Charman, 2008; Dawson, Mottron, & Gernsbacher, 2008; Rice et al., 2010). Upon receiving an award recognizing his scientific contributions, Kanner's 1965 acceptance lecture stressed to the people how this diagnosis had multiplied seemingly "overnight." Unfortunately, many diagnoses were not warranted and many "mentally defective

children” were negligently branded as autistic (Kanner, 1965, p.413). Many, including Kanner, van Krevelen, and Grewel, tried to warn people of this farce.

The substantial rise in the prevalence in autism over time is still debated as to whether it is due to changes in diagnostic tendencies, an increase in possible triggers, a broadening of diagnostic criteria and less stringent screeners and assessments, a greater amount of attention dedicated to this disorder and public awareness, or a genuine growth in the disorder (Bertoglio & Hendren, 2009; Chakrabarti & Fombonne, 2001, 2005; CDC, 2010; Elsabbagh & Johnson, 2007; Inglese & Elder, 2009a; Leonard et al., 2010; Matson & Kozlowski, 2011; Rice et al., 2010). Initially, ASDs were thought to be very rare with a prevalence rate of about 5 in every 10,000 children (Charman, 2008; Inglese & Elder, 2009a). Other reports began emerging in the 1980s suggesting that the rate of diagnosis was now estimated to be about 30 to 60 per 10,000 children and only about one fourth of them having symptoms qualifying them for true autism. This startling trend generated many to ask if this could be an autism “epidemic” (Inglese & Elder, 2009a). The Centers for Disease Control and Prevention (CDC) have been investigating the ever increasing prevalence of ASDs in the United States and across the world. It has founded the Autism and Developmental Disorders Monitoring Network (ADDM) to take on this task. The most current rates released by the ADDM state that with about a prevalence of 1% or about 1 in 110 children have an ASD (CDC, 2010). The *DSM-IV-TR* reports the prevalence rates of AD as 5/10,000 (APA, 2000). Howlin (2006) found somewhat higher rates of 19/10,000 for autism.

It is also stated in the *DSM-IV-TR* that because of lack of sufficient epidemiological data prevalence rates cannot be reported for all other PDDs (APA, 2000). However, since PDD-NOS is a diagnosis given when an ASD is appropriate but presenting symptoms do not meet all necessary criteria of the 4 other ASDs (APA, 2000), studies have shown it to be the most

common ASD with prevalence rates ranging from 31.4 to 36.1 per 10,000 individuals (Chakrabarti & Fombonne, 2001, 2005; Howlin, 2006). Other studies have found Asperger's Disorder to occur in approximately 8.4 to 9.5 in every 10,000 people (Chakrabarti & Fombonne, 2001, 2005; Howlin, 2006). The two PDDs that occur least frequently are Childhood Disintegrative Disorder and Rett's Disorder. These have been found to occur at similar rates of around 0.6 in every 10,000 people (Chakrabarti & Fombonne, 2001, 2005).

Furthermore, studies have reported higher incidence rates of autism among immigrants, Hispanic populations, and higher socioeconomic status populations (Dyches, Wilder, Sudweeks, Obiakor, & Algozzine, 2004; Kogan et al., 2009; Liptak et al., 2008). Because these findings are not consistent among all studies, many experts believe that these factors do not have an influence on the incidence of autism (Bertoglio & Hendren, 2009). Contrary to the plethora of studies finding a consistent and significant rise in the occurrence of ASDs, Rice et al. (2010) examined the changes in prevalence for ASDs from 2000 to 2004 in four different areas of the United States and found inconclusive results with significant and insignificant increases and decreases across the four areas.

Some suggested, yet uncorroborated, causes for a child developing autism include but is not limited to: medications, infections, anoxia at birth, induced labor, exposure to environmental contaminants, high metal toxicity levels (including mercury, cadmium, and lead), and a diet containing gluten and/or casein (Inglese & Elder, 2009a). However, the most contentious explanation to date is the measles, mumps and rubella (MMR) vaccine. In 1998, Wakefield et al. published an article describing 12 children with gastrointestinal problems. He stated that the MMR vaccine caused these certain bowel symptoms which ultimately led to the specific behavioral symptoms indicative of autism. Although, this hypothesis was not supported by

empirical evidence, Wakefield's claim gained momentum and attention through many media sources (Charman, 2008). Triggering this general belief among many parents resulted in a 12% drop of administration of this vaccine in the UK, and the incidence of measles increased 24-fold over the decade following the release of Wakefield's article (Thomas, 2010).

The World Health Organization released a statement warning parents of Wakefield's unsubstantiated claims and of the importance for children to receive the MMR vaccine (WHO, 2001). Taylor et al. (1999) conducted a study in the United Kingdom to determine the causal link between the MMR vaccine and the incidence of ASDs. A sample of 498 children born after 1979 with a diagnosis of autism, atypical autism, or Asperger's Syndrome was selected for this study. Using time-series analyses, it was found that a spike in the number of ASD cases did not occur shortly after the implementation of the MMR vaccine in the UK in 1988. Additionally, similar rates of administration of the vaccine were found for children born after 1987 with and without an ASD. This study was extended in 2001 and once again no association between the vaccine and autism was ascertained (Farrington, Miller, & Taylor). The authors studied children who had received one and two doses of the vaccine and confirmed that a second exposure to the MMR vaccine does not increase the risk of developing autism as some have suggested. Another study supported these findings as they inspected the incidence of autism in the UK which significantly increased from 1988 to 1993, yet no fluctuations in the MMR vaccine administration was established during this time (Kaye, Melero-Montes, & Jick, 2001). Additionally, The CDC and the Institute of Medicine (IOM) have also released reports asserting that there is no causal link between autism and this vaccine (CDC, 2008; IOM, 2004). In 2010, the General Medical Council found Wakefield guilty of unethically manipulating evidence alongside other conflicts of interest (Burns, 2010).

A more accepted explanation of most professionals is the idea that the criteria defining autism has become more expansive which allows for inclusion of cases that Kanner's original description would not. In conjunction with this, assessments used to screen and diagnose children with ASDs are reported to concentrate on behavioral indicators that are more common among most people (Elsabbagh & Johnson, 2007). One of the most recent reviews by Leonard et al. (2010) reiterated the aforementioned likely contributions to the occurrence of ASDs. The authors stated three major possible factors leading to this increase in prevalence including better clinical understanding, changes made to the criteria for diagnosis, and overuse of ASD diagnosis to allow for early intervention funding. Although now corrected for in the most recent edition of the DSM, two of the main changes in diagnostic criteria included the removal of "by 30 months" as describing the age of onset in the DSM-III-R (APA, 1987). This phrase was replaced by a less restricted one of anytime during infancy and childhood. Secondly, the DSM-IV defined PDD-NOS as needing deficits in only one of the three main areas (restricted and repetitive behaviors and interests). As mentioned above, these examples of "broadening" of criteria have been addressed and tweaked in the *DSM-IV-TR* (APA, 2000).

Lastly, diagnostic substitution has also been a reported link to the increased prevalence of ASDs. Diagnostic substitution is the replacement of a current diagnosis with a more popular and accurate alternate (Leonard et al., 2010). For instance, it was customary several years ago for a child with ID and autistic-like features to be given a primary diagnosis of ID. Today, it is common for ID to become the secondary diagnosis and an ASD to replace it. In 2002, Croen, Grether, Hoogstrate, and Selvin colleagues published a study examining the rates of prevalence of autism and ID in California from 1987 to 1994. Unsurprisingly to those familiar with effects of diagnostic substitution, there was a clear inverse relationship between the two measures of

changes in prevalence. As the rates of autism increased, this was offset with a reduction in the rates of ID. It still remains uncertain as to how much of this inflation is due to a true increase of ASDs. This is a topic that will continue to be of great importance to the scientific community.

Assessment

Historically, disagreeing opinions about what important aspects should be at the heart of ASD assessment have resulted in a less than comprehensive protocol to follow when assessing children in need (Richdale & Schreck, 2008). Fortunately, this issue has generated much attention over many years leading to improved diagnostic tools today. Existing reliable and valid assessment tools negate the once assumed reality that children with autism were, in fact, “untestable” (Alpern, 1967, p. 478). The main objective of these diagnostic tools should be to effectively distinguish the child’s symptomatology from that of low ID, sensory deficits, or other developmental disorders (Howlin, 2006).

When standardized methods of diagnostic instruments were first being developed, many fell into three main categories as outlined by Rutter and Schopler (1988): questionnaires completed by a parent and/or caregiver, controlled observations of the child, and parental interviews. One of the first questionnaires that was standardized for this purpose were Rimland’s E1 and E2 scales (1964, 1971; Rutter, 1978). They were used to differentiate between autism and other disorders, specifically ID. Rutter & Schopler (1988) identified several problems with the earlier instruments and some of the assessments still in use today: an inadequacy when assessing higher functioning children or less severe cases, many items qualify a lack of skill rather than a deviance from the ability, questionnaires do not draw on the quality of the behaviors, observations only witness behavior in a brief and single setting, and parental interviews overlook the importance of expert observation needed to make several distinctions.

Thus, it is important to amalgamate various types of diagnostic instruments to provide a more cohesive assessment.

The National Institute of Mental Health (NIMH) estimates that only about half of all children with an ASD are actually diagnosed prior to entering kindergarten (May Institute, 2010). To thwart this statistic, the American Academy of Pediatrics (AAP) advises primary care pediatricians to regularly screen all patients for any developmental problems with an assortment of screeners, including ones for autism (AAP, 2006). It is important for not only professional ASD diagnosticians, but also primary care pediatricians, to be knowledgeable on the more popular assessment tools.

The *Autism Behavior Checklist (ABC)* (Krug, Arick, & Almond, 1980a, 1980b) was developed in hopes to aid children and their families in making a distinction between autism and any other major disabilities. Focusing on the observable traits of autism, the 57 items on the *ABC* gather information regarding the child's symptomatology on the following areas: sensory; relating; body and object use; language; social and self-help skills (Krug et al., 1980b). The items are presented in yes/no form to the informant (i.e., teacher, parent, and/or caregiver). Endorsed items are then rated on a severity scale with higher ratings equating to more severe deficits. Scores falling below 53 are within the unlikely autism range. Those within 53-67 are considered of questionable autism, and scores of 67 or higher are of the highly probable range for autism (Sevin, Knight, & Braud, 2007). The original inter-rater reliability, criterion validity, and concurrent validity proved to be high (Krug et al., 1980b). More current research, conversely, has confirmed that the reliability and validity is not as high as previously thought (Sevin, Matson, Coe, Fee, & Sevin, 1991; Volkmar et al., 1988). As a result of these discordant

findings, Volkmar et al. (1988) suggest that the ABC be utilized as a screening tool as opposed to a true diagnostic instrument.

One of the more popular screening tools used today is the *Childhood Autism Rating Scale* (CARS; Schopler, Reichler, DeVellis, & Daly, 1980). Children who were referred to the Treatment and Education of Autistic and related Communication-handicapped Children (TEACCH) program were among the first to be screened using this instrument to determine if they needed a further evaluation for an ASD. The creation of the CARS was in response to a similar opinion that the authors held about the already established screening tools. Collectively, they did not feel that autism was sufficiently assessed when using any other scale. More specifically, these other scales were not appropriately developed to accommodate very young children. The 15 subscales that are comprised within the CARS includes: Impairment in Human Relationships; Imitation; Inappropriate Affect; Bizarre Use of Body Movement and Persistence of Stereotypes; Peculiarities in Relating to Nonhuman Objects; Resistance to Environmental Change; Peculiarities of Visual Responsiveness; Peculiarities of Auditory Responsiveness; Near Receptor Responsiveness; Anxiety Reaction; Verbal Communication; Nonverbal Communication; Activity Level; Intellectual Functioning; and General Impressions (Schopler et al., 1980). Each of these subdomains can be given a numerical score of 1 to 4, ranging from normal to severely abnormal, respectively.

The psychometric properties of the CARS have proven to be reliable with an internal consistency of .94 and an interrater reliability of .71. The test-retest reliability of the measure has shown to also to be a high .88 (Schopler et al., 1980). One limitation of this instrument is over-inclusion as stated by Inglese and Elder (2009b). Because it does not follow the diagnostic criteria precisely from the *DSM-IV-TR*, the CARS is liable to include either a different and/or a

more expansive population. In tandem with this limitation, the *CARS* fails to acknowledge that social deficits are currently believed to be the most pervasive impairment in autism since it was developed before the *DSM-IV-TR*. This reflects throughout the test (Lord & Risi, 1998). Regardless of these weaknesses, the *CARS* is still held in high esteem today among most diagnosticians as it is said to be “one of the strongest, well-published, most popular scales” (Inglese & Elder, 2009b). Furthermore, it can be used across many countries as it has been translated into several languages, its administration time is quite brief, and it is easy to administer.

The *Autism Diagnostic Interview – Revised (ADI-R)* (Lord, Rutter, & Couteur, 1994) was also developed to aid in the diagnosis of autism. The design of this semistructured interview was in response to the shortcomings of the initial *ADI*, which was originally crafted for research purposes. The revised version incorporates more autism-specific items and is able to assess children younger than the age of 5, unlike the *ADI*. This tool concentrates on the development of the child between the ages of 3 and 4 (Bertoglio, & Hendren, 2009). It is subdivided into the following five sections of the instrument: Opening questions; Communication; Social development and play; Repetitive and Restricted behaviors; and General behavior problems. The system for scoring the *ADI-R* is founded upon the *DSM-IV-TR* and *ICD-10* diagnostic criteria. As the interviewing process typically takes approximately 2 hours, training for administration can be quite extensive. In spite of this weakness, some claim the *ADI-R* to be one of the most reliable assessments when diagnosing autism (Bertoglio & Hendren, 2009) with a high inter-rater reliability from .62 to .89 (Lord et al., 1994).

Usually used in combination with the *ADI-R*, the *Autism Diagnostic Observation Schedule (ADOS)* (Lord et al., 2000) was developed as an interactive evaluation with the child.

Children suspected of having an ASD, often times have impairments in several areas including communication, social skills, and play. These are the exact domains that the *ADOS* addresses. Because expressive language is a large component of the impairments seen throughout all PDDs, the *ADOS* tended to overdiagnose these cases. To resolve this issue, the *Autism Diagnostic Observation Schedule – Generic (ADOS-G)* was developed (Lord et al., 2000). This revised version has four different modules, one of which is chosen specifically for the child depending on their level of language development (Bertoglio & Hendren, 2009). The *ADOS-G* also incorporates imaginative object use into its 30 minute assessment. Although some may applaud the *ADOS-G* for its good inter-rater reliability (.65 to .78), others are discouraged by its inability to discriminate between autism and PDD-NOS (Lord et al., 2000). While simulating social situations that elicit behaviors that are pertinent to diagnosing ASDs, items on the *ADOS-G* are rated on a three-point scale. A score is then computed for each of the communication and socialization domains, individually, and a total score is calculated to determine the presence of an ASD.

Cutoffs for ASD and AD exist on the *ADOS* through rigorous, empirical research (Ozonoff et al., 2010). The specificity of the *ADOS* has shown to decrease when assessing children with a nonverbal mental age younger than 15 months (Martinez-Pedraza & Carter, 2009). The *ADOS* also requires extensive training to administer and score despite its somewhat brief 30 minute administration. Lastly, the behaviors observed and scored during the assessment only allow the examiners to rate their current level of functioning rather than their development over time, while also overlooking the importance of examining restricted and repetitive behaviors as well. Recently, a revised version of the *ADOS* has been established. Although the *ADOS-Toddler Module (ADOS-T)* does not have definitive cutoffs for ASDs, it does offer a way

to help in the diagnosis in children as young as 12 months of age by providing ranges of ASD impairment (Martinez-Pedraza & Carter, 2009).

Another measure of recent development that has been gaining esteem is the *Autism Spectrum Disorder-Diagnostic for Children (ASD-DC)* (Matson, Gonzalez, Wilkins, & Rivet, 2008). The instrument's 40 items differentiates between autism, Asperger's Disorder, and PDD-NOS. Each item is scored on a three-point scale: 0 (not different, no impairment), 1 (somewhat different, mild impairment), or 2 (very different, severe impairment). This measure is intended to be a 10 minute interview with the parent and/or caregiver serving as the informant. The *ASD-DC* along with its variant, the *Autism Spectrum Disorders-Diagnostic for Adults (ASD-DA)*, are comprised in the Autism Spectrum Disorders Adult and Child Battery. This battery of assessments additionally targets the presence of problem behaviors and comorbid psychopathology. Upon analysis of its psychometric properties, the *ASD-DC* attested to an inter-rater reliability of .67, an internal consistency of .99, and a test-retest reliability of .77 (Matson, Gonzalez, et al., 2008). Further examination of reliability and validity are needed as this is still a fairly recent instrument.

Early Detection

Although some ASD-specific deficiencies manifest during infancy, it is rare that any such diagnosis is given before the age of two (Charman, 2008). In fact, since most autism diagnoses are made at around age 3, the paucity of literature regarding early symptomatology for ASDs is expected, yet astounding (Elsabbagh & Johnson, 2007; Martinez-Pedraza & Carter, 2009). Unfortunately, the methods employed by many professionals when attempting to learn more about autism in infancy includes either resorting to retrospective research by using homemade video tapes or prospective research by studying a multitude of infants before they are given a

diagnosis (Brown, Dawson, Osterling, & Dinno, 1998; Saint-Georges et al., 2010; Ozonoff et al., 2010).

In 2010, Ozonoff and colleagues carried out a prospective longitudinal study of 25 infants who were later determined to have an ASD and 25 typically developing infants. It was found that a surprising 83% of parents' retrospective reports did not match with the symptom onsets found during the prospective evaluations. These hindrances have led to an ever-increasing amount of attention over the past decade devoted to early identification of ASDs, primarily autism (Elsabbagh & Johnson, 2007; Matson, Wilkins, & Gonzalez, 2008; Martinez-Pedraza & Carter, 2009). Early detection lessens parental stress while guiding parents to early intervention programs, plans to assist their child throughout their education experience, establishment of a support system of specialists, and early genetics testing.

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 & Cater, 2009). Ben-Itzhak and Zachor (2007) noted that approximately half of participants in studies of 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. In hopes to at least ameliorate the behavioral symptoms that accompany all ASDs, intervention and treatment has shown to have the best outcomes when implemented as early as possible. It is widely accepted that the earlier an ASD can be identified in a child and treatment begun, the better their overall prognosis will be for their future (Matson, Wilkins, & Gonzalez, 2008); however, Howlin (2006) claimed that this belief is uncorroborated

and fears that the emphasis on early detection will weaken the study of interventions for older children and adults.

The rationale as to why many argue that the earliest intervention plans are more effective stems from the fact that the neural systems are of a more malleable state in younger children allowing the treatment to engrain or make changes to these systems before becoming unyielding (Ben-Itzhak & Zachor, 2011; Dawson, Ashman, & Carver, 2000). In contrast, it has also been suggested that too much of early intensive intervention can ultimately strain the child leading to undesirable results including burnout, a lack of progress, and even a regression in skills (Nebel-Schwalm & Matson, 2008).

Most of the interventions applied to young children with an ASD are based upon the techniques derived from behaviorism including classical and operant conditioning. Applied Behavioral Analysis (ABA) is just one example of such treatment. There are four main versions of ABA which include discrete trial training (DTT), pivotal response training (PRT), incidental training (IT), and applied verbal behavior (AVB). However, it was not until the 1970's that this type of intervention was applied to students with ASDs (Leach, 2010). The techniques used in this treatment and other related ones generally include shaping behavior by immediate positive reinforcement, teaching new skills, repetitive practice of these skills, discrimination learning, modeling/request imitation, and direct and clear instruction (Leach, 2010; Martinez-Pedraza & Carter, 2009; Weis, Fiske, & Ferraioli, 2008). To provide the child and their family an early and accurate diagnosis, assessment instruments have been established to measure the functioning of these young children usually between 18 months and 3 years of age. Lord and Luyster (2006) reviewed two prospective studies one of which resulted in a very high stability (84%) of diagnoses at 2 years of age.

The *Checklist for Autism in Toddlers (CHAT)* is a screening tool which combines a parental interview with a direct observation of the child (Baron-Cohen et al., 2000). Its intended use is for children of at least 18 to 24 months of age. Ease of administration is the measure's main advantage with a 10 minute administration time and yes/no scoring design. With a total of 14 items, the parental interview consists of nine questions regarding the child's pretend play and joint attention, and the direct observation includes the remaining five questions regarding the child's observable behaviors. Unfortunately bringing to light its low sensitivity, the results of one study found that of the children diagnosed with an ASD between the ages of 20 and 84 months, the *CHAT* was only able to positively detect 18% of those at 18 months of age (Martinez-Pedraza & Carter, 2009).

In hopes of improving the *CHAT*'s low sensitivity, a revised version was created called the *Modified Checklist for Autism in Toddlers (M-CHAT)*; Robins, Fein, Barton, & Green, 2001). Upon initial development, the *M-CHAT* consisted of 30 yes/no items including the original nine questions of the parental interview from the *CHAT*. These were later reduced to 23 questions as a functional analysis deemed some questions not adequately discriminatory. Of these 23 items, six questions are printed in boldface to indicate critical items. Failing to pass three or more of the 23 total items or two or more of the six critical items warrants a referral for the child to have a true diagnostic evaluation since the *M-CHAT* is simply a screening tool. Despite better sensitivity than the *CHAT*, the *M-CHAT* can still result in many false positives. This shortcoming can sometimes be avoided with use of an additional follow-up interview. If parental responses to the 23 questions suggest the possibility of an ASD, a supplementary follow-up interview is available. This simply probes for further clarification and information on failed items. Two advantages to the *M-CHAT* are its ease of accessibility since it is available

free of charge on the internet and its wider screening age range of 16 to 30 months of age.

Respectable psychometric properties were also found with an internal reliability of .85 (Robins et al., 2001), a sensitivity of 74.1, a specificity of 87.5, and a classification rate of 83.0 (Matson, Wilkins, et al., 2009). Correct identification of children later diagnosed with an ASD is estimated to be approximately 85% for the *M-CHAT* (Martinez-Pedraza & Carter, 2009).

The *Screening Tool for Autism in Two-Year-Olds (STAT)* is another example of an instrument used to assess functioning in young children (Stone, Coonrod, & Ousley, 2000). This is a 20-minute interactive measure consisting of 12 items. As the direct observation is play-based, the examiner is able to score the child on several domains including, imitation, imaginative play, requesting, and directing attention. Initial studies of its psychometric properties indicated high specificity (0.86) and sensitivity (0.83). The *STAT* was designed as a screener for children between the ages of 24 to 35 months. Created with the intent of solely detecting autism in 2-year-old children, the *STAT*, unfortunately, cannot distinguish and/or detect all ASDs. Another limitation of this screener is that it cannot be used as a diagnostic instrument, and it is not as easily accessible as the *M-CHAT*. Despite these limitations, with training the *STAT* can be administered by a multitude of different people including social workers, preschool teachers, and early intervention specialists (VU e-Innovations, 2010). Additionally, the ease and brevity of administration is another advantage to utilizing this screener.

Another instrument designed for early identification of autism is the *Baby and Infant Screen for Children with aUtism Traits (BISCUIT)*; Matson, Wilkins, Sevin, et al., 2008). Unlike the previously mentioned screeners, the *BISCUIT* is designed to assess autism in young children along with PDD-NOS, comorbid psychopathology, and challenging behaviors. This screener is an extension of the Autism Spectrum Disorders Child Battery. Aimed at assessing children of 17

to 37 months of age with developmental delays or with a medical condition that is likely to result in a developmental delay, the *BISCUIT* was designed to be a diagnostic tool rather than a screener like the aforementioned measures. It is divided into 3 separate parts: Part 1 – aids in the diagnosis of autism and PDD-NOS; Part 2 – assesses other emotional difficulties often accompanying ASDs; Part 3 – considers various challenging behaviors that may be associated with ASDs.

The section of interest to this discussion is the *BISCUIT-Part 1* which consists of 62 items in which the parents rate their 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. Internal reliability for this 62 question component was found to be a high .97 (Matson, Wilkins, Sevin, et al., 2008). Because it is unlikely that Asperger's disorder would be diagnosed at the early ages that the *BISCUIT-PART 1* addresses, those items fell out of the measure. Item content for autism and PDD-NOS was, however, successfully established.

Validity studies found that the *BISCUIT-Part 1* was able to effectively distinguish between those with and without ASDs. Furthermore, the sensitivity and specificity was established as .844 and .833, respectively, when differentiating between PDD-NOS and autism (Matson, Wilkins, et al., 2009). These statistics slightly increased to .847 and .864, respectively, when distinguishing between PDD-NOS and no diagnosis (Matson, Wilkins, et al., 2009). Lastly, the overall classification rate was found to be 88.8 for the *BISCUIT-Part 1*. The major advantage of this measure is that it is designed to be a diagnostic tool rather than a screener. Its use as an instrument to diagnose autism and PDD-NOS should be strengthened with further

studies. Additionally, its ease of administration and use of scaled scoring are other strengths of the *BISCUIT-Part 1*. However, it does not include a direct observation component characteristic of other assessment tools.

Specific Infant and Toddler Characteristics

Communication

Although popular belief is that socialization is the main impairment among ASDs, some aver that, on the contrary, communication is the primary handicap (Rutter, 1968; Rutter & Bartak, 1971). Hence, communication has also been on the forefront of ASD research and is said to be the most common complaint presented by parents of children being assessed for an ASD (Volkmar & Pauls, 2003). Impairments in this area can be seen as early as 12 months of age if the child displays no babbling sounds (Bertoglio & Hendren, 2009). Between 30% to 50% of parents retrospectively report noticing impairments during the first year of life (Zwaigenbaum et al., 2005). Similar findings stated that parents report first seeing atypical development between 18 to 24 months of age (Martinez-Pedraza & Carter, 2009). Dawson and Sterling (2008) additionally reported that these signs can emerge as early as 8 to 12 months of age. These reports could also be ones of regression in skills. Although some suggest that signs of an ASD can be detected before the age of 1 and even at birth (Kanner & Eisenberg, 1957), others have found that signs are, in fact, not present at birth and that they surface over time through a regression in skills (Ozonoff et al., 2010). According to Hansen, et al. (2008), the rate of regression in autism has been found to range anywhere from 15% to 50%. Much of the variance can be attributed to different definitions used to term a “regression.” Similar estimates were reported by Dawson and Murias (2009) and Johnson and Myers (2005) with 25% to 30% of those with autism showing a regressive skill set, which often occurs between 15 and 24 months of age.

Parents often mistake their child’s lack of speech and/or great inattentiveness to hearing their name or people coming and going for a hearing impairment (Eveloff, 1960; Manning-

Courtney et al., 2003; Ornitz & Ritvo, 1976). However, this is not always the case, as Konstantareas and Homatidis (1987) found that typically developing children had significantly fewer ear infections and hearing impairments than children with autism. Infants should be able to turn their head toward a sound according to the Bayley Scales of Infant Development in addition to reacting to the disappearance of a face at 2 months of age (Bayley, 1993). Milestones such as this can help parents more accurately identify impairments in their child including hearing loss.

In addition to inattentiveness, young children with an ASD diagnosis often possess communication deficits. These can take the form of either simply a delay in the development of language or a complete lack of linguistic abilities (Inglese & Elder, 2009a), which are also said to be the “hallmark symptom for evaluation” (Bertoglio & Hendren, 2009, p. 4). Whereas most children with an ASD are able to acquire linguistic abilities, approximately 25% - 50% do not develop language skills (Dawson & Murias, 2009; Howlin, 2006; Rutter 1978; Tager-Flusberg, 2001). It is important to highlight the nature of communication development of the typically developing population in order to better understand where the deficits lie within the ASD child.

Typically developing infants begin displaying prelinguistic communication almost immediately after birth. This can include facial expressions, gesturing, sounds, cooing and babbling; although, cooing usually begins around 2 or 3 months of age (Yule, 2006) and babbling arises around 6 to 8 months of age (Tager-Flusberg, 2002; Yule, 2006). Around 4 months of age, the child displays an increase in their vocal turn-taking between themselves and their parent during vocal play (Tager-Flusberg, 2002). Yule (2006) stated that during the later stages of babbling the child is able to add intonation to their verbalizations, which is typically around 9 months. As the child ages, they usually are able to utter their first words around 10 to

14 months of age (Feldman, 2006; Yule, 2006). Once they begin talking, learning new words happens at a rate of about 9 new words every month (Feldman, 2006).

Ordinarily, it is about 8 to 12 months after the child has said their first word when they will utter their first two-word phrase (Feldman, 2006; Ushakova, 2000). Usually this happens around 18 to 20 months of age and their vocabulary spans beyond 50 words (Yule, 2006). It is at this time that young children also begin to learn how to pose questions to find answers. Soon after, this will develop into telegraphic speech around 24 to 30 months of age which also develops in tandem with the child initiating more conversation. Once 25 to 75 words have been learned and cataloged into the child's vocabulary, it is at this point when normal language is said to develop (Matson & Neal, 2010). By 3 years of age, typically developing children can produce hundreds of words while employing clearer pronunciation as well (Yule, 2006). Since infants are not diagnosed with autism, there still are no known studies of the onset of babbling and other communicative abilities during infancy among this population. Much of the knowledge in this area is achieved through retrospective research, which often uses home video tapes (Brown et al., 1998; Saint-Georges et al., 2010).

Typically at 1 year of age, children are able to use joint attention (Feldman, 2006; Tager-Flusberg, 2002). Joint attention is the ability to obtain another's attention to some object or event. The desire is simply to share experiences with another person. Developing in stages, infants are first able to engage in "gaze monitoring" around 8 months of age. This is the ability to follow a parent's gaze simply when they look at something else in the surrounding environment (i.e., a clock on the wall). At around 10 to 12 months of age, infants are now able to turn their gaze to wherever their parent is pointing and telling them to look. After attending to the object,

the child will generally look back at the parent and make the appropriate facial expression (i.e., smile or frown; Johnson & Myers, 2005).

Between 16 and 24 months of age, a typically developing child's vocabulary can escalate at a very fast rate from around 50 to 400 words. During this time at around 1 year of age, the child is able to string these words together to form short meaningful sentences (Feldman, 2006), and as early as 30 months of age they are able to produce longer and more complex sentences (Tager-Flusberg, 2002). When under the age of 2 years, children typically use their language skills to either get something they want, to regulate their behavior, for social interaction, or for pretend play. As this child ages, around 3 years old, the functions of their communicative abilities broaden to include the description of objects or events and insertion of their opinions into conversations (Tager-Flusberg, 2002). Maintaining a conversation is a skill that usually arises as the child begins preschool.

The pattern of linguistic and communicative skill development for children possessing an ASD diagnosis paints a very different picture. Some of the parental concerns that are frequently reported include: the child does not respond to their name being called, cannot express his or her wants, delayed language, inability to follow directions, possibility of a hearing impairment, failure to point or wave, and regression of speech (Charman, 2008). Unfortunately, much of the information regarding early communication impairments rely upon parental reports because children are not identified as having an ASD until around the age of 3. Between 30% to 50% of parents report noticing behavior abnormalities within the first year of their child's life (Zwaigenbaum et al., 2005). These early signs of atypicalities have, thankfully, led research in a direction of early detection, diagnosis, and intervention. These studies have begun to outline the course that ASD takes in most young children.

In 2001, Helen Tager-Flusberg provided a detailed description of communication deficits among this young population. Although she reported that there is no knowledge of the onset of babbling, Charman (2008) stated that if the infant is not babbling by 12 months, then this is an indication for immediate evaluation. Before 12 months of age it is characteristic for children with an ASD to not be responsive to contact, have an inability to display turn-taking skills, and have the inability to utilize joint attention. This typically involves the child pointing to or shifting their eye gaze from the social partner (i.e., parent) to something of interest (i.e., a airplane in the sky). These behaviors are usually achieved around 12 months of age (Dawson, Toth, Abbott, Osterling, Munson, Estes, & Liaw, 2004; Leekam, Lopez, & Moore, 2000).

Joint attention is critical in a young child's life as they begin to learn the verbal and nonverbal cues within reciprocal communication (Corkum & Moore, 1998). The degree of severity of the impairment of joint attention has shown to have a correlation with the amount of linguistic abilities that the child possesses and can act as a predictor for receptive language (Dawson & Sterling, 2008; Matson & Neal, 2010). This ability is closely linked to social impairments as well. In 1998, Corkum and Moore studied the joint visual attention of 11 infants from 6 to 11 months of age. Joint visual attention is the sharing of an interest or experience with another person simply by getting them to look where your eye gaze is fixated without using gestures. It was determined that joint visual attention cannot reliably be established prior to 10 months of age among the normal population.

Marked by 1 year of age, infants who later are diagnosed with an ASD are unable to make eye contact and often have no social orienting (i.e., responding to the call of their name) by this time (Osterling & Dawson 1994; Tager-Flusberg, 2001). By 2 years of age, toddlers with an ASD often have a substantial language deficit. Higher-functioning children with an ASD are

sometimes able to acquire a functional language. Achieving a functional language by 5 years of age is one of the best predictors for an optimal outcome (Rutter, 1970; Tager-Flusberg, 2001; Volkmar & Pauls, 2003). Evidence of this can even be seen in Eisenberg's 1956 study of children diagnosed with autism once they developed into adolescents. Results showed that the children's prognoses varied significantly depending on the presence or lack of speech at age 5 (Eisenberg, 1956). As reported by Volkmar and Pauls (2003), 15% of this ASD population is able to mature into self-sufficient adults. Additionally, communication impairments such as the ones mentioned here have shown to be positively correlated with the amount and degree of challenging behaviors that the child poses (Matson & Neal, 2010).

In addition to a delay or lack of expressive language, toddlers with ASD also are often unable to gesture appropriately. This often results in taking the hand of the caregiver and bringing their hand to what they want instead of pointing (Manning-Courtney et al., 2003). Kanner (1944) even noted that the child may treat the hand of the other person as if it is an object itself. One of the most evident features of language impairments is echolalia which was first described by Kanner (1943) who noted that children would repeat words or phrases. Additionally, children with autism are less likely to engage in pretend play (Bertoglio & Hendren, 2009; Charman, Swettenham, Baron-Cohen, et al., 1997; Rutter, 1978). Howlin (2006) notes that this is one of the first symptoms parents tend to notice.

In 2005, Zwaigenbaum and colleagues published a prospective longitudinal study focusing on the symptoms found during the first year of life for infants with high-risk of autism. They followed 150 infants who are considered to be at high risk for developing autism due to having an older sibling with an ASD diagnosis to track behavioral manifestations. Of this sample, 65 infants were followed for a total of 24 months and were compared with a control

sample of 74 low-risk infants (23 of the controls were followed until 24 months of age). The low-risk infants were matched on gender, birth-order, and age and qualified for the control sample if they did not have 1st or 2nd degree relatives with an ASD. To follow these behaviors, an observational scale, a computerized visual orienting task, and measures of temperament, cognitive and language development were utilized. Results indicate that no significant differences can be found between the two samples at 6 months of age when comparing infants who later exceeded the threshold for autism spectrum or autism on the *ADOS* at 24 months of age with infants who did not meet this threshold. However, risk markers observed at 12 months of age while using the Autism Observation Scale for Infants (*AOSI*) did significantly predict the classification of the child on the *ADOS* at 24 months of age. These predictors “include atypical eye contact, visual tracking, disengagement of visual attention, orienting to name, imitation, social smiling, reactivity, social interest, and sensory-oriented behaviors” (Zwaigenbaum et al., 2005, p. 148). Furthermore, siblings later classified with autism at 24 months of age showed lower scores on measures of expressive and receptive language when compared to siblings who were not later classified as autistic or the control infants. Infants later classified as having autism also showed fewer gestures and understood fewer phrases at 12 months of age when compared to the other infants. The authors stated that as these results are preliminary they will continue with this prospective study as these children age in hopes to develop a better framework for the early behavioral manifestations of autism.

Although retrospective studies can possess a limitation of recall bias and usually lack appropriate controls (Kishore & Basu, 2011), Saint-Georges and colleagues (2010) reviewed 18 retrospective studies using home movies to present a compilation and overview of the results. During the first 6 months of life, only 1 out of 18 studies consistently found significant signs of

abnormalities including less social attention, failure to follow the aim of another person, inability to comprehend pointing, and less explorative activity. Six other studies found a fraction of these behaviors within the first 6 months as well. Atypicalities were found for all three domains of autism within the first year of life in the majority of the 18 studies reviewed. Although vocalizations as a whole were not found to be reduced at this time in most of the reviewed studies, vocalizations directed to other people were sometimes found to be diminished. Three studies found a decrease in the amount of declarative pointing made by these infants at 1 year of age. Other studies found impairments including showing and looking at objects held by others and less gesturing. Impairments observed in many of the home movies during the 2nd year of life include less looking at others, lower quality of eye contact, diminished positive affect, less gestural movements, a reduction in vocalizations, impairments in language comprehension, less responding to their name, and less pointing.

As stated previously, the lack of assessment tools for young infants who are at risk for autism have resulted in an increasing interest in understanding the behavioral manifestations during these early developmental periods. Unfortunately, the knowledge relies on retrospective and prospective data collection. These types of studies both have downfalls as retrospective studies have the potential for recall bias, often have inadequate control groups, the behaviors reported may be limited to what the parents believe is relevant to ASDs, and these studies tend to be inaccurate when reporting timing of behavioral observations (Zwaigenbaum et al., 2005). Prospective studies, unfortunately, rely on studying infants before they are even given a diagnosis of autism. In order to obtain optimal data, it would be best to study individuals who already have an ASD diagnosis. As research on this subject continues, this objective remains possible.

Socialization

Considered to be the primary impairment associated with ASDs (Rutter, 1968), socialization proves to be very important even throughout infancy. There are many agents that influence socialization of the developing child including school, neighborhoods, religion, peers, and media (Henslin, 2005; Parke & Burial, 2004), but the factor that initially affects an infant's social life is family. Socializing with and relating to others from the beginnings of life are essential to later functioning in life. Learning from others is also one of the most important adaptations of the human species (Grossman & Johnson, 2007). Matson and Ollendick (1988) broadly defined social skills as one's capability of interacting well with others reciprocally by exhibiting appropriate social behavior.

Typically, infants are particularly sensitive to stimuli in their surroundings and social setting (Dawson et al., 2004). There are many skills that infants acquire over the first few years of life, yet there are also some skills that can be seen immediately after or within months of birth. Immediately after birth many infants exhibit face processing abilities. They show a preference for faces over other objects (Grossman & Johnson, 2007). Around two months of age, infants begin to smile at others, recognize their mother's face, and prefer direct eye-gaze (Farroni, Massaccesi, Menon, & Johnson, 2007; Sirios & Jackson, 2007; Tager-Flusberg, 2010). Eye-gaze is another social ability that if not acquired correctly social learning and communication with others can be significantly affected (Grossman & Johnson, 2007). It can serve many functions including inferring mental states, intimacy, and simply to shift another's attention (Farroni, Massaccesi et al., 2007). Farroni, Massaccesi et al. (2007) confirmed that infants prefer direct eye gaze by exhibiting better recognition of faces with direct eye gaze. This was accomplished by presenting images of faces with both direct and indirect eye gaze to the infant

participants. A later recognition phase of the images was held, and the infants were more likely to show preference for the faces who were looking directly at them. Around 6 months of age, infants become quite skilled in this ability (Sirios & Jackson, 2007).

Interpreting and producing facial expressions are another very important social skill that develops during early childhood. Being able to interpret the expressions of others gives one the ability to speculate their inner emotional states, their intentions, and even future behavior (Grossman & Johnson, 2007; Striano & Vaish, 2006). Grossman & Johnson (2007) reviewed studies that suggested this ability is present in 7 months of age. However, others report that this skill is seen as early as 4 months of age (Thomas, De Bellis, Graham, & LaBar, 2007) and that at this time infants can even understand the meanings behind the expressions (Feldman, 2006). Infants have also reportedly been able to discriminate between and imitate expressions of happiness, sadness, and surprise (Feldman, 2006). In fact, 84% of mothers believe their baby expressed feelings of interest and joy by only 1 month of age (Feldman, 2006). Furthermore, Farroni, Menon, Rigato, & Johnson (2007) conducted multiple studies on the interpretation of facial expressions by newborns resulting in conflicting results. This highlights the controversy still remaining on this topic.

In 1998, Carpenter, Nagell, Tomasello, Butterworth, and Moore examined nine different social behaviors monthly in infants from 9 to 15 months of age. The behaviors that emerged first were labeled as those that required the sharing or checking of an adult's attention in close proximity. These included joint engagement, proximal declarative gestures, and reaction to social obstacles. The behaviors that emerged next were those that required following an adult's attention to more distant external entities which included imitation of instrumental acts, imitation of arbitrary acts, point following, and gaze following. Finally, the social behaviors that emerged

last were ones that required the infant to direct the adult's attention to external entities. These included declarative pointing and imperative gesturing. In 2010, Inada, Kamio, & Koyama found that typically developing infants began to spontaneously seek others out to share their interests around 15 to 17 months of age.

Additional abilities include social smiling which typically occurs around 6 to 9 months of age; however, the social smiling begins to be directed more towards the child's mother rather than to others at around 18 months of age (Feldman, 2006). Just before 12 months of age, typically developing infants are also able to engage in gestural communication, pointing gestures, and imitations of actions (Carpenter, Pennington, & Rogers, 2002). Empathy is an emotional response that is often lacking in those with ASDs. This skill is often evident in typically developing children around the age of 24 months (Feldman, 2006). Forming attachments and relationships with others is a large part of socialization that rests upon the basic social skills previously mentioned. This is an ever-evolving process throughout a child's life that can be seen in early infancy by the choice of proximity that the child makes in relation to his mother and/or caregiver (Dissanayke & Sigman, 2001). Of the four main types of attachment (i.e., Avoidant, Secure, Ambivalent, and Disorganized-disoriented), about two-thirds of North American children are able to form secure bonds with their caregivers (Feldman, 2006). Finally, social reciprocity often seen in typically developing infants and toddlers is the expression of behaviors that "invites further responses from parents and other caregivers" (Feldman, 2006, p. 207).

Kanner (1943) explained how children with autism fail to ever develop proper social skills. With evidence to support his theory, he believed that autism was present at birth. For instance, many of the infants he studied never assumed the normal anticipatory posture when

being held and often preferred to be left alone. This is evident in some of the concerns noted by many parents which include lack of social interest and responsiveness and rarely ever smiling. Collectively, these suggest that autism is, in fact, present at birth (Zwaigenbaum et al., 2007). Matson and Wilkins (2007) even noted social deficits as being “behavioral cusps” to emphasize the fact that there are many consequences that arise from having impairments in this area.

Although ASDs are not usually diagnosed until the child is attending preschool, many parents report detecting ASD-specific symptoms within 16 to 20 months of age and noticing other developmental issues within the first 12 months of life (Cassel et al., 2006). Infants and toddlers that either have an ASD diagnosis or later come to acquire one often do not present the same social skills as typically developing children. However, Tager-Flusberg (2010) stated that many behavioral studies have found that there are, in fact, no differences socially between typically developing infants and infants who later were diagnosed with an ASD within the first few months of life. These at-risk infants appear to enjoy social interactions with others during this time. This likeness dissolves around 9 to 24 months of age (Tager-Flusberg, 2010). From here on out, the manifestation of socialization deficits can vary significantly. There are children who appear completely disconnected from the world, and there are others who are very interactive but fail to do so appropriately (Sigafos, Schlosser, Green, O’Reilly, & Lancioni, 2008).

Results of many retrospective (Osterling & Dawson, 1994; Werner & Dawson, 2005) and prospective studies (Charman, Swettenham, Baron-Cohen, et al., 1997; Wetherby et al., 2004) determined that infants who later develop an ASD have poorer social interaction. This broad deficit subsumes impairments including playing with others, eye contact, imitation, joint attention, and social orienting. Charman and colleagues (1997) carried out a prospective

longitudinal study of social communication in infants to strengthen the limited resources currently available on this topic. Participants included a group of 20 month old infants who were at risk for autism ($n=10$), a group of 20 month old infants who were at risk for a developmental delay ($n=9$), and a group of 20 month old infants who were classified as typically developing ($n=19$). In regards to measuring empathy, fewer of the infants with autism expressed empathy by looking at the experimenter when he feigned distress or expressing facial concern for the experimenter. The ability to imitate others was also assessed. The infants with autism did produce less imitation when compared to the developmentally delayed group. Lastly, there was no difference found between the developmentally delayed group and the group with autism when measuring rates of engaging in pretend play. Both groups displayed very low ratings of this social ability. The authors state that these results show that there are some clear differences between children with autism and developmental delays by the end of infancy. Some limitations of this study include the fact that all participants were male and any infant with a severe developmental delay was excluded from the study (Charman, Swettenham, Baron-Cohen, et al., 1997).

In 2007, Clifford, Young, and Williamson conducted a prospective longitudinal study of 15 infants who were later diagnosed with autism, 15 infants who were later diagnosed with a developmental or language delay, and 15 infants who were later confirmed as being typically developing. Apparent differences were noted before 2 years of age between the autistic group and the other two groups. The main differences included less eye contact and poorer eye contact quality, less positive affect, gaze aversion, less social peer interest, engaging less in conventional social games, assuming the anticipatory posture less, and fewer occurrences of proto-declarative

showing. Given that intentionality is a characteristic of many of these differences, the authors assert that this quality is an important predictor for autism.

Other findings include a 1993 study conducted by Adrien et al. analyzing home videos of infants who were later diagnosed with autism and infants who were later determined to be typically developing. Before 1 year of age, blind raters found those with autism to perform significantly poorer on several different abilities including poor social ability. Videos filmed after the infants reached the age of two were also analyzed. Those with autism exhibited more deficits when compared to the control group and with a greater severity. Socialization deficits included ignoring others, preferring to be alone, and lack of eye contact (Adrien et al., 1993). Similar findings were established later in 1998 by Brown and colleagues. This study examined home video tapes of 15 infants from 8 to 10 months of age who were later diagnosed with autism and 15 infants from 8 to 10 months of age who were later confirmed as being typically developing. In regards to socialization, looking at others in the environment, smiling while looking at someone else's face, and orienting to one's name being called were three of the behaviors being tracked. Two of the participants were removed due to parental reports of their child having late-onset autism. After this adjustment, results found a significant difference between the two groups' social behaviors. When examining the social behaviors individually, significant group differences was found for orienting to one's name when called ($p=.004$; Brown et al., 1998).

Zwaigenbaum et al. (2009) reviewed several prospective studies and concluded that infants from 12 to 18 months of age who later develop an ASD significantly differ from control groups that do not. Results found significant differences in the socialization domain. Specific social impairments include poorer eye contact, deficits in social orienting, less imitation, reduced

social smiling, less responding to social games, impairments in social interest, and more negative emotions and less positive ones. Similar findings were once again established by Zwaigenbaum and colleagues (2005) by conducting another prospective longitudinal study of infants before 12 months of age with and without an ASD diagnosis given to them in later development. Significant social deficits consisted of atypical eye contact, poorer social orienting, social smiling, social interest, and social affect.

Prospective studies have consistently found a first-degree relative recurrence rate estimate of 5% to 10% (Martinez-Pedraza & Carter, 2009). Retrospective studies analyzing home videos like the ones previously mentioned indicate that approximately 80% to 93% of children who later develop an ASD possess communication and socialization difficulties including social orienting, imitation, greater negative affect, and ambiguous affective expressions (Martinez-Pedraza & Carter, 2009). With these optimistic findings, early diagnosis remains to be a goal within child psychology that appears to be one-day attainable.

Purpose

Over the past thirty 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 (Bertoglio & Hendren, 2009). Nevertheless, more children are in need of services and accommodations, thus making early detection and intervention a top priority among today's diagnosticians (Volkmar & Pauls, 2003). The literature on socialization and communication deficits individually, much less the relationship between the two, among candidates for early ASD identification (17-37 months) is sparse since the average age for diagnosis of ASDs is approximately 3 to 4 years of age (DeGiacomo & Fombonne, 1998; Matson, 2005; Tager-Flusberg et al., 2005). Having said that, the current study serves as a means to provide such an analysis as all participants are 17 to 37 months of age.

While much research has been conducted on the presence of communication and socialization impairments in this population, the amount of literature greatly diminishes for younger children, especially under the age of 3. The majority of the studies conducted that examine the core ASD symptomatology among this very young population have done so through the utilization of retrospective analyses (e.g., inspecting old home videos). The current study will strengthen this literature by examining deficits in communication and socialization using real time, objective measures (i.e., the *BISCUIT* and the *BDI-2*).

Since Kanner's original description, many researchers have conducted studies in an attempt to better define the three core features of ASD on an individual basis. 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 suggesting a strong association between these symptoms (Dworzynski, Happé, Bolton, & Ronald, 2009). Some, however, have questioned this association. 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 of the first signs suggesting a child is atypically developing.

The aim of the current study was to build upon these abovementioned findings. The *Baby and Infant Screen for Children with aUtism Traits-Part 1 (BISCUIT-Part 1)* and the Personal/Social domain of the *Battelle Developmental Inventory, Second Edition (BDI-2)* were utilized to assess any communication impairments and socialization deficits among infants and toddlers (17-37 months of age) with diagnoses of either autism, PDD-NOS, or atypical development. These domains were examined to establish if a relationship exists, and if so determine 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. Individual items on the communication domain of the *BISCUIT-Part 1* were also measured to determine their ability to predict socialization scores.

Hypothesis 1

First, it was hypothesized that children with AD should possess the most communication impairments, those with PDD-NOS would possess less, and those with non-ASD related developmental delays would exhibit the least impairments in communication. This was based upon the diagnostic criteria outlined in the *DSM-IV-TR* (APA, 2000) which states that deficits must be present in at least one of two areas (communication and socialization); whereas, there are no well-defined criteria for developmental delays. Furthermore, Horovitz & Matson (2010) found that children with PDD-NOS possessed significantly more communication deficits than those with non-ASD related developmental delays and children with a diagnosis of Autistic Disorder displayed significantly more deficits in communicative skills than children with PDD-NOS and non-ASD related developmental delay. It should be noted that this current study was an updated sample of the one utilized in the Horovitz & Matson (2010) study. The updated sample included newly recruited participants and only children that have been administered the *BDI-2*. Additionally, this present study examines the relationship of communication and socialization deficits. Matson, Fodstad et al. (2009) also concluded that a sample of children 17 to 37 months of age exhibited significantly more communication deficits when diagnosed with PDD-NOS rather than those who had non-ASD related developmental delay. Other researchers have established that children with autism have both more communication deficits than children with PDD-NOS as well (Anderson et al., 2006; Matson, Fodstad et al., 2009b). It has also been shown that children with autism exhibit more impairment in the area of communication when compared to other developmental delays (Anderson et al., 2006; Matson, Fodstad et al., 2009).

Additionally, researchers have found several behaviors that best distinguish between children with autism and children with PDD-NOS. These behaviors include repetitive language,

pretend play, nonverbal communication, eye gaze, and social interaction, which all are subsumed under either the communication or socialization diagnostic criteria domains (Buitelaar, Van der Gaag, Klin, & Volkmar, 1999; Matson & Boisjoli, 2007). Other researchers have demonstrated similar findings with those with PDD-NOS displaying greater communication skills in comparison to those with autism (Cohen, Paul, & Volkmar, 1986; Sevin, Matson, Williams, & Kirkpatrick-Sanchez, 1995).

Hypothesis 2

Second, it was hypothesized that children in the PDD-NOS group would possess significantly more socialization impairments when compared to children in the non-ASD related developmental delay group and children in the AD group were hypothesized to show significantly more impairments in socialization than both those with PDD-NOS and those with non-ASD related developmental delays. One rationale for this hypothesis rests upon the diagnostic criteria outlined in the *DSM-IV-TR* (APA, 2000). The criteria state that deficits must be present in at least one of two areas (socialization and communication), while there are no clearly defined criteria for determining if a child has a developmental delay. Matson, Kozlowski, Neal, Worley, & Fodstad (2011) found that children with ASDs have more impairment in adaptive/appropriate social skills in comparison to typically developing children. Significantly more socialization deficits were also found present for those with PDD-NOS than those with non-ASD related developmental delays among a sample of children 17 to 37 months of age (Matson, Fodstad et al., 2009).

In 1998, Myhr noted that children with autism have more severe socialization problems in comparison to those with PDD-NOS. Elsewhere it has been established that children with autism have more impairments in socialization when compared to children with PDD-NOS as

well (Anderson et al., 2006; Cohen, Paul, & Volkmar, 1986; Matson, Fodstad et al., 2009b; Sevin, Matson, Williams, & Kirkpatrick-Sanchez, 1995). Once again, many of the behaviors that best differentiate between those with autism and those with PDD-NOS fall under either the communication or socialization diagnostic criteria domains (Buitelaar, Van der Gaag, Klin, & Volkmar, 1999; Matson & Boisjoli, 2007).

Hypothesis 3

It was hypothesized that the correlation between communication and socialization scores for the AD group would be strongest when compared to the PDD-NOS group and the non-ASD related developmental delay group. Rationale for this hypothesis was based on the *DSM-IV-TR* (APA, 2000) diagnostic criteria which requires clinically significant levels of impairment in both of these areas for a diagnosis of autism; thus, these two core features are thought to be greatly associated among this population (Dworzynski et al., 2009). As previously mentioned, Dworzynski et al. (2007) found significant correlations between communication and socialization skills as well. Also, children with greater communication deficits are believed to display more severe socialization impairments as well (Newborg, 2005), partially, because the social strain develops from the inability to communicate with adults and/or peers (Matson, Fodstad, Hess, & Neal, 2009). Many social skills rely upon a certain amount of communicative abilities and vice versa (Sigafos et al., 2008) which highlights the interconnectedness of these two constructs and suggests a strong association among them for this diagnostic group.

Communication-socialization (C-S) correlations are hypothesized to be less correlated for the children with non-ASD related developmental delays or for the PDD-NOS group when compared to the AD group. Rationale for this hypothesis was based upon the fact that while communication and socialization deficits are possible in PDD-NOS and non-ASD related

developmental delay, they are not diagnostically required as they are for any child receiving a diagnosis of AD (APA, 2000). Moreover, researchers state that while clear diagnostic criteria for PDD-NOS is not provided and is often thought of as a diagnosis of exclusion, PDD-NOS diagnoses can be described in several ways: children who have fewer than six symptoms total, children with an age of onset after 36 months, subthreshold autism, or atypical autism in which the child possesses only two out of the three core features (Buitelaar, Van der Gaag, Klin, & Volkmar, 1999; Matson & Boisjoli, 2007; Walker et al., 2004). Atypical autism may often be presented as possessing only one of these two core features; thus, the correlation between these constructs is thought to be low.

Hypothesis 4

These C-S correlations were then compared and tested for significant differences among the three diagnostic groups. It was first hypothesized that the C-S correlation for the AD group would significantly differ from the C-S correlations for the PDD-NOS group as a diagnosis of PDD-NOS is often given when the child possesses subthreshold symptoms of autism.

Hypothesis 5

The non-ASD related developmentally delayed group was also hypothesized to differ significantly from the AD group as well. As previously stated, unlike a diagnosis of autism, impairments in these two areas (communication and socialization) are not required for PDD-NOS or developmental delay (APA, 2000); thus, the communication – socialization behavioral profiles are thought to quite different.

Hypothesis 6

Lastly, the C-S correlation for the PDD-NOS group was not hypothesized to significantly differ from the C-S correlation for the group with non-ASD related developmental delay. A

diagnosis of PDD-NOS is acceptable when the child possesses subthreshold symptoms of autism (Buitelaar, Van der Gaag, Klin, & Volkmar, 1999). Thus, these subthreshold symptoms in the communication and socialization domains may be of the same severity as atypical development, and the subthreshold repetitive and restricted behaviors and interests is what best distinguishes these two groups. Therefore, if the C-S correlations for these two groups are both believed to be low, then these low C-S correlations should not differ significantly from one another.

Finally, a regression analysis was conducted to determine which of the six communication items on the *BISCUIT-Part1* best predict socialization scores on the P-S domain of the *BDI-2*. While this analysis was exploratory in nature and not theory-driven, no hypotheses were formulated for these results.

Methods

Participants

Five hundred ninety one children have been selected to serve as the participant sample for this study. Ranging from 17 to 37 months of age ($M = 26.03$; $SD = 4.71$) these infants and toddlers were recruited through the EarlySteps program funded by the State of Louisiana. EarlySteps 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 have developmental delays or a medical condition likely to result in a developmental delay qualify for services through EarlySteps. 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. The diagnosis relied upon scores attained on the *M-CHAT*, the *DSM-IV-TR* criteria, and the developmental profiles from the *BDI-2* (Matson et al., 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. 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 are equal, each with 197 participants. This process was conducted by utilizing the select random cases function in SPSS. Therefore, 1 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 atypically developing group, the children were between the ages of 18 to 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.

To determine if the diagnostic groups differed significantly on demographic variables (i.e., gender, ethnicity, or age) *a priori* analyses were run (Matson, Rivet, Fodstad, Dempsey & Boisjoli, 2009). The results from chi-square analyses revealed that the groups did not differ significantly in 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. Demographic information is presented within Table 1.

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%

Measures

Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT). The *Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT)* 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). The *BISCUIT* is a battery of assessments designed to assess autism in young children along with PDD-NOS, comorbid psychopathology, and challenging behaviors. The *BISCUIT-Part 1* is the section concerned with diagnostic criteria consisting 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, Boisjoli, Hess, & Wilkins, 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 (the full list of items can be found in the Appendix). This communication domain has been determined to have a good internal consistency of 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 a 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).

Battelle Developmental Inventory, Second Edition (BDI-2). The *Battelle Developmental Inventory, Second Edition (BDI-2;* Newborg, 2005) is a revision of the original *BDI*. The revisions include, but is 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 to 2 hours. 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 2,500 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 intentions 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). It is made up of 3 subdomains: Adult Interaction (AI), Peer Interaction (PI), and Self-Concept and Social Role (SR). The AI subdomain is made up of 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 of 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.

Reliability studies of the *BDI-2* found good internal reliability 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).

Procedure

Parental interviews and child observations were conducted by individuals whose training qualified them to screen children that may benefit from services provided by EarlySteps. Physical therapy, occupational therapy, social work, education, speech-language pathology, and psychology are the various disciplines that the evaluators were educated in (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 serve 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.

Statistical Procedures

All statistical analyses were carried out using SPSS 16.0. As mentioned earlier, the groups were not found to significantly differ in regards to demographic variables. To fulfill assumptions of normal distribution, a Kolmogorov-Smirnov test of normality was conducted to test for significant differences between the distribution of scores within this sample and a normal distribution for both the overall communication score and the overall developmental quotient on the P-S domain of the *BDI-2* (Field, 2009). The results of the Kolmogorov-Smirnov test were significant indicating that the data was not normally distributed for both the overall communication score of the *BISCUIT*, $D(591) = .21$, $p = .00$, and the overall developmental quotient on the P-S domain of the *BDI-2*, $D(591) = .05$, $p = .01$. While significant differences were found, Field (2009) states that this is a common finding of this test when sample sizes are very large. In instances such as, this the Kolmogorov-Smirnov test often finds significant differences even though the distribution is only slightly different from that of a normal distribution due to the large sample size. For that reason, it was decided that parametric statistics met a level of robustness that would overcome the violation of normality with a sample of 591 participants. Additionally, equal sample sizes within each group allow the assumption of homogeneity of variance to be satisfied (Field, 2009; Leech, Barrett, & Morgan, 2008).

GPOWER, a power analysis computer program, was used to establish appropriate sample sizes *a priori* for all analyses (Erdfelder, Faul, & Buchner, 1996). Appropriate levels of power, alpha, and effect size were used for all analyses as determined by the literature (Cohen, 1992; Cohen, 1997; Cohen, 2008). As the dataset for all analyses exceeded the sample sizes indicated as necessary by the power analysis, all participants meeting criteria (i.e., within appropriate age limits) and those without any missing data were included in all analyses.

A 3x2 MANOVA was conducted with the overall communication score on the *BISCUIT-Part 1* and the P-S domain score of the *BDI-2* serving as dependent variables. The independent variable for this analysis was group membership (i.e., Autism, PDD-NOS, Atypically Developing). As the Pillai-Bartlett trace is said to be the most robust to violations of assumptions with equal sample sizes, this was the test statistic used for this analysis (Bray & Maxwell, 1985; Olson, 1976; Stevens, 1979). 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*. Again, the diagnostic groups will be the independent variable. To account for the inflation of type-I errors, Tukey *post hoc* tests were conducted following significant ANOVAs.

Prior research has shown that communicative and social abilities are strongly connected, and deficits in either of these areas can greatly differ amongst different diagnostic groups (e.g., Autism, PDD-NOS, and atypically developing with no ASD). The next set of analyses involved identifying if 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* 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 Atypically Developing). These three correlations were then compared 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. Therefore, $\alpha = .02$ was used for all correlations.

Next, a sequence of forced entry regression analyses were carried out with the 6 communication items on the *BISCUIT* serving as the predictor variables and the socialization score (i.e., the developmental quotient score of the P-S domain of the *BDI-2*) serving as the outcome variable. The Durbin-Watson test statistic was computed to determine if the assumption of independent errors has been violated. The VIF and correlation statistics were also analyzed in the output to determine if multicollinearity is a problem. Field (2009) states that there is no cause for concern if the VIF values are either less than 10 or if the average VIF value is not substantially greater than 1 and if the correlation coefficients are no greater than .80. A plot of *ZRESID and *ZPRED was inspected to determine if the assumption of heteroscedasticity was met. The resulting histogram and normal probability plot were also examined to check for normal distribution of the residual terms.

Results

A 3x2 MANOVA was conducted to test for differences among the three groups, Autism, PDD-NOS, and Atypically Developing with no ASD, 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, $F(4, 1176) = 71.69, p < .001$.

Hypothesis 1

Separate univariate ANOVAs on the outcome variables were significant across diagnostic group effects on communication, $F(2, 588) = 117.22, p < .001$, and socialization, $F(2, 588) = 86.08, p < .001$. In regards to communication, the hypothesis was partially supported. It was revealed that the Autism group did not differ significantly when compared to the group with a PDD-NOS diagnosis, $p = .062$. Significant differences were found for communication, however between the Autism group and Atypically Developing group, $p < .001$, and between the PDD-NOS group and the Atypically Developing group, $p < .001$. See Figure 1 for a depiction of the mean scores on the communication domain of the *BISCUIT* for all diagnostic groups.

Hypothesis 2

For socialization, all comparisons (i.e., Autism vs. PDD-NOS; Autism vs. Atypically Developing; and PDD-NOS vs. Atypically Developing) were found to differ significantly, $p < .001$, universally. See Figure 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*.

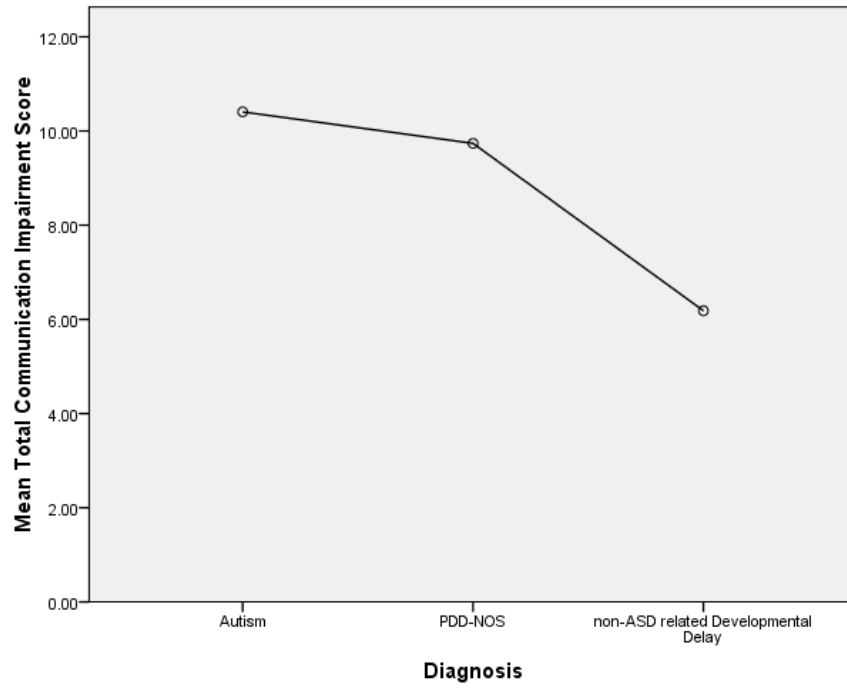


Figure 1. Mean score on the communication domain of the *BISCUIT* for autism, PDD-NOS, and non-ASD related developmental delay

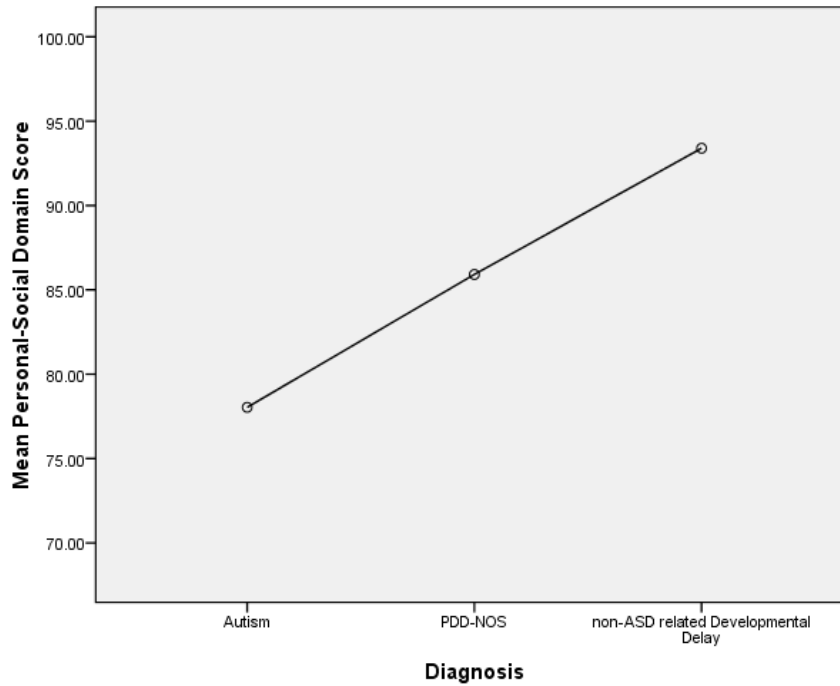


Figure 2. Mean score on the P-S domain of the *BDI-2* for autism, PDD-NOS, and non-ASD related developmental delay

Hypothesis 3

Next, two-tailed bivariate correlations were calculated for communication and socialization scores for each of the three diagnostic groups. Of the three correlations analyzed, two were found to be clinically significant; thus, the hypothesis was partially supported. For the Autism group, the overall communication score on the *BISCUIT-Part 1* was strongly correlated with the *BDI-2* P-S domain developmental quotient, $r = -.207, p < .01$. For those with non-ASD related developmental delays, level of communicative abilities on the *BISCUIT-Part 1* was also strongly related to socialization level on the *BDI-2*, $r = -.187, p < .01$. There was a weaker relationship, however, between communication and socialization for the PDD-NOS group at the .02 level, $r = -.137, p = .05$.

Hypothesis 4

Analyses were conducted to test for significant differences between these three correlations. When comparing the Autism group with those with a PDD-NOS diagnosis, the relationship between communication and socialization was not significantly stronger in either group; thus, significant differences were not found, $z = -.711$, $p = 0.48$.

Hypothesis 5

Non-significant differences were found when comparing the correlations for communication and socialization for the Autism and Atypically Developing group, $z = -.205$, $p = 0.84$, as well.

Hypothesis 6

Finally, significant differences were not found for the communication/socialization relationship when comparing the PDD-NOS and Atypically Developing group, $z = .506$, $p = 0.61$.

Finally, communication items on the *BISCUIT* which may predict socialization level on the *BDI-2* were examined using multiple regression. To assess for the assumption of multicollinearity was not violated, the correlations between all six predictors were inspected. Field (2009) states that a correlation coefficient below .80 meets the multicollinearity assumption meaning that the predictors are measuring different constructs. This was the case for all inter-item correlations, and the VIF statistics for each predictor was less than 10 and not substantially larger than one; thus, this assumption of multicollinearity was not violated. The assumption of normally distributed errors was not violated which was determined by inspection of the histogram and normal probability plot (Field, 2009). Additionally, to meet the assumption of categorical predictor variables with no more than two categories, severity of endorsement was

not accounted for in this analysis. Thus, data was configured to depict either no endorsement or any endorsement. A singular score of one (i.e., mild impairment) or a score of two (i.e., severe impairment) was coded as endorsement of each item; whereas, a score of zero (i.e., no impairment) indicated no endorsement. These results, however, should be interpreted with caution as the assumptions of independent errors and homoscedasticity have been violated. The Durbin-Watson test computed a coefficient of .700 which indicates a positive correlation between the residual terms (Field, 2009) violating the assumption of independent errors. The assumption of homoscedasticity appears to have been violated as the data does not appear to be evenly dispersed around zero in a plot of *ZRESID and *ZPRED.

Keeping in mind the limitations of this data, a significant model was found, $R^2 = .059$, $F(6, 584) = 6.09$, $p = .00$. Upon inspection of the beta values, the predictors which made significant contributions to this model were item 16 (*use of language in conversation with others*), $t(584) = -2.10$, $p = .04$, and item 24 (*communicates effectively (e.g., using words, gestures or sign language)*), $t(584) = -2.54$, $p = .01$. See Table 2 for a depiction of the beta values, standard errors, and standardized beta values for all six predictor variables.

Table 2
Beta Values, Standard Errors, and Standardized Beta Values for Predictor Variables

	B	SE B	B
Item 1	-5.02	2.63	-.104
Item 5	-1.45	2.79	-.030
Item 9	.892	2.57	.020
Item 16	-3.66	1.74	-.102*
Item 24	-3.73	1.47	-.120*
Item 50	1.27	3.11	.024

Note: * indicates significance at the .05 level or lower.

Discussion

Although ASDs have recently been receiving great attention among researchers in the scientific community (Evans et al., 2001; Lord & Luyster, 2006), few studies examine symptomatology prior to age 3 (Matson, Wilkins, & Gonzalez, 2008). Given that the general consensus among researchers is that diagnoses are present from birth (Baghdadli, Picot, Pascal, Pry, & Aussillou, 2003; Kanner & Eisenberg, 1957; Rogers, 2000), infancy and toddlerhood is a crucial developmental period to study. Many have attempted to gain insight into this time of development through the use of retrospective studies, which possess many limitations making real time assessments the ideal method of study (Brown, Dawson, Osterling, & Dinno, 1998; Saint-Georges et al., 2010; Ozonoff et al., 2010). This is precisely what this current study aimed to do, by comparing the socialization and communication deficits between children with AD, PDD-NOS, and atypical development with no ASD diagnosis.

Hypothesis 1

In 2010, Horovitz and Matson studied communication deficits in children with Autistic Disorder, children with a diagnosis of PDD-NOS, and children without an ASD but determined to have atypical development. While this current study examines this construct from children of this sample, an updated sample was used and only included those who had been administered the *BDI-2*. This current study also examined the interplay of socialization and communication deficits with this sample. Some differences, however, were found with this updated sample. Children with autism did not have significantly more communication impairments than the children with the PDD-NOS diagnosis, which does not support the hypothesis.

In regard to communication deficits, the Autism group and the PDD-NOS group did not significantly differ from one another. Rationale for this finding may rest upon the fact that many

researchers argue that communication impairments are the main deficit of ASDs and tend to be the most pervasive (Rutter, 1968; Rutter & Bartak, 1971). While their prevalence in relation to the two other impairments that characterize ASDs (i.e., socialization impairments and repetitive or restricted behaviors and interests) is inconclusive, deficits with communicative abilities may be more noticeable to parents of young children. These parents may not find socialization problems or stereotyped behaviors to be as evident or may not yet consider these symptoms to be a problem at this early stage in their child's life. As such, speech and language delays are said to be one of the most common and among the first concerns of parents with children who were later diagnosed with autism (Goin-Kochel & Myers, 2004; Kishore & Basu, 2011).

Furthermore, the non-significant findings between the Autism group and the PDD-NOS group in regards 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 into determining where the line that distinguishes communicative abilities for these two disorders lies. 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., 2006; Matson, Fodstad et al., 2009b; 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 rationale for the non-significant findings

between these two groups. Another explanation of these findings may be located within the proposed revisions to ASDs for the *DSM-V*. PDD-NOS is being subsumed under the diagnosis of Autistic Disorder which is going to be defined by only two core features (i.e., social/communication deficits and fixated interests and repetitive behaviors). It is being suggested that language impairments are more of a factor that influences the severity of other ASD symptoms (i.e., socialization deficits) rather than acting as a defining characteristic of ASDs (APA, 2010). Therefore, determining any definite separation between these two groups in terms of this construct needs to be done with caution as this current study failed to detect significant differences between these two disorders within this sample.

Secondly, the communicative impairments were found to be significantly greater in children with a diagnosis of PDD-NOS in relation to children with non-ASD related developmental delays. These results are in agreement with the hypothesis and the findings of Horovitz and Matson (2010). Children of the current sample determined to have non-ASD related developmental delays received this diagnosis from family pediatricians. It is unknown as to how these pediatricians formulated these diagnoses and what symptoms their decisions were based upon; therefore, we do not know if, and to what extent, communication deficits were assessed. Furthermore, 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. With this confidence, these findings suggest that it is possible to differentiate children with PDD-NOS from developmentally delayed children in respect to communication impairments.

Also in regards to communication, significant differences were found between the Autism group and the non-ASD developmental delay group, which is consistent with the results from the Horovitz and Matson (2010) study. The children with autism displayed more impairment in this area than those with non-ASD related developmental delay. This finding is in support of the hypothesis. In sum, these results suggest that deficits in communication can aid in differentiating between not only those with ASDs and typically developing children but also 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.

Hypothesis 2

Socialization scores were also examined among these three diagnostic groups to test for significant differences. The results of this construct were in support of all three hypotheses regarding socialization. The AD group had significantly more socialization impairments, which were displayed through lower scores on the P-S Domain of the *BDI-2*, than the PDD-NOS group and the group with non-ASD related developmental delays. Additionally, children with a diagnosis of PDD-NOS evinced more deficits in socialization when compared to those with non-ASD related developmental delay. 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 fact, and the treatment of ASDs should place emphasis on this deficit when trying to attain a higher level of functioning.

In conclusion, the results from the current study suggest that communication and socialization deficits can clearly distinguish between those with and without an ASD diagnosis

and partially distinguish between those with Autistic Disorder and PDD-NOS even at ages prior to age 3. This is in support of and strengthens the argument for early detection and diagnosis of ASDs and that diagnoses can be made prior to age 3 (Baird et al., 2001; Matson, Wilkins, & Gonzalez, 2008). Although many aver for earlier detection of behavioral symptoms because there currently are no biological markers for ASDs (Barbaro & Dissanayake, 2009), little research has been done to substantiate this argument. Nevertheless, earlier detection and interventions provide a better prognosis for these young children (Matson, Wilkins, & Gonzalez, 2008).

Hypothesis 3

Next, 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 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. Additionally, 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). Thus, 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. This is especially important since most ASDs diagnoses are not made

until the child is 3 years of age. 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.

Hypotheses 4-6

Moreover, 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. The correlation between communication and socialization for the Autism group did not significantly differ from the children with PDD-NOS and with non-ASD related developmental delay. Additionally, the PDD-NOS group did not differ from the correlation for the non-ASD related atypically developing group. 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 items. Researchers may also consider conducting future research which examines if these differences increase or decrease with age which would suggest that these diagnostic groups

would either be easier to distinguish between as children become older based on this particular relationship or that these diagnostic groups become even more similar to one another, when only considering communication and socialization relationships.

Finally, the six communication items of the *BISCUIT-Part 1* were entered as predictors for socialization deficit level in a multiple regression. “Use of language in conversation with others” (item 16) and “communicates effectively (e.g., using words, gestures, or sign language)” (item 24) were found to be significant predictors of socialization. While this analysis was exploratory in nature and not theory-driven, no hypotheses were formulated for these results. These findings, however, suggest for those administering the *BISCUIT-Part 1* to pay close attention to severity endorsements of these two items.

One should consider the possible limitations of this current study while interpreting the results. The inability to account for intelligence is one limitation. Research has shown level of ID to affect adaptive functioning, including communication and socialization abilities (Matson & Shoemaker, 2009). However, the participants recruited for this study consisted of infants and toddlers 17 to 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 consideration regarding limitations of this study would involve 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 are administered to all participants of this study, the Peer Interaction subdomain is only administered to children between the ages of 24 to 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 to 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 to 23 months of age ($r=.95$).

The findings of this current study help not only diagnosticians, but parents as well in understanding the behavioral presentation of young children with an ASD. Research has shown that the earlier an intensive behavioral intervention is implemented, the better the prognosis for that child (Matson, Wilkins, & Gonzalez, 2008). This research has supported the cause for researchers to develop measures, identify early symptoms, and ultimately diagnose children with ASDs at an earlier age. To provide the best supports and interventions possible, children must first be properly diagnosed. Based upon the results of this study, children with an ASD display significantly more communication and socialization deficits than do children of typical or atypical development between 17 and 37 months of age. Additionally, children with Autistic Disorder evince significantly more socialization impairments than children with PDD-NOS.

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 which were the focus of this study; 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 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, 2010); 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 as previously stated. This will instruct the scientific community on how the dynamic of this relationship either strengthens or diminishes as these young children age.

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Appendix

Factor Loadings for the BISCUIT-Part 1

Item	Factor 1	Factor 2	Factor 3
	Repetitive Behavior/ Restricted Interests	Socialization/ Nonverbal Communication	Communication
58. Abnormal, repetitive motor movements involving entire body	.*		
41. Use of facial expressions	*		
29. Eye-to-eye gaze	*		
48. Becomes upset if there is a change in routine	*		
42. Abnormal fascination with the movement of spinning objects	*		
27. Restricted interests and activities	*		
39. Interest in a highly restricted set of activities	*		
26. Display a range of socially appropriate facial expressions	*		
8. Maintains eye contact	*		
43. Curiosity with surroundings	*		
4. Engages in repetitive motor movements for no reason	*		
34. Abnormal preoccupation with parts of an object or objects	*		

61. Isolates self	*	
49. Needs reassurance, especially if events don't go as planned	*	
57. Abnormal, repetitive hand or arm movements	*	
55. Limited number of interests	*	
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6. Prefers food of a certain texture or smell	*	
38. Expects others to know their thoughts, experiences, and opinions without communicating them	*	
33. Sticking to odd routines or rituals that don't have a purpose of make a difference	*	
11. Reactions to normal, everyday sounds	*	
13. Reaction to normal, everyday lights	*	
30. Reaction to sounds and sights	*	
44. Saying words or phrases repetitively	*	
7. Ability to recognize the emotions of others		*
51. Responds to others' distress		*
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20. Interest in another person's side of the conversation		*
46. Understand of appropriate jokes, figures of speech, or sayings		*
18. Ability to make and keep friends		*

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|---|---|
| 47. Gives subtle cues or gestures when communicating with others | * |
| 21. Able to understand the subtle cues or gestures of others | * |
| 22. Use of too few or too many social gestures | * |
| 19. Interest in participating in social games, sports, and activities | * |
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- | | |
|---|---|
| 59. Development of social relationships | * |
| 23. Body posture and/or gestures | * |
| 28. Motivated to please others | * |
| 36. Reads nonverbal cues of other people | * |
| 32. Facial expressions corresponds to environmental events | * |
| 12. Responds to others social cues | * |
| 14. Peer relationships | * |
| 52. Socializes with other children | * |
| 35. Plays appropriately with others | * |
| 62. Participation in games or other social activities | * |
| 45. Make-believe or pretend play | * |
| 10. Social interactions with others his/her age | * |
| 17. Shares enjoyment, interests, or achievement with others | * |

2. Intellectual abilities	*	
3. Age appropriate self-help and adaptive skills	*	
9. Use of language to communicate		*
1. Communication skills		*
5. Verbal communication		*
50. Language development		*
16. Use of language in conversations with others		*
24. Communicates effectively		*
53. Use of non-verbal communication		

Note. Factor loadings of each item are indicated by an asterisk.

Vita

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