Gender and Comorbid Psychopathologies in Toddlers with Autism Spectrum Disorders

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By

Erica Buchholz
Bachelor of Arts
Wilkes University, 2007

Director: Johannes Rojahn, Professor
Department of Psychology

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George Mason University
Fairfax, VA

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Abstract

GENDER AND COMORBID PSYCHOPATHOLOGIES IN TODDLERS WITH AUTISM SPECTRUM DISORDERS

Erica Buchholz, Ph.D.

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Dissertation Director: Dr. Johannes Rojahn

Comorbid psychopathology, the co-existence of two or more disorders, often occurs in individuals with developmental disabilities. This study examined whether there were sex differences in five types of psychopathology in three groups of infants and toddlers: (1) a group with autism (n = 201), (2) a group with pervasive developmental disorder, not otherwise specified (PDD-NOS) (n = 254), and (3) a group at risk for developmental delays but without autism or PDD-NOS (n = 1146). The three groups were compared in a cross-sectional design at three ages: 12 to 24 months, 25 to 31 months, and 32 to 39 months of age. Five types of psychopathology (conduct/tantrum problem behaviors, inattention/impulsivity, anxiety, avoidance, and eating and sleeping problems) were assessed with the *Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT) – Part 2 for Infants and Toddlers.* The major statistical analyses consisted of a factorial MANOVA and a factorial ANOVA. Results showed that children with autism were at the

greatest risk for comorbid psychopathologies, followed by children with PDD-NOS, and then atypically developing children. Older children with autism were more strongly affected with comorbid symptoms than younger children with autism. Additionally, older children with PDD-NOS were more strongly affected by comorbid symptoms compared to younger children with PDD-NOS. No gender differences were found.

1. Introduction

Autism Spectrum Disorder (ASD) refers to a group of neurodevelopmental disorders that consist of Autistic Disorder, Asperger's Disorder and Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS). ASD consists of diagnostic conditions that are part of the broader category of Pervasive Developmental Disorders as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, text revision *(DSM-IV-TR*) (American Psychiatric Association, 2000), which also includes Rett's Disorder and Childhood Disintegrative Disorder. The latter two conditions have been found to have marked difference with ASD and have therefore been treated as separate from ASD. ASD, which emerges before age three is characterized by impaired development in socialization, and communication and the presence of repetitive behavior will affect an individual throughout his or her lifetime (Levy, Mandell & Schultz, 2009).

2. Autism Spectrum Disorder (ASD)

2.1 Diagnostic Criteria (DSM-IV-TR)

Pervasive Developmental Disorders (PDD) is the category in *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, text revision *(DSM-IV-TR*) that holds criteria for the five PDDs, including the Autism Spectrum Disorders (ASDs). These five disorders include: Autistic Disorder, Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), Asperger's Disorder, Rett's Disorder, and Childhood Integrative Disorder.

The term Autism Spectrum Disorder (ASD) will be used to refer to three of the PDDs, Autistic Disorder, Asperger's Disorder and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS). In other words, this discussion will exclude Rett's Disorder and Childhood Disintegrative Disorder. ASDs are neurodevelopmental disorders, the exact etiology of which is still unknown (Johnson, Myers, & The Council on Children with Disabilities, 2007). Leo Kanner (1943), an American Psychiatrist of Austro-Hungarian descent was the first to describe autism disorder in children who showed aloofness and indifference to other people. A year later, Hans Asperger (1944), a Viennese pediatrician, unaware of Kanner's work, published an article in a German Language journal describing a group of patients he referred to as "Autistische Psychopathen" (autistic psychopaths), who had higher verbal and cognitive skills, than

Kanner's sample. These early clinical studies ultimately led to the creation the diagnostic category of "infantile autism" adopted in the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (DSM-III) (Johnson et al., 2007).

Since that time, terminology has changed and a clearer understanding of the behaviors and symptoms associated with autism and its varying spectrum disorders has developed. The following are the DSM-IV diagnostic criteria for the three ASD conditions:

2.1.1 Criteria for Autistic Disorder

The DSM-IV-TR diagnosis for Autistic Disorder requires the presence of symptoms in three specific categories:

1. Qualitative impairment in social interaction (marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction, failure to develop peer relationships appropriate to developmental level, lack of spontaneous seeking to share enjoyment, interest, or achievements with other people, lack of social or emotional reciprocity).
2. Qualitative impairments in communication (delay in, or total lack of, the development of spoken language, stereotyped and repetitive use of language or idiosyncratic language, lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level).
3. Restricted repetitive and stereotyped patterns of behavior, interests and activities (encompassing preoccupation with one or more stereotyped and restricted patterns of

interest that is abnormal either in intensity or focus, apparently inflexible adherence to specific, nonfunctional routines or rituals, stereotyped and repetitive motor mannerisms, persistent preoccupation with parts of objects). Additionally, there should be delays or abnormal functioning in at least one of the following areas, with onset prior to age three years: 1) social interaction, 2) language as used in social communication, or 3) symbolic or imaginative play. Additionally the disturbance should not be better accounted for by Rett's Disorder or Child Disintegrative Disorder.

2.1.2 Criteria for PDD-NOS

The diagnostic criteria as set in the DSM-IV-TR for PDD-NOS notes that this label should be used when there is a severe and pervasive impairment in the development of reciprocal social interaction or verbal and nonverbal communication skills, or when stereotyped behavior, interests, and activities are present, but the criteria are not met for a specific pervasive developmental disorder, schizophrenia, schizotypal personality disorder, or avoidant personality disorder. Although autism is on a spectrum, these two diagnoses are commonly studied. PDD-NOS and autistic disorder are the main disabilities of focus in this review.

2.1.3 Criteria for Asperger's Disorder

For diagnosis of Asperger's Disorder six criteria must be fulfilled:

1. Qualitative Impairment in social interaction, as manifested by at least two of the following: (1) in the use of multiple nonverbal behaviors, such as eye-to-eye gaze, facial expression, and gestures to regulate social interaction; (2) in peer

relationships appropriate to developmental level; (3) lack of seeking to share enjoyment, interests or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people); (4) lack of social or emotional reciprocity.

2. Restricted, repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following: (1) encompassing preoccupation with one or more stereotyped and restricted patters of interest that is abnormal either in intensity or focus (2) apparently inflexible adherence to specific, nonfunctional routines or rituals (3) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements) (4) persistent preoccupation with parts of objects.
3. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.
4. There is no clinically significant general delay in language (e.g., single words used by age two years, communicative phrases used by age three years).
5. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.
6. Criteria are not met for another specific pervasive developmental disorder or schizophrenia.

Asperger's Disorder will not be discussed further in this study. Given that language skills are important parts of the diagnosis, this diagnostic label is typically not used in children as young as those we are focusing on in this project.

2.2 Etiology/Causation of ASD

Functional neuroimaging of individuals with an ASD suggest that there may be various abnormalities in brain structure across individuals, but no one focal defect has been reliably identified (Johnson & de Haan, 2006). There are few longitudinal studies that examine brain structure and function in individuals with ASD that suggest abnormalities can vary with age (Johnson & de Haan, 2006). In addition, exposure to early experiences and exposure to teratogenic substances can directly affect brain development in terms of the rate at which certain functions develop, and the specialization processes and localization of function development.

An autism spectrum disorder will affect an individual for their entire life, as there is no cure and the development of the individual across their life is delayed. However, there is the additional concern of a comorbid diagnosis with an autism spectrum disorder. Along with the behavioral issues of autistic disorder or pervasive developmental disorder, many children develop comorbid disorders. The combined effect of the disorders can make identification and treatment challenging and complex.

Although there have been several theories about the causation of autism spectrum disorders, empirical support has been lacking. The consensus is that ASD is the outcome of the complex multiple gene interactions (as cited in Kozlowski, Matson & Worley,

2012; Cook, 1998; Mazefsky, Goin-Kochel, Riley, & Maes, 2008; Muhle, Trentacoste, & Rapin, 2004; Nebel-Schwalm & Matson, 2008). Genetic studies of twins have shown that monozygotic twins show a much higher concordance rate for autism spectrum disorders (36-91%) when compared to dizygotic twins (0-10%) (as cited in Kozlowski, Matson & Worley, 2012; Bailey et al., 1995; Folstein & Rutter, 1977; Muhle, Trentacoste, & Rapin, 2004; Steffenburg et al., 1989). Since the concordance rates are not 100% for monozygotic twins, it suggests that multiple gene interactions play a vital role in the occurrence of autism spectrum disorders. Additionally, studies examining siblings with and without autism, suggest that genetics play a role in the development of the disorder for at least some of the individuals ultimately diagnosed with an autism spectrum disorder (Kozlowski, Matson & Worley, 2012). The prevalence of autistic disorder among siblings of individuals with autistic disorder ranges from 2-6%, with estimates as high as 14% for siblings of females with autistic disorder (Newschaffer, Croen, Daniels, Giarelli, Grether, … Windham, 2007). Family studies have shown that about 20% of siblings who have a sibling with an autistic disorder may have more subtle variants of the core features of autism spectrum disorders, such as aloofness, limited friendships, and preference for predictable routines (Newschaffer et al., 2007).

2.3 Epidemiology

2.3.1 Prevalence

Prevalence rates, a measure of the total number of cases of disease in a population, for ASD have increased since Kanner and Asperger's time. To what extent

that increase is merely a function of changes in terminology, change in diagnostic criteria, education about the disorder for practitioners, researchers and caregivers, advancements in research techniques, better assessment techniques, and increased awareness of the disorder and its associated behaviors in the general population across the globe are being debated.

Through the 1980s autism spectrum disorders were thought to be rare, with a prevalence of 5 per 10,000 individuals (Newschaffer et al., 2007). Levy, Kim, and Olive (2006) note that the prevalence of autism has increased dramatically with increased research results broadening the concept of ASD. The U. S. Department of Education (2000; as cited in Levy, et al., 2006) reported that the number of children with autism increased by 244% between 1993 and 1998. The increase in prevalence could be due to a variety of factors, including improved assessment tools, broader definition of ASD, or exposure to certain environmental toxins. Before the 1990's estimates were that one in every 2,000 to 5,000 children were affected by autism. There is now an estimated prevalence of one in every 88 children in the United States (Autism and Developmental Disabilities Monitoring Network Surveillance Year 2008 Principal Investigators, 2012).

2.3.2 Incidence

The incidence rate is the number of new cases per population in a given time period. This measure can be challenging to acquire, as the process of diagnosis with an autism spectrum disorder can vary greatly between individuals. The time between initiation of the disorder and the timing of acquiring a clinical diagnosis can be

influenced by a wide range of factors potentially unrelated to the risk of developing an autism spectrum disorder. Parent education can affect the speed at which a child is diagnosed after they begin to exhibit symptoms. Since behavioral symptoms associated with ASD do not always present at the same time in every person, not all individuals can be identified with ASD at the same point in their development. According to Rutter (2005), the true incidence of ASD is likely to be within the range of 30–60 cases per 10,000. This is an increase over the original estimate 40 years ago of 4 per 10,000 (Rutter 2005). The increase is likely due to improved ability to diagnose individuals with autism at a younger age, a clearer understanding of an ASD, and a broadening of the diagnostic concept (Rutter, 2005).

2.3.3 Relation to Gender, Cognitive Impairment and Ethnicity

According to Newschaffer and colleagues (2007), males are affected with autism spectrum disorders more frequently than females with a ratio of 4.3:1. Cognitive impairment can affect the sex ratio, as those with an intellectual disability (ID) have a sex ratio where for every 2 males, one female is diagnosed with a comorbid autism spectrum disorder. Intellectual disability and an ASD can be comorbidly diagnosed. The more severe the person's ID, the more likely it is for the person to also have a diagnosis of ASD. Additionally, for those individuals with the comorbid diagnosis of ASD and ID, those with lower IQ scores tend to exhibit significantly higher rates of stereotyped behaviors and self-injury (Matson & Shoemaker, 2009). One study reports that the rates of individuals with ASD and ID are about 50-70% of all ASD cases (Matson &

Shoemaker, 2009). Factors that influence racial and ethnic vulnerability across studies include participant selection process, consideration of autism subtypes and immigration status (Newschaffer et al., 2007). In national surveys, frequency of parental reports of autism diagnosis is comparable in black and white children, but is significantly lower in Hispanic children.

2.4 Assessment Instruments for ASD

Various assessment instruments have been developed to aid in the identification of children at risk for ASD and the diagnosis of ASD. Each assessment instrument is used after parents, teachers, or pediatricians notice delays in development. As described by Dumont-Mathieu and Fein (2005), documentation of the variety of behavioral signs of autism demonstrated in very young children suggests the need for early screening. According to Begeer, Koot, Rieffe, Terwogt, and Stegge (2008), review of current empirical studies on autism show that the main research focus is primarily on school-age children within the normal IQ range. Because autism is a disorder that begins affecting development before a child enters school, there is a great need for longitudinal analyses to establish reliable diagnoses and provide understanding into the long-term effects on development.

Dumont-Mathieu and Fein (2005) suggest that parents, whose children are ultimately diagnosed with autism, may report symptoms of atypical development around the age of 1.5 years. Unfortunately however, a definitive diagnosis of ASD is commonly not made until children are around four years old (Dumont-Mathieu & Fein, 2005).

Growing evidence suggests that: (1) children can be reliably diagnosed with autism by age 24 months; (2) the neurobiology of infants with ASD can be distinguished in the first two years of life; and (3) developmental differences can be noted as early as 12 months (Dumont-Mathieu & Fein, 2005). When retrospectively viewing videotapes of first-year birthday parties of children diagnosed with autism, aspects of atypical development can become apparent (Osterling & Dawson, 1994). How often a child looked at other people was their best predictor of a later autism diagnosis. Combining this with the behavior of pointing, 91% of cases of autism were correctly classified merely by examining the videotape of the child's birthday. This evidence shows the need to attend to joint attention, eye contact, and orientation to speech behaviors shown by very young children (Osterling & Dawson, 1994). All of this evidence supports the need to examine atypical development as early as possible.

2.4.1 Diagnostic Instruments: Autism Diagnostic Interview-Revised, Autism Diagnostic Observation Scale

There are no diagnostically informative biological tests for autism spectrum disorders. Therefore, the diagnostic criteria are behavioral, including specific numbers and levels of impairment in the three core domains (Newschaffer, et al., 2007). There are various assessment instruments used to aid in the diagnosis of autism, such as the Autism Diagnostic Interview-Revised (ADI-R) (Rutter, Lecouteur, & Lord, 2003) and the Autism Diagnostic Observation Scale-Generic (ADOS-G) (Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, et al., 2000).

The ADI-R is an 85 page semi-structured interview with the parent. The administrator must be trained to conduct the ADI-R and takes two hours to complete and score. This clinician must be familiar with the developmental timeline of the individual, especially the preschool period (Murray, Mayes, & Smith, 2011). The measure is appropriate for an individual with a mental age of two years or older. The assessment tool differentiates children with autism from non-autistic clinical and typically developing children. Of note, as the diagnostic criteria of the varying autism spectrum disorders changes with the new version of the DSM, the structure and scoring of the ADI-R will have to change. Additionally, symptom stability can be uncertain in young children with autism, therefore the diagnostic ability of the ADI-R has been a topic of concern for researchers. To address this issue, the ADI-R Domain and Total scores have been assessed by a variety of researchers (Soke, Philofsky, Diguiseppi, Lezotte, Rogers, & Hepburn, 2011).

Another common assessment is the Autism Diagnostic Observation Schedule-Generic (ADOS-G), which is based on observations of behaviors (Lord, Risi, Lambrecht, Cook, Leventhal … & Rutter, 2000). Observations are not completed by parents, but rather by a professional trained on the ADOS-G. The observation period can last between 30-45 minutes. There are semi-structured assessments of communication, social interactions and relatedness, play, and imagination (Pandey, Verbalis, Robins, Boorstein, Klin, … & Fein, 2008). There are planned social interactions and opportunities for the children to engage in imaginative play. The child receives a score in several domains and exceeding specified cutoff scores determines a classification.

The ADOS-G has been developed to assess verbal and non-verbal young children. It has also been designed to measure social and communication deficits in autism spectrum disorders. This instrument requires substantial training and practice. Pediatricians are not advised to administer this assessment. At-risk toddlers should complete a developmental assessment with a pediatrician, and then be referred to a clinician who is trained in the ADOS-G. A limitation of the ADOS-G is the lack of opportunity to measure restricted and repetitive behaviors (Lord et al., 2000). The ADOS-G alone cannot be used to make a complete standard diagnosis since it does not include information about personal history or behavior in other contexts (Lord et al., 2000).

Lord and colleagues (2000) found excellent inter-rater reliability, internal consistency and test-retest reliability on the (1) item, (2) domain, and (3) classification levels for autism and non-spectrum disorders when using the ADOS-G. The validity of the ADOS-G was also rated very high. Interpretation of the ADOS-G is very important for early intervention specialists to understand. Those who score high above the cutoffs for autism, score within a range of the high proportion of participants with autism with similar levels of expressive language deficits in social behavior (Lord et al., 2000). However, this is not enough to provide a full diagnosis of ASD. The ADOS-G is a reliable measure to observe social-communicative behaviors of individuals in order to work towards a diagnosis of ASD.

Van Daalen, Kemner, Dietz, Swinkels, Buitelaar, and Van Engeland (2009), used the ADOS-G, along with various other screening tools to examine reliability between

several measures. They found the ADOS-G to have poor specificity in diagnosis of very young children with an intellectual disability. Since many young children with ASD have a comorbid intellectual disability, it is important for diagnostic methods used with very young children to have strong specificity (Van Daalen et al., 2009). Although this assessment lacks the ability to distinguish between similar psychopathologies, it is still an important screening tool to determine eligibility in early intervention services.

2.4.2 Screening Instruments: Childhood Autism Rating Scale, Modified Checklist for Autism in Toddlers, Autism Behavior Checklist, *Baby and Infant Screen for Children with aUtIsm Traits – Part 1 for Infants and Toddlers*

The Childhood Autism Rating Scale (CARS) is an assessment to be completed by a teacher or physician following an observation period. This scale requires selection on a five-point scale determining level of deficit of a skill. The observation period lasts 15 minutes and the scale takes between 10-15 minutes to complete. The scale is designed to measure the presence and severity of symptoms on items regarding communication, socialization, emotional responses and sensory preferences (Pandey et al., 2008). Based on a combined score, an individual can get a classification of mild, moderate or severe autism, or no autism.

Many studies have examined the reliability of the CARS, noting good internal consistency, alpha= 0.94 in a large sample (n=537), as stated in the manual. (Perry, Condillac, Freeman, Dunn-Geier & Belair, 2005). Inter-rater agreement has been reported to be high in a variety of studies (Perry et al., 2005). Typically the validity of the CARS

has been found by comparing results to clinical diagnoses. The rates of agreement with clinical diagnosis are very high as well. The CARS has the added benefit of relative ease in training practitioners to use it reliably (Perry et al., 2005).

Perry and colleagues (2005) examined the CARS with 274 preschool children (age 2-6) who were referred for developmental-diagnostic assessment. They found that the CARS showed high concordance with clinical diagnoses, yet they do not suggest using the CARS alone to make a diagnosis. Rather, it should be used as the behavioral observation method of the assessment, for which it proves very useful.

Limitations of the CARS include the lack of a measure regarding peer relationships, joint attention or symbolic play. Yet, it does include aspects of sensory impairments and activity level that is often not included in ASD assessments. There is also limitation in the ability to distinguish between autism and other conditions of developmental delay and PDD-NOS.

The Modified Checklist for Autism in Toddlers (M-CHAT) is used as a parent report screener for ASD (Pandey et al., 2008). This parent completes 23 yes/no questions to identify risk or to generate a diagnosis of an ASD. Parents normally complete the M-CHAT when their child is 24 months of age. This scale includes items on joint attention, interest in other children responding to name, and imitation (Pandey et al., 2008).

Several studies have been completed, testing the specificity and sensitivity of the M-CHAT. Pandey and colleagues (2008) report that sensitivity tends to be rather high with 77% and 92% values on a sample of 84 children, 64% who were diagnosed with ASD. The specificity however, was lower (43% and 27%). Several researchers have

suggested that the M-CHAT has good sensitivity for population screening, but that additional follow-up data are needed on the initial sample. The M-CHAT is not to be used as the sole instrument to make a diagnosis of ASD. The predictive power of the M-CHAT is the best when used on high-risk children or children already suspected of developmental disorder, compared to low-risk, general pediatric samples (Pandey et al., 2008). Therefore, the M-CHAT should not be administered to all toddlers visiting a pediatrician. The M-CHAT should be used after an initial developmental screening, when the individual is considered to be at-risk for a developmental disorder.

A study completed by Pandey and colleagues (2008) of toddlers (*n*=4592, 16-23 months; *n*=2184, 24-30 months) split into high and low risk groups and screened through the M-CHAT found predictive ability was best for at-risk infants. The differences of age of the infants were not significant. With this predictive ability, it is suggested to test all infants considered to be at risk for a developmental disorder, despite their age. The predictive power of the M-CHAT does not vary significantly across the age of the toddler. The earliest possible identification is favored against the possibility of unnecessary referrals (Pandey et al., 2008). Unnecessary alarm of a potential ASD diagnosis is not likely to be a serious risk, especially if parents are told that a positive screen on the M-CHAT indicates the need for further assessment (Pandey et al., 2008). A separate community based sample, using the M-CHAT, showed that deficits in socialization and communication were the hallmark early identifiers of autism in toddlers. This study showed that items regarding joint attention and social responsiveness were also important for early identification (Barbaro & Dissanayake, 2009).

The Autism Behavior Checklist (Krug, Arick, & Almond, 1990a, 1980b) is a widely used instrument containing 57 items, covering five subscales: sensory, relating, body and object use, language and social and self-help (Eaves, Campbell, & Chambers, 2000). Respondents mark whether the characteristics are present or not present in the individual. Each item is weighted according to the degree to which the characteristic is a symptom of autism. Higher ABC scores indicate an individual with many autistic behaviors (Miranda-Linne, & Melin, 2002). Since the levels and severity of behavioral symptoms change as the individual ages, the ABC provides different profile charts for different age groups, ranging from 18 months to 35 years. The reliability and validity estimates have varying results across studies and researchers (see reviews by Eaves et al., 2000; Miranda-Linne, & Melin, 2002).

The *Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT)* battery was designed to assess the extensive needs of infants and toddlers at-risk for ASD (Matson, Fodstad, Mahan, & Sevin, 2009). It is a respondent-based measure, with a rating scale of 0-2 on level of impairments observed in the child. The *BISCUIT-Part 1* is a respondent measure designed to assess symptoms of autistic disorder and PDD-NOS. It consists of 62 items on which the parent/caretaker rates the child compared to other children his/her age on a 3-point Likert scale of impairment compared to others of the same age. According to *BISCUIT-Part 1* assessment procedures, participants with scores of 0-20 were identified as demonstrating atypical development (without meeting criteria for a specific ASD diagnosis), scores of 21-38 identified children with PDD-NOS, and scores of 39 and above identified children with autistic disorder. The *BISCUIT-Part 1*

includes items to be rated such as: age appropriate self-help and adaptive skills, prefers foods of a certain texture or smell, use of language to communicate, social interactions with others his/her age, etc. As found by Matson et al. (2009), the *BISCUIT-Part 1* demonstrated excellent internal consistency. If this measure were used with an individual who was typically developing, they would receive a very low score on this assessment.

2.5 Assessment Instruments for Behavior Disorders and Comorbidity: *Baby and Infant Screen for Children with aUtIsm Traits – Part 2 for Infants and Toddlers*

The *BISCUIT-Part 2* was used to assess the symptoms of comorbid psychopathology as they are uniquely demonstrated in the autism toddler populations. *Part 2* of the *BISCUIT* contains 57 items to be rated by the parent or caregiver on a 3-point Likert scale according to the degree to which the child had recently demonstrated them. As determined by exploratory factor analysis (described in the *BISCUIT* manual (Matson, Boisjoli, & Wilkins, 2007)), five factors of psychopathology were determined: *Tantrum/Conduct Problem Behavior, Anxiety/Repetitive Behavior, Inattention/Impulsivity, Avoidance Behavior, and Eat/Sleep Problems* (Matson, Boisjoli, Hess & Wilkins, 2009).

This measure is currently the only validated measure to examine comorbid symptamology in very young children. Few measures exist to examine the symptoms in very young children, likely due to the complexities of the behavioral patterns exhibited by these young children. Beyond looking at autism symptoms, practitioners must also

look for the presence of comorbidity development, knowing that autism rarely presents alone.

3. Comorbidity

The DSM-IV-TR (American Psychiatric Association, 2000) suggests that symptoms of autistic disorder must be present prior to age three. With increased study of the disorder, diagnosis at younger ages is becoming more reliable and common in practice. Diagnosis as early as 18-36 months has been found possible and optimal for early treatment (Matson, Wilkins, & Gonzalez, 2008). Symptom stability for autism has been found in toddlers at 17 months of age (Worley, Matson, Mahan, Kozlowski, & Neal, 2011). Just as early intervention for autism has been demonstrated as most effective for improving developmental outcomes, early treatment for comorbid diagnoses is essential for complete treatment and enhancing positive outcomes (Matson & Smith, 2007).

Individuals with autism are vulnerable to comorbid diagnoses. Comorbid psychopathology, the co-existence of two or more disorders in an individual, often occurs in individuals with an autism spectrum disorder (Fodstad, Rojahn, & Matson, 2010); Matson et al., 2009; Tervo, 2007). Yet, few researchers have examined comorbid psychopathology in very young children. As children are being reliably diagnosed at earlier ages – as early as 18-36 months (Matson, Wilkins, & Gonzalez, 2008) - and as early intervention is essential for optimal outcomes (Matson & Smith, 2007; National Research Council, 2001), it is important that symptoms of comorbid psychopathologies in infants and toddlers with ASDs are also examined.

It is important to note that much of the research on comorbidity has been conducted with individuals who are on the higher functioning section of the autism spectrum; individuals who can articulate their symptoms (LoVullo & Matson, 2009). Individuals who are lower functioning may show symptoms differently, therefore making it challenging to correctly identify psychiatric conditions. For example, a child who is nonverbal may have a difficult time expressing their feelings of depression. When assessing nonverbal, lower functioning individuals for depression, clinicians must rely on observable behavior and changes in functioning or regression of skills (LoVullo & Matson, 2009). Along these lines, it can be challenging for a clinician to determine between a comorbid disorder and the core characteristics of an ASD.

Knowing and understanding prevalence of autism and other comorbid psychopathology is essential for various realms of support including public policy, medical science, therapeutic environments, welfare reform, service delivery and managed care (Roberts, Atkinson, & Rosenblatt, 1998). Many prevalence studies, which have been reviewed by Roberts and colleagues (1998), have focused primarily on children and adolescents. They found that prevalence was examined in a variety of ways across studies, most of which did not share common measurement criteria. This can make our understanding of the epidemiology of childhood disorders unclear. Standardization of measurement is essential to comparing results across studies.

The Centers for Disease Control and Prevention report that autism is approximately 3–4 times more prevalent in boys than girls (Hartley & Sikora, 2009). Yet, differences in autistic symptoms between males and females remain unclear. In their

review, Rivet and Matson (2011) found no overall differences in autistic symptoms across gender for an infant/toddler group sampled or a child/adolescent group sampled. Similarly, Sipes, Matson, Worley, and Kozlowski (2011) found that differences in symptomatology between male and female toddlers with autism could better be accounted for by developmental quotient (DQ) as opposed to actual gender differences. A DQ was created for each toddler using the *Battelle Developmental Inventory, 2nd Edition* (BDI-2; Newborg, 2005). Male and female toddlers with average DQ were found to have less symptoms related to autism, as found on the *Baby and Infant Screen for Children with aUtIsm Traits – Part 1* (*BISCUIT-Part 1*) (Matson, Boisjoli, & Wilkins, 2007), compared with both males and females with low DQ, regardless of gender (Sipes et al., 2011). Additionally, males and females with low DQ did not significantly differ from each other in terms of autistic symptoms. As mentioned earlier autism is clearly more prevalent in males, but the differences in symptom presentation for males and females with an autistic disorder are not clear.

Findings are varied regarding gender differences in comorbid psychopathological symptoms. In looking at the five types of comorbidity that will be discussed later, gender differences are inconsistent and variable. For inattention, using parent report, Holtmann, Bolte, and Poustka (2007) found slightly higher levels of coexisting psychopathology for females than males on social problems, attention problems, and thought problems. Even fewer researchers have looked at co-existing psychopathologies for very young children with autism. In toddlers with autism, Carter and colleagues found minor increases in depression/withdrawal symptoms for females, but no differences for externalizing,

internalizing, dysregulation, or maladaptive behavior (Carter, Black, Tewani, Connolly, Kadlec, & Tager-Flusberg, 2007). Whether there are gender differences for eating and sleeping problems is not clear, as the literature is full of studies that are difficult to compare, due to differing sampling techniques and measurement tools used. Tantrum and conduct problems can be found in both genders, yet the conduct problem behaviors are more noticeable in young males compared to young females, as described later. Avoidance behavior has not been reliably shown to differ across gender at this point. Gender differences in particular must be interpreted with caution, as we do not know whether the causes of gender differences are the same across disorders or if different risk processes are contributing to the gender differences (Rutter & Sroufe, 2000).

Significant portions of individuals with autism also tend to exhibit intellectual disability (ID), depression, anxiety disorder, and/or eating disorder (LoVullo & Matson, 2009). Some individuals may experience a diagnosis of autism with a type of mood disorder (Matson & Shoemaker, 2009). Infants and toddlers with autism show greater levels of comorbid psychopathology than infants and toddlers with atypical development, developmental delays, and typical development (Davis, Fodstad, Jenkins, Hess, Moree, Dempsey, et al., 2010; Matson, Boisjoli, & Wilkins, 2011).

Comorbid symptomatology has important implications for the well-being of young children with autism. Greater levels of symptoms of comorbid psychopathology are associated with higher rates of challenging behaviors such as aggression, destructive behaviors, stereotypies, and self-injurious behavior (Matson, Mahan, Sipes, & Kozlowski, 2010). This literature by Matson and his colleagues (2010) show that the

most frequently demonstrated comorbid symptoms include behaviors relating to conduct/tantrum problems, inattention/impulsivity, anxiety, avoidance, and eating and sleeping problems.

3.1 Inattention/Impulsivity

School-age children with autism often display behaviors associated with attention deficit hyperactivity disorder (ADHD) (Goldstein, Johnson, & Minshew, 2001). Inattention, especially in a school setting, can negatively affect a child's achievement/academic performance and social and emotional well-being. Such behaviors can be seen early in life and continue through the lifespan. The *DSM-IV-TR* characterizes ADHD with two main domains of symptoms: inattention-disorganization and hyperactivity-impulsivity. Inattention-disorganization refers to losing materials, difficulty with attention maintenance, and regulation issues such as effortful control (Nigg, Goldsmith, & Sachek, 2004). Hyperactivity refers to activity level exceeding that of a typical age-matched peer. Impulsivity may be positive in valence (exuberance or contentment withdrawal) or negative in valence (anger proneness or fear, sadness or disgust) (Nigg et al., 2004).

Historically, the process of diagnosing ADHD has been challenged. Initially, there was controversy over whether a diagnosis of conduct disorder should be separate from a diagnosis of ADHD. Ultimately, it has been favored to split them into two different diagnostic categories (Milich, Balentine, & Lynam, 2001). More recently, controversy of separation of diagnosis of ADHD/combined type and

ADHD/predominately inattentive type has received a good deal of consideration. Milich and colleagues (2001) make strong arguments for the separation of ADHD and conduct disorder into distinct disorders. With the realization that complete agreement on the classification of attention disorders has not been reached, it is important not to rule out the possibility of observing autism symptoms in conjunction with inattentive symptoms. With knowledge that co-occurrence is possible, early identification of symptoms should be encouraged.

Inattention can present differently across ages. Preschoolers may demonstrate excessive motor activity while older children show less physical activity but become inattentive or distractible (Goldstein et al., 2001). Males show a higher prevalence of physical aggression and ADHD across age groups compared to females. Bell, Foster and Mash (2005) found that symptoms of inattention tend to vary across gender, particularly in the presentation of aggression and attention deficit difficulties, ultimately with fewer females showing adjustment challenges over time. According to Biederman, Newcorn and Sprich (1991), externalizing behavior problems occur in 50% or more of children with ADHD-combined type. Considering the variety in symptom presentation, research focus on inattention in very young children is essential.

There is limited literature on the comorbidity of autism and ADHD, due to the *DSM-IV-TR* specification that the disorders cannot be dually diagnosed. If there are behaviors of inattention, the *DSM-IV-TR* posits that the inattentive behaviors are the result of the primary autism symptoms, rather than features of a distinct disorder. This discourages clinicians from considering the possibility of comorbid autism and ADHD

diagnoses and could be contributing to under-diagnosed and underserved children and needs. Thus, it is important to understand at an early age what inattention looks like in children with autism. For children with autism, deficits in attention and hyperactivity are some of the most frequently reported and pervasive problems (Matson, Boisjoli, & Wilkins, 2007). Yet it is only recently that researchers have begun to investigate the co-existence of autism and ADHD.

Lecavalier (2006) found that more than 50% of almost 500 children and adolescents with AD had moderate to severe symptoms of inattention and hyperactivity. Goldstein and Schwebach (2004) found that of 100 children with autism, 95% exhibited attention deficits, 50% demonstrated impulsive behaviors, and 75% met diagnostic criteria for ADHD. In their study, Goldstein and Schweback (2004) emphasized how the presence of comorbidity predicts greater impairment in daily life. Further, Frazier, Biederman, Beliodre, Garfield, Geller, Coffey, et al. (2001) found that the co-existence of both autism and ADHD symptoms leads to higher rates of hospitalization. Deficits in attention in 20-month-old children with autism have been found to begin in infancy and continue through preschool and beyond (Frazier et al., 2001). Interestingly, children who "recover" or move off the spectrum (likely due to early and intensive interventions), often retain the behavioral symptoms of inattention and subsequently acquire a diagnosis of ADHD (Frazier et al., 2001). Thus it can be assumed that the two disorders are inherently linked; investigation of symptoms at the earliest ages may better inform this link.

3.2 Anxiety/Repetitive Behaviors

Anxiety is an internalizing disorder than can be seen in children as young as four years old (Buss, 2011). Anxiety is marked by an uncontrollable sense of future threat, danger or other negative event (Perez-Edgar & Fox, 2005). Certain levels of anxiety can serve an adaptive function, protecting children from potential harm. Yet, when anxiety reaches a point where it is maladaptive and creating difficulties with emotion regulation, it is a cause for concern. Common risk factors in the development of anxiety include: individual differences in temperament, biological sensitivity and biosocial risk. Maternal stress, anxiety, harsh discipline parenting and parental conflict are additional factors related to the development of anxiety in children (Bayer, Hiscock, Ukoumunne, Price, & Wake, 2008).

Anxiety disorders and depressive disorders are commonly diagnosed together with comorbidity rates between 20% and 50% (Zahn-Waxler, Race, & Duggal, 2005; Perez-Edgar & Fox, 2005) Disruptive behavior disorders and attention deficit disorders are also commonly diagnosed with depression. Individuals with a depressive disorder commonly show symptoms of irritability, anxiety, excessive worry, rumination and obsessive behaviors. Although depression is rare in preschoolers and few gender differences exist in young children (Zahn-Waxler et al., 2005), many of these symptoms of depression and anxiety are captured in Matson's factor of *Anxiety/Repetitive Behavior* (Matson, Boisjoli, & Wilkins, 2007). It is important to study these symptoms in young children because the effects of anxiety and depression become much greater as a child gets older. Anxiety can limit the individual in actively engaging with and exploring their

environment, thus potentially denying their exposure to life events. This can delay and interfere with the typical developmental trajectory. Childhood anxiety is likely to signal risk for psychopathology later in development (Perez-Edgar & Fox, 2005). Anxiety, fearfulness and shyness are developmental precursors to child and adolescent depression (Zahn-Waxler et al., 2005). Depression and autism show heritability rates suggesting genetics are involved in the etiology of both of these disorders.

Females are more likely to experience anxiety than males (Albano & Krain, 2005). Several studies suggest that anxiety and depression are closely linked and that anxiety precedes and can predict later depressive disorders (Zahn-Waxler, Race, & Duggal, 2005). Depression and eating disorders are more commonly diagnosed in female teenagers than male teenagers according to Bell and colleagues (2005). The research on depression and anxiety in males is much more limited.

Sensory experiences can contribute to the development of anxiety over time. Children with autism experience a variety of sensory difficulties, and over time, it can contribute to the development of anxiety and internalizing problems. Children may anticipate distress and become anxious (Ben-Sasson, Cermak, Orsmond, Tager-Flusberg, Kadlec, & Carter, 2008). It is important for parents and practitioners to monitor the development and presence of anxiety in children with autism. Negative emotions and depressive symptoms were shown to be associated with sensory symptoms in the young children with autism that Ben-Sasson and colleagues (2008) tested. Those with more sensory disruption showed a higher rate of depression. Sensory disruption, depression

and anxiety can all be contributing factors to the delay of social skills development, a core symptom of autistic disorder.

Presence of ritualistic and repetitive behaviors is essential for an autism diagnosis, as it is a core symptom of autism. Children with autism exhibit repetitive behaviors, such as body rocking, hand flapping, ordering objects, and restricted patterns of movements. Certain developmental rituals of childhood are normal at specific ages, although the severity and type must be considered when assessing the behaviors (Leonard, Ale, Freeman, Garcia & Ng, 2005). Autism spectrum disorder ritualistic behaviors begin to emerge early in childhood. Those individuals diagnosed with Obsessive Compulsive Disorder (OCD) also show rituals, yet the behaviors tend to be more persistent, dramatic and have a later age of onset (Leonard et al., 2005). The behaviors seen in OCD can be confused with autism symptoms, as both disorders present with a variety of ritualistic behaviors. For example, a young child with either autism or OCD may not want to be touched by other people. The individual with autism may experience sensory challenges with physical contact, and the individual with OCD may have a concern over contamination by the other person. The behaviors exhibited would be very similar, but their cause is very different. Young children with OCD may not be able to communicate their obsessive thoughts, whereas a young child with autism may not be able to communicate their feelings of discomfort due to a delay in communication skill development. With similar symptom presentation, the behaviors and contributing factors must be carefully analyzed and assessed to determine the appropriate course of action for diagnosis and treatment.

3.3 Eating/Sleeping Problems

Eating problems are a common among children with autism. Ahearn, Castine, Nault, and Green (2001) found that over half the children in their study demonstrated problems with food acceptance, such as selectivity and refusal, and 13% would refuse all foods presented to them. Such problems with eating may result from gastrointestinal (GI) problems thought to be prevalent in individuals with autism. GI problems were found to be present in 46% to 84% of children with an AD (Filipek, 2005).

Anecdotal parent reports have long demonstrated the frequency and severity of sleep problems for children with autism. For children with autism, abnormalities in sleep-wake cycles have been noted in a number of studies (see review by Stores & Wiggs, 1998). Studies show the majority of children with autism often have severe sleep problems, most frequently involving prolonged periods between sleeping, extended wakefulness at night, shortened sleep periods, and early morning waking (see review by Filipek, 2005). In one study of children with autism, almost half demonstrated rapid eye movement (REM) sleep behavior disorder (Thirumalai, Shubin, & Robinson, 2002).

Sleep disturbances worsen the maladaptive behavioral symptoms of autism, just as a typically developing child's behavior often worsens when he/she does not receive enough sleep (Wiggs & Stores, 1996). Combined with the inability to communicate if they are feeling tired or rundown, the behavioral manifestations of autism may be caused or at least exacerbated by sleep disorders (Wiggs & Stores, 1996). Yet, few studies have examined sleep problems for children younger than five years of age. The sleep patterns of infants and toddlers then are extremely important to investigate. Further, as REM sleep

behavior disorder is more frequently seen in the male population (Filipek, 2005), gender differences or equalities may be telling of the function of sleep disruption in children with autism. For example, differing from the above statistic, in recent studies, females on the spectrum exhibited slightly more sleep problems than males (Hartley & Sikora, 2009; Holtmann et al., 2007).

3.4 Tantrum/Conduct Problem Behaviors

Limited data about the prevalence of infant-toddler social-emotional problems is available. According to Briggs-Gowan, Carter, Skuban and Horowitz (2001), prevalence estimates of parent reported behavioral problems in 2 and 3-year-old children were around 10%. The persistence of social-emotional and behavioral problems in very young children is an important factor when discussing interventions. Children showing social-emotional challenges may be lacking the age-appropriate competencies needed for achieving developmental tasks and may be at risk for developing problem behaviors (Briggs-Gowan, et al., 2001). Data regarding social-emotional and behavioral difficulties in very young children is limited. Briggs-Gowan and colleagues (2001) found that parents take emotional competence into account when evaluating their child's adjustment. Additionally, research should focus on the relationships family challenges affect both social skills development and emotional.

Conduct problem behavior has been shown to be more prevalent in males compared to females, especially the association between temperament and conduct problems (Frick & Morris, 2004). Children with a "difficult" temperament are more at

risk for conduct problems. These individuals exhibit more irregularities in behavior, are highly physically active, have intense reactions, and poor adaptability (Frick & Morris, 2004). The particular temperament style of the child can also impair a child's ability to develop skills for appropriate emotional regulation, development of cognitive skills involved in controlling behavior, and the development of guilt and empathy (Frick & Morris, 2004). Young children with a difficult temperament are at risk for early development of severe conduct problems. Additionally they are at risk for delays in development. Early identification is vital for development of necessary coping skills. Exposure to a variety of developmentally stimulating interventions can also reduce the risk.

The presentation of conduct problems can vary between males and females (Rutter & Sroufe, 2000). The number of symptoms required to determine conduct problems may need to vary based on gender. Perhaps conduct and tantrum problem behaviors present differently for females than for males. It is common to see external behaviors when it comes to tantrum and antagonistic behaviors in males; however, females experience more internal forms of tantrum and are therefore less commonly a disruption in their environment, calling attention to the behaviors. Females may be similarly distressed as males, but not showing outward problem behaviors, so their issues may not be addressed as quickly and intervention could be delayed. While addressing gender differences in symptomatology and assessment, such factors as varying presentation of symptoms must be considered.

Patterns of anti-social and conduct problem behaviors are present in childhood and adolescence. Early identification of these patterns during early childhood suggests poorer outcomes for an individual as they continue to develop. Childhood-onset of conduct problem behaviors suggests an increased likelihood to show antisocial and criminal behavior into adulthood (Frick, Cornell, Bodin, Dane, Barry & Loney, 2003). Additionally, children in this group tend to show more aggression, greater impulsivity, greater social alienation, and neuropsychological disturbances (Frick et al., 2003). Studies indicate that aggressive children are at a higher risk for depression, anxiety, severe conduct problems and emerging psychopathology (Tiffin & Kaplan, 2004). It has been estimated by the World Health Organization that 50% of children with conduct disorder may have an additional diagnosis of attention, specifically impulsivity, disorder. Additionally, individuals with lower than average IQ, very common for individuals with autism, show a higher incidence of conduct problem behaviors (Tiffin & Kaplan, 2004). In addition, impaired social ability can be directly related to antisocial responses, especially among those individuals with autism (Tiffin & Kaplan, 2004). Combinations of factors are typically responsible for both the development and progression of conduct problems behaviors.

3.5 Avoidance Behavior

Avoidance behavior can include fear of being around others, avoidance of specific situations, people or events, or when removing one's self from social situations (Matson, Boisjoli, & Wilkins, 2007). When a child shows persistent fear that is not age-

appropriate, or if exposure to a specific object/situation provokes stress it is another example of avoidance behavior. Additionally, if presentation of a specific object or situation results in loss of control, panic, or fainting, the child can be showing avoidance behavior (Matson, Boisjoli, & Wilkins, 2007).

Much of the research on fear in young children is taken from a differing perspective than psychopathology. It is common and normative for young children to develop a fear of strangers and new situations (Costello, Egger, & Angold, 2005). After age 2.5 years most children do not experience the same fears. About 15% of young children develop more intense and persistent fear, shyness and social withdrawal compared to other young children (Costello et al., 2005). These individuals are more likely to show behavioral inhibition and to later develop an anxiety or phobic disorder. Studies have not shown gender differences in very young children regarding fear and phobia; yet, in older children, comorbidity with other psychiatric disorders is common (Costello et al., 2005).

As children continue to develop and grow older, the prevalence for specific phobia begins to be more prevalent in females than males (Costello et al., 2005). The research is unclear as to whether there are more incidences of specific phobia, or that females are more likely to report specific phobias. Schwartz, Wright, Shin, Kagan, Whalen, McMullen and colleague (2003) found that 15% of young adults, who were classified as behaviorally inhibited toddlers, later developed generalized social phobia. Schwartz, Snidman, and Kagan (1999) found that when a child at age two was inhibited, as an adolescent they were more likely to show symptoms of social anxiety. This was

assessed by use of a semi-structured interview, in which 80% (of the 61% of adolescents currently exhibiting symptoms of social anxiety) had shown anxiety symptoms earlier in life.

4. Hypotheses and Significance

Identifying symptoms of both autistic and comorbid psychopathology symptoms as early as possible allows for more appropriately and effectively tailored interventions for very young children. As early intervention is deemed the most important route for optimal outcomes, early identification of all psychopathologic symptoms is essential for improving developmental outcomes for children with ASDs. Identifying symptoms in a population with poor verbal abilities is extremely difficult, making it especially important that a clinician is aware of the frequency of comorbid symptoms.

As such, this study seeks to identify symptoms of comorbid psychopathologies demonstrated by infants and toddlers on the autism spectrum. The study examined the following main question. Are there gender differences in symptom presentation of comorbid psychopathologies across age and across three diagnostic groups (autism vs. PDD-NOS vs. children without ASD but delayed development)? The following secondary questions will be addressed:

a) Are there sex differences in psychopathology across the three diagnostic groups?
b) Are there sex differences in five specific forms of psychopathology across the three diagnostic groups?

c) Are there age differences in the onset five specific forms of psychopathology across the three diagnostic groups?

5. Method

5.1 Participants

Participants were drawn from EarlySteps, a program in Louisiana's Early Intervention System under the *Individuals with Disabilities Education Act, Part C*. EarlySteps provides services to infants and toddlers from birth to 39 months diagnosed with a developmental delay/atypical development or with a medical or physical condition that is likely to cause developmental delays. Individuals enrolled in EarlySteps were part of an ongoing study on early child development and emergent psychopathology. Enrolled in the program at the time of the study were 2214 infants and toddlers ages 12 months to 39 months. Of those, 1601 participants were used in this study. Others were excluded because they were missing data.

All participants in this study were categorized as "having an ASD diagnosis" or "being atypically developing without an ASD diagnosis" by a licensed clinical psychologist with over 30 years of experience working with children with developmental disabilities. Diagnostic decisions were based on the criteria set forth in the DSM-IV-TR for individuals with ASDs, developmental profile scores obtained on the *Battelle Developmental Inventory, Second Edition* (Newborg, 2005), and scores on the *Modified Checklist for Infants and Toddlers* (Robins, Fein, Barton, &

Green, 2001) in addition to clinical judgment. Diagnostic inter-rater reliability was obtained for 14% of participants within this sample by having a second psychologist with many years of experience working with children with developmental disabilities supply diagnoses using the same diagnostic criteria (Matson et al, 2010). Inter-rater reliability was found to be excellent with a Cohen's Kappa value of .93, $p < .001$.

Participants were divided into three diagnostic groups based on their scores on the *Baby and Infant Screen for Toddlers with aUtIsm Traits– Part 1* (Matson, Boisjoli, & Wilkins, 2007), which will be described below. There were 1146 participants classified as atypically developing, 254 met criteria for PDD-NOS, and 201 met criteria for autistic disorder. In the sample group, 633 participants were between the ages of 12-24 months, 689 participants were between the ages of 25-31 months, and 279 participants were between the ages of 32-39 months. Male participants numbered 1124, and females numbered 477. Information is displayed in Table 1.

Table 1.
Numbers of participants in each group

		Groups		
Age (months)	Sex	Autism	PDD-NOS	Atypical
12-24	Male	49	73	324
	Female	16	17	154
25-31	Male	73	96	321
	Female	21	29	149
32-39	Male	27	25	136
	Female	15	14	62

5.2 Procedure

The comprehensive *BISCUIT* assessment battery was administered to all participants in the study. Each test assessor held at least a bachelor degree up to doctoral level degree and certification or licensure in psychology, education, early childhood development, social work, or a related area. All assessors attended trainings on administration of the *BISCUIT;* which included information on ASD, practice administration and question and answer sessions (Matson, Boisjoli, & Wilkins, 2007). Directions for the *BISCUIT* were read to informants and scoring criteria explained. Additional demographic information was collected at the same time. Data was entered to create a database for the present study, which was approved by the Louisiana State University Institutional Review Board and the state of Louisiana's Office for Citizens with Developmental Disabilities (OCDD) Department of Health and Hospitals.

5.3 Assessment Instrument

In response to researchers attempting to identify symptoms of autism in young children, Matson, Boisjoli, and Wilkins (2007) created the *Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT)* assessment tool. The American Academy of Pediatrics (AAP) has suggested that practitioners screen all children for autism at their 18 and 24 month well-child visits as well as following any parental concerns about the child's development (Johnson & Myers, 2007). While there has been this call from the

AAP to screen all toddlers, few scales exist to measure symptoms in this young population (Matson, Boisjoli, & Wilkins, 2007).

The *Baby and Infant Screen for Children with aUtIsm Traits* (*BISCUIT*; Matson, Boisjoli, & Wilkins, 2007) is a comprehensive screening tool assessing ASD symptomatology (*Part 1*), comorbid psychopathology (*Part 2*), and challenging behaviors (*Part 3*) in infants and toddlers ages 12 to 39 months (Matson et al., 2009). The *BISCUIT-Part 1* is a measure designed to assess symptoms of autistic disorder and PDD-NOS. A parent or caregiver responds to a rating scale that can aid in the diagnosis of autistic disorder, as well as providing means for treatment monitoring of toddlers.

The *BISCUIT-Part 1* consists of 62 items on which the parent/caretaker rates the child compared to other children his/her age on the following 3-point Likert scale: 0 = "not different; no impairment;" 1 = "somewhat different; mild impairment;" 2 = "very different; severe impairment." According to *BISCUIT-Part 1* assessment procedures, participants with scores of 0-20 were identified as demonstrating atypical development (without meeting criteria for a specific ASD diagnosis), scores of 21-38 identified children with PDD-NOS, and scores of 39 and above identified children with autistic disorder. The *BISCUIT-Part 1* includes items to be rated such as: age appropriate self-help and adaptive skills, prefers foods of a certain texture or smell, use of language to communicate, social interactions with others his/her age, etc. As found by Matson et al. (2009), the *BISCUIT-Part 1* demonstrated excellent internal consistency. If this measure were used with an individual who was typically developing, they would receive a very low score on this assessment.

In an article by Matson et al. (in press), cutoff scores were established to differentiate between diagnoses. For all children in that sample, diagnoses were made by a licensed psychologist with over 30 years of experience in the field of development disabilities. The psychologist was blind to the *BISCUIT-Part 1* scores. The DSM-IV-TR algorithm for Autistic Disorder (APA, 2000), the descriptors in DSM-IV-TR for PDD-NOS, *M-CHAT* scores, and developmental profiles scores from the *Battelle Developmental Inventory-2nd Edition* (BDI-2) were used to make the diagnoses. To obtain potential cutoff scores for the *BISCUIT-Part 1*, two methods were used. First, the standard deviation method was utilized, with two standard deviations above the "normal population" indicating clinical significance. Additionally, analysis used the grid means as reference points to determine the cutoff points by finding the largest spread between groups. "Then, logistical regression analyses were employed to establish the sensitivity and specificity of the prospective cutoff scores. Last, to optimize the sensitivity and specificity of the *BISCUIT-Part 1,* receiver operative characteristics (ROC) were computed to determine the best cut-point to utilize for this measure" (Matson, Boisjoli, & Wilkins, 2007, p. 8). The specific cutoff scores were determined from a sensitivity/specificity analysis as described in the *BISCUIT* manual.

The *BISCUIT-Part 2* was used to assess the symptoms of comorbid psychopathology as they are uniquely demonstrated in the autism toddler populations. *Part 2* of the *BISCUIT* contains 57 items to be rated by the parent or caregiver on a 3-point Likert scale according to the degree to which the child had recently demonstrated them. Items are scored as: 0 = not a problem or impairment; 1 = mild problem or

impairment, 2 = severe problem or impairment, or X = does not apply or don't know. The *BISCUIT – Part 2* has demonstrated strong internal consistency ($\alpha = .96$) (Matson, Wilkins, et al., 2009). As determined by exploratory factor analysis (as described in the *BISCUIT* manual (Matson, Boisjoli, & Wilkins, 2007)), five factors of psychopathology were determined: *Tantrum/Conduct Problem Behavior, Anxiety/Repetitive Behavior, Inattention/Impulsivity, Avoidance Behavior, and Eat/Sleep Problems* (Matson, Boisjoli, Hess & Wilkins, 2009).

Table 2.
BISCUIT-Part 2 raw score cutoffs and percentage score cutoffs for participants with autism or PDD-NOS

	No/Minimal Impairment		Moderate Impairment		Severe Impairment	
Subscale	Raw	Percentage	Raw	Percentage	Raw	Percentage
Tantrum/Conduct Problem Behavior	0-16	0-42%	17-24	42-63%	25 and up	64% and up
Inattention/Impulsivity	0-15	0-50%	16-22	51-73%	33 and up	74% and up
Avoidance Behavior	0-6	0-37%	7-10	38-62%	11 and up	63% and up
Anxiety/Repetitive Behavior	0-6	0-27%	7-9	28-41%	10 and up	42% and up
Eating/Sleep Problems	0-3	0-37%	4-5	38-63%	6 and up	64% and up

6. Results

6.1 Descriptive Statistics

Percentage scores were used to calculate performance on the *BISCUIT-Part 2*. These percentage scores represent the level of impairment that the child scored on the assessment. The higher the percentage then the more impairment the child presented with. Using the impairment cutoff scores determined by Matson, Boisjoli, and Wilkins (2007) in Table 2., the cutoff scores were divided by the total possible score for each subscale. Percentage ranges of impairment were then created, which are displayed in Table 2. The *Tantrum/Conduct Problem Behavior* subscale has 19 items, with a possible total score of 38. "Minimal Impairment" on this subscale would be a percentage score between 0-42%, "Moderate Impairment" on this subscale would be a percentage score between 43-63%, and "Severe Impairment" on this subscale would be a percentage score of 64% and up. The *Inattention/Impulsivity* subscale has 15 items, with a possible total score of 30. "Minimal Impairment" on this subscale would be a percentage score between 0-50%, "Moderate Impairment" on this subscale would be a percentage score between 51-73%, and "Severe Impairment" on this subscale would be a percentage score of 74% and up. The *Avoidance Behavior* subscale has 8 items, with a possible total score of 16. "Minimal Impairment" on this subscale would be a percentage score between 0-37%, "Moderate Impairment" on this subscale would be a percentage score between 38-62%,

and “Severe Impairment” on this subscale would be a percentage score of 63% and up. The *Anxiety/Repetitive Behavior* subscale has 11 items, with a possible total score of 22. “Minimal Impairment” on this subscale would be a percentage score between 0-27%, “Moderate Impairment” on this subscale would be a percentage score between 28-41%, and “Severe Impairment” on this subscale would be a percentage score of 42% and up. The *Eat/Sleep Problems* subscale has 4 items, with a possible total score of 8. “Minimal Impairment” on this subscale would be a percentage score between 0-37%, “Moderate Impairment” on this subscale would be a percentage score between 38-63%, and “Severe Impairment” on this subscale would be a percentage score of 64% and up.

6.2 Dependent Variables

The dependent variables were based on the *BISCUIT-Part 2* subscales. *BISCUIT-Part 2* subscale scores were derived for each participant based on the parent/caregiver assessment. Total scores were generated for each *BISCUIT-Part 2* subscale.

Since the five subscales consisted of unequal numbers of items, each subscale score was then converted into a percentage score in order to make the subscale scores comparable for each individual. The actual score on a subscale was divided by the total score possible on each subscale. A percentage score was then calculated. This was done for each participant, on each of the five *BISCUIT-Part 2* subscales. Figure 1 shows the mean percentage scores for the three diagnostic groups across the three age cohorts for male and female participants.

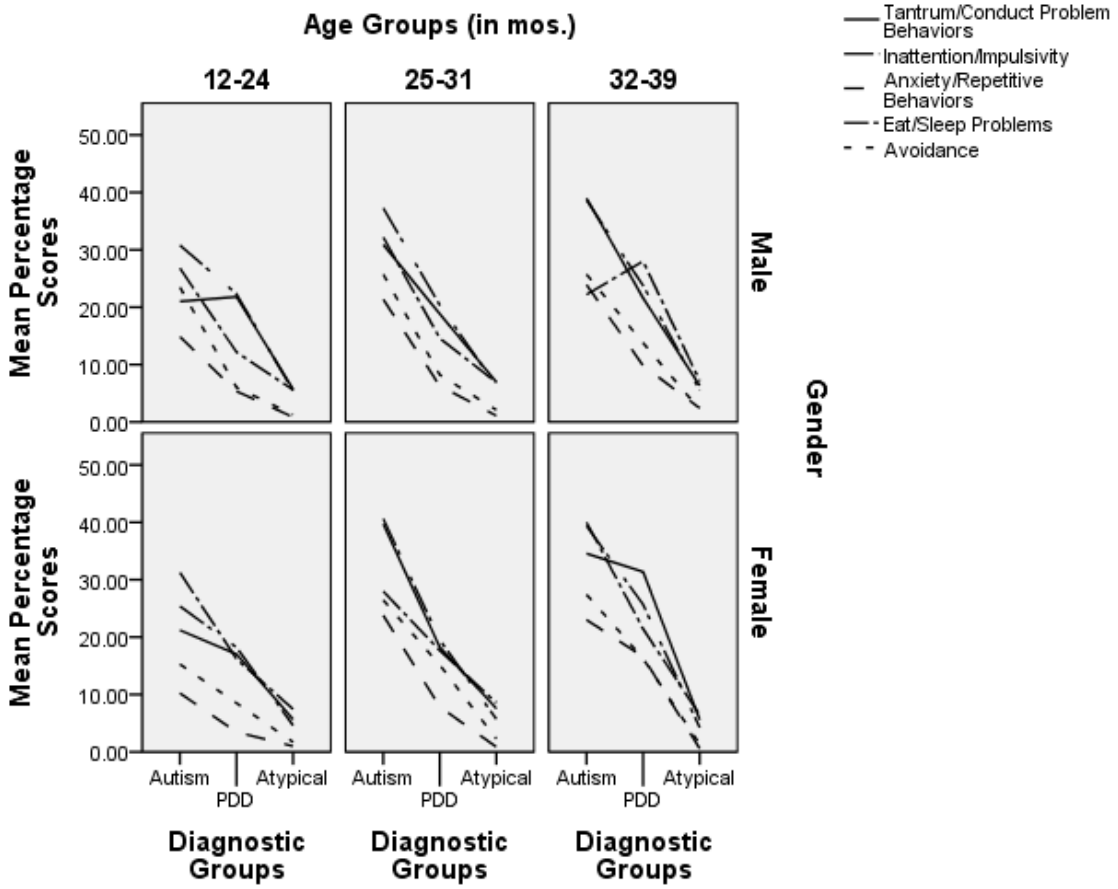

Figure 1. Mean percentage scores across sex, age, and diagnostic group.

6.3 Factorial MANOVA

The main analysis was a three (3 [Age] x 3 [Diagnostic Group] x 2 [Sex]) multivariate analysis of variance (MANOVA) with the five *BISCUIT-Part 2* subscale percentage scores as the multiple dependent variables. The multivariate tests revealed a significant triple interaction effect (Sex X Age X Diagnostic Group) (Wilks' λ = .97,

$F(20, 5237.9) = 2.4$, $p < .001$), as can be seen in Table 3. However, the effect size ($\eta^2 = .007$) was very small.

The two-way interaction effect for Age X Diagnostic Group was significant albeit with a small effect size (Wilks' $\lambda = .952$, F [20, 5237.9] = 3.943, $p < .001$, $\eta^2 = .012$). The two-way interaction effects for Sex X Diagnostic Group (Wilks' $\lambda = .992$, F[10, 3158] = 1.289, $p > .05$, $\eta^2 = .004$) and for Sex X Age were not significant (Wilks' $\lambda = .991$, F[10, 3158] = 1.362, $p > .05$, $\eta^2 = .004$).

The main effects for Diagnostic Group was significant (Wilks' $\lambda = .573$, F[10, 3158] = 101.304, $p < .01$, $\eta^2 = .243$) and Age (Wilks' $\lambda = .956$, F[5, 3158] = 7.198, $p < .01$, $\eta^2 = .022$) were significant. There was no significant main effect for Sex (Wilks' $\lambda = .996$, F[5, 1579] =1.419, $p > .05$, $\eta^2 = .004$).

Table 3.
Multivariate Tests, Factorial MANOVA

	Wilks' Lambda	*F*	*df*	Error *df*	Sig.	Partial Eta Squared
Intercept	0.423	429.933	5	1579	.000*	0.577
Sex	0.996	1.419	5	1579	0.214	0.004
Age	0.956	7.198	10	3158	.000*	0.022
Diagnostic Group	0.573	101.304	10	3158	.000*	0.243
Sex X Age	0.991	1.362	10	3158	0.192	0.004
Sex X Diagnostic Group	0.992	1.289	10	3158	0.25	0.004
Age X Diagnostic Group	0.952	3.943	20	5237.9	.000*	0.012
Sex X Age X Diagnostic Group	0.97	2.386	20	5237.9	.000*	0.007

*p<.05

Next, the tests of between subjects for the factorial MANOVA were examined. This allows a clearer understanding of where the interaction effects were seen across the *BISCUIT-Part 2* subscales. As can be seen in Table 4, significant triple interaction effects were observed in the *Tantrum/Conduct Problem Behaviors* subscale, $F(4,1583) = 2.634$, $p < .05$, $\eta^2 = .01$, the *Anxiety/Repetitive Behavior* subscale, $F(4, 1583) = 2.656$, $p < .05$, $\eta^2 = .01$, and the *Eat/Sleep Problems* subscale, $F(4, 1583) = 2.722$, $p < .05$, $\eta^2 = .01$. There were no significant effects for the subscale *Avoidance*, $F(4, 1583) = 1.624$, $p > .05$, $\eta^2 = .00$ or *Inattention/Impulsivity*, $F(4, 1583) = 1.006$, $p > .05$, $\eta^2 = .00$.

Among the two-way interactions of Age X Diagnostic Group, there were significant effects for the subscales of *Avoidance,* $F(4, 1583) = 3.842$, $p < .01$, $\eta^2 = .01$,

Tantrum Conduct Problem Behaviors, $F(4, 1583) = 8.680$, $p < .01$, $\eta^2 = .02$, *Inattention/Impulsivity*, $F(4, 1583) = 6.142$, $p < .01$, $\eta^2 = .02$, and *Anxiety/Repetitive Behavior,* $F(4, 1583) = 12.635$, $p < .01$, $\eta^2 = .03$ (see Table 4). There was no significant effect for *Eat/Sleep Problems,* $F(4, 1583) = 1.671$, $p > .05$, $\eta^2 = .00$.

The two-way interactions for Sex X Diagnostic Group were not significant effects: *Avoidance,* $F(2, 1583) = 2.795$, $p > .05$, $\eta^2 = .00$, *Tantrum/Conduct Problem Behavior,* $F(2, 1583) = .334$, $p > .05$, $\eta^2 = .00$, *Inattention/Impulsivity,* $F(2, 1583) = .023$, $p > .05$, $\eta^2 = .00$, *Anxiety/Repetitive Behaviors,* $F(2, 1583) = 1.776$, $p > .05$, $\eta^2 = .00$, and *Eat/Sleep Problems,* $F(2, 1583) = 1.260$, $p > .05$, $\eta^2 = .00$ (Table 4).

Among the two-way interaction of Sex X Age there were no significant effects: *Avoidance*, $F(2, 1583) = 2.352$, $p > .05$, $\eta^2 = .00$, *Tantrum/Conduct Problem Behavior,* $F(2, 1583) = 1.580$, $p > .05$, $\eta^2 = .00$, *Inattention/Impulsivity,* $F(2, 1583) = 1.936$, $p > .05$, $\eta^2 = .00$, *Anxiety/Repetitive Behaviors,* $F(2, 1583) = 2.763$, $p > .05$, $\eta^2 = .00$, and *Eat/Sleep Problems,* $F(2, 1583) = .659$, $p > .05$, $\eta^2 = .00$ as can be seen in Table 4.

The main effects for factor Age was significant effects for the subscales *Avoidance,* $F(2, 1583) = 10.963$, $p < .01$, $\eta^2 = .01$, *Tantrum/Conduct Problem Behavior,* $F(2, 1583) = 14.010$, $p < .01$, $\eta^2 = .02$, *Inattention/Impulsivity,* $F(2, 1583) = 9.162$, $p < .01$, $\eta^2 = .01$, *Anxiety/Repetitive Behaviors,* $F(2, 1583) = 28.7$, $p < .01$, $\eta^2 = .03$ as can be seen in Table 4. There was no significant effect for the factor of *Eat/Sleep Problems,* $F(2, 1583) = 2.421$, $p > .05$, $\eta^2 = .00$ (Table 4).

The main effects for factor Diagnostic Group were significant for each of the five subscales: *Avoidance*, $F(2, 1583) = 252.598$, $p < .01$, $\eta^2 = .24$, *Tantrum/Conduct Problem*

Behavior, F(2, 1583) = 226.579, $p < .01$, $\eta^2 = .22$, *Inattention/Impulsivity, F*(2, 1583) = 424.506, $p < .01$, $\eta^2 = .35$, *Anxiety/Repetitive Behaviors, F*(2, 1583) = 287.282, $p < .01$, $\eta^2 = .27$ and *Eat/Sleep Problems, F*(2, 1583) = 107.313, $p < .01$, $\eta^2 = .12$ (Table 4).

The main effects for factor Sex were not significant for any of the five subscales: *Avoidance*, *F*(1, 1583) = .518, $p > .05$, $\eta^2 = .00$, *Tantrum/Conduct Problem Behavior, F*(1, 1583) = .730, $p > .05$, $\eta^2 = .00$, *Inattention/Impulsivity, F*(1, 1583) = .432, $p > .05$, $\eta^2 = .00$, *Anxiety/Repetitive Behaviors, F*(1, 1583) = .053, $p > .05$, $\eta^2 = .00$, and *Eat/Sleep Problems, F*(1, 1583) = 2.543, $p > .05$, $\eta^2 = .00$ (see Table 4).

Table 4.
Tests of Between Subjects for Factorial MANOVA

	DV	df	*MS*	*F*	Sig.	η^2
Sex	*Avoidance*	1	68.075	.518	.472	.00
	Tantrum/Conduct Problem Behaviors	1	151.071	.730	.393	.00
	Inattention/Impulsivity	1	95.190	.617	.432	.00
	Anxiety/Repetitive Behaviors	1	4.070	.053	.819	.00
	Eat/Sleep Problems	1	879.894	2.543	.111	.00
Age	*Avoidance*	2	1439.580	10.963	.000*	.01
	Tantrum/Conduct Problem Behaviors	2	2901.067	14.010	.000*	.02
	Inattention/Impulsivity	2	1413.496	9.162	.000*	.01

	Anxiety/Repetitive Behaviors	2	2222.343	28.700	.000*	.03
	Eat/Sleep Problems	2	837.688	2.421	.089	.00
Diagnostic Group	*Avoidance*	2	33170.610	252.598	.000*	.24
	Tantrum/Conduct Problem Behaviors	2	46916.569	226.579	.000*	.22
	Inattention/Impulsivity	2	65491.082	424.506	.000*	.35
	Anxiety/Repetitive Behaviors	2	22245.557	287.282	.000*	.27
	Eat/Sleep Problems	2	37130.639	107.313	.000*	.12
Sex X Age	*Avoidance*	2	308.901	2.352	.095	.00
	Tantrum/Conduct Problem Behaviors	2	327.208	1.580	.206	.00
	Inattention/Impulsivity	2	298.678	1.936	.145	.00
	Anxiety/Repetitive Behaviors	2	213.971	2.763	.063	.00
	Eat/Sleep Problems	2	228.187	.659	.517	.00
Sex X Diagnostic Group	*Avoidance*	2	367.001	2.795	.061	.00
	Tantrum/Conduct Problem Behaviors	2	69.061	.334	.716	.00
	Inattention/Impulsivity	2	3.485	.023	.978	.00
	Anxiety/Repetitive Behaviors	2	137.532	1.776	.170	.00
	Eat/Sleep Problems	2	436.137	1.260	.284	.00
Age X Diagnostic Group	*Avoidance*	4	504.584	3.842	.004*	.01
	Tantrum/Conduct Problem Behaviors	4	1797.392	8.680	.000*	.02
	Inattention/Impulsivity	4	947.490	6.142	.000*	.02
	Anxiety/Repetitive Behaviors	4	978.412	12.635	.000*	.03

	Eat/Sleep Problems	4	578.114	1.671	.154	.00
Sex X Age X Diagnostic Group	*Avoidance*	4	213.325	1.624	.166	.00
	Tantrum/Conduct Problem Behaviors	4	545.466	2.634	.033*	.01
	Inattention/Impulsivity	4	155.147	1.006	.403	.00
	Anxiety/Repetitive Behaviors	4	205.693	2.656	.031*	.01
	Eat/Sleep Problems	4	941.874	2.722	.028*	.01

** $p<.05$*

To interpret the specific meaning of the triple interaction effect of the factorial MANOVA we proceeded to conduct post hoc analyses. Since the tests for between subjects effects (for Sex x Age x Diagnostic Groups) showed significance for the subscales *Tantrum/Conduct Problem Behaviors, Anxiety/Repetitive Behavior and Eat/Sleep Problems*, (see Table 3.), factorial ANOVAs were conducted for each one of them.

6.4 Factorial ANOVAs

6.4.1 Descriptive Statistics

The *Tantrum/Conduct Problem Behaviors* factor has 19 items, with a possible score range of 0-38. With percentage score means for males and females of 11.74%, and 11.07% respectively, on average, the children were minimally impaired with tantrum/conduct problem behaviors according to cutoff scores by Matson, Boisjoli, and

Wilkins (2007). This can be shown in Table 5. The *Anxiety/Repetitive Behaviors* factor has 11 items, with a possible score range of 0-22. With percentage score means for males and females of 4.55%, and 3.84% respectively, on average, the children were minimally impaired with anxiety/repetitive behaviors according to cutoff scores by Matson, Boisjoli, and Wilkins (2007). The *Eat/Sleep Problems* factor has 4 items, with a possible range of 0-8. With percentage score means for males and females of 10.93%, and 11.74% respectively, as can be seen in Table 5. On average the children were minimally impaired with eat/sleep problems according to percentage cutoff scores.

It is important to remember that these numbers are low because all of the participants with atypical development are included in this analysis. There are more participants in this diagnostic category than the others. Additionally, those with atypical development should be earning lower scores on the *BISCUIT-Part 2* in theory.

Table 5.
Descriptive statistics for Factorial ANOVA

	Male *n*=1131		Female *n* =480	
Subscales	*M*	*SD*	*M*	*SD*
Tantrum/Conduct Problem Behaviors	11.74	16.84	11.07	17.13
Anxiety/Repetitive Behaviors	4.55	10.99	3.84	10.49
Eat/Sleep problems	10.93	19.84	11.74	21.07

6.4.2 *Tantrum/Conduct Problem Behavior*

Separate 3-factor (Sex x Age x Diagnostic Groups) ANOVAs were conducted; one for each of the three *BISCUIT-Part 2* subscales with significant between subjects effects on the MANOVA. The factorial ANOVAs were conducted to examine the interaction effect of the Factorial MANOVA and to isolate the *BISCUIT-Part 2* subscales. The effect of each factor (Sex, Age, and Diagnostic Group) and their interactions with a single subscale was examined.

The *Tantrum/Conduct Problem Behavior* subscale showed a significant interaction between Age and Diagnostic Groups, $F(4, 1800)=9.6$, $p<.001$, but no sex effects (Sex X Age, $F(2,1800)=.814$, $p>.05$; Sex X Diagnostic Group, $F(2, 1800)=.826$, $p>.05$; Sex X Age X Diagnostic Group, $F(4, 1800)=1.950$, $p>.05$, as can be seen in Table 6.

Table 6.
Tests of Between Subjects for Factorial ANOVA, Tantrum/Conduct Problem Behaviors

	df	*MS*	*F*	Sig.	η^2
Sex X Age	2	175.829	0.814	0.443	0.001
Sex X Diagnostic Group	2	41.216	0.191	0.826	0
Age X Diagnostic Group	4	2077.287	9.611	.000*	0.021
Sex X Age X Diagnostic Group	4	421.414	1.95	0.1	0.004
Error	1782	216.127			

* $p<.05$

Table 7 shows the means across gender for the factorial ANOVA of the *Tantrum/ Conduct Problem Behavior* subscale. Males tended to score higher than females, however this difference was not significant. Due to a lack of gender differences, Sex was removed to examine differences across Diagnostic Group and Age.

Table 7.
Descriptive Statistics in Factorial ANOVA, Tantrum/Conduct Problem Behaviors

		Male			Female		
Age		*M*	*SD*	*n*	*M*	*SD*	*n*
12-24	Autism	20.59	18.73	57	21.93	17.73	18
	PDD-NOS	20.56	21.11	85	15.51	16.92	19
	Atypical	5.99	10.28	362	5.91	9.87	175
25-31	Autism	33.15	25.11	89	37.97	27.54	28
	PDD-NOS	18.8	17.05	103	19.19	20.66	31
	Atypical	7.21	12.05	359	7.48	10.45	170
32-39	Autism	40.2	23.54	29	34.56	30.93	15
	PDD-NOS	23	23.97	27	31.39	18.27	14
	Atypical	6.71	10.5	155	5.72	11.61	64

Analyses show that the older children with autism scored higher on the *Tantrum/Conduct Problem Behavior BISCUIT-Part 2* subscale than the younger children with autism (32-39 *M*=37.38, *SE*=2.34; 25-31 *M* =35.56, *SE*=1.59; 12-24 *M*=21.26,

SE=1.99). Additionally, the older children with PDD-NOS scored higher than the younger children with PDD-NOS (32-39 *M*=27.20, *SE*=2.42; 25-31 *M*=18.99, *SE*=1.51; 12-24 *M*=18.03, *SE*=1.99); with the same trend for those with atypical development (32-39 *M*=6.21, *SE*=1.09; 25-31 *M*=7.34, *SE*=0.68; 12-24 *M*=5.95, *SE*=0.68). Mean comparisons can be seen in Table 8. Graphic representations are shown in Figures 2 and 3.

Table 8.

Estimated Marginal Means of the Interaction of Diagnostic Groups and Age Groups, Tantrum/Conduct Problem Behaviors

Diagnostic Group	Age	*M*	*SE*
Autism	12-24	21.26	1.99
	25-31	35.56	1.59
	32-39	37.38	2.34
PDD-NOS	12-24	18.03	1.87
	25-31	18.99	1.51
	32-39	27.2	2.42
Atypical	12-24	5.95	0.68
	25-31	7.34	0.68
	32-39	6.21	1.09

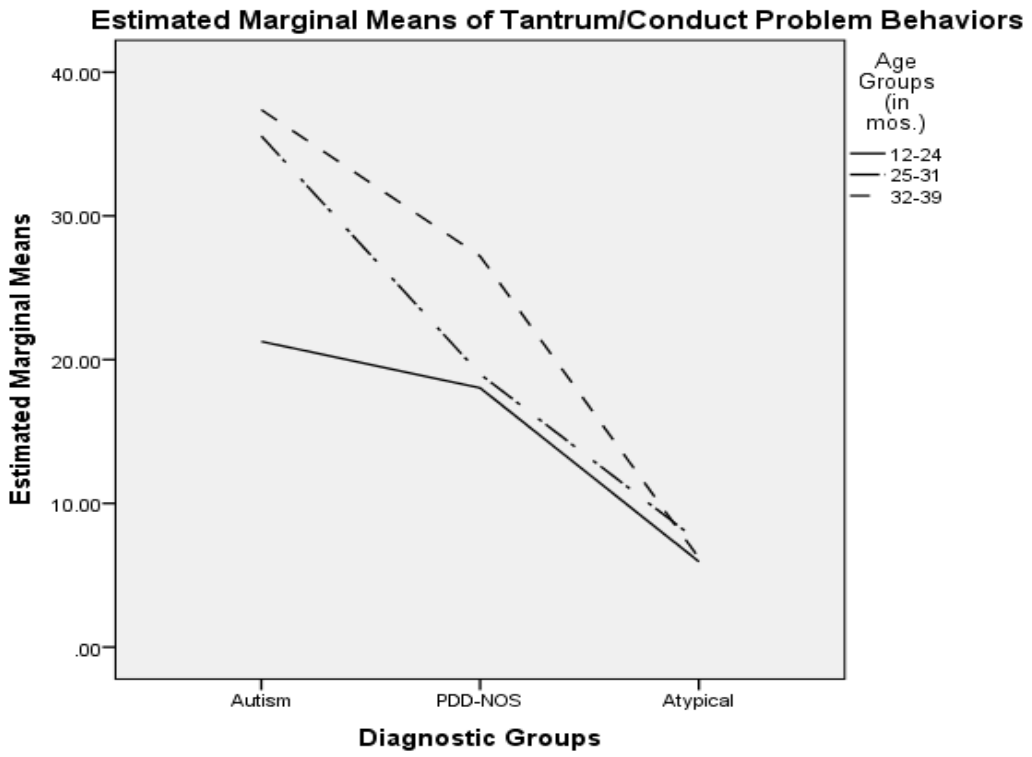

Figure 2. Estimated Marginal Means of *Tantrum/Conduct Problem Behaviors* comparing Diagnostic Group and Age.

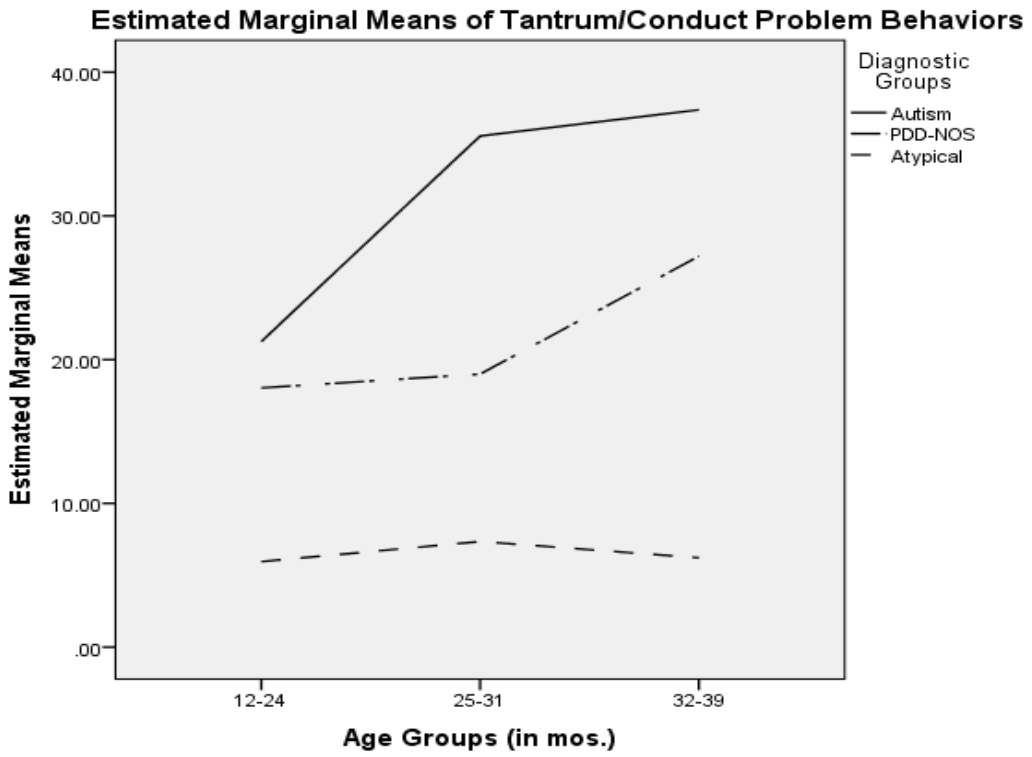

Figure 3. Estimated Marginal Means of *Tantrum/Conduct Problem Behaviors* comparing Age and Diagnostic Group.

Post hoc analyses were run using the Hochberg procedure, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Diagnostic Groups demonstrate that children with autism score significantly higher than individuals with PDD-NOS in presentation of *Tantrum/Conduct Problem Behavior* (*MD*=10.59, *SE*=1.30, $p<.05$). Children with autism score significantly higher than individuals with atypical development in presentation of *Tantrum/Conduct Problem Behavior* (*MD*=24.20,

SE=1.04, *p*<.05). Additionally, children with PDD-NOS score higher on the *Tantrum/Conduct Problem Behavior BISCUIT-Part 2* subscale than the children in the atypical development diagnostic group (*MD*=13.60, *SE*=0.97, *p*<.05), which can be seen in Table 9.

Table 9.
Post Hoc Hochberg Multiple Comparisons of Diagnostic Groups, Tantrum/Conduct Problem Behaviors

Diagnostic Groups		Mean Difference	*SE*	Sig.
Autism	PDD-NOS	10.59	1.3	0.00*
	Atypical	24.2	1.04	0.00*
PDD-NOS	Autism	-10.59	1.3	0.00*
	Atypical	13.6	0.97	0.00*
Atypical	Autism	-24.2	1.04	0.00*
	PDD-NOS	-13.6	0.97	0.00*

*p<.05

Post hoc analyses were run using the Hochberg procedure, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Age demonstrate that older children score significantly higher than younger children in presentation of *Tantrum/Conduct Problem Behavior* (32-39 to 12-24 *MD*=4.14, *SE*=1.01, *p*<.05; 25-31 to 12-24 *MD*=3.82, *SE*=0.76, *p*<.05). Post hoc analyses can be seen in Table 10.

Table 10.
Post Hoc Hochberg Multiple Comparisons of Age Groups, Tantrum/Conduct Problem Behaviors

Age Groups (in mos.)		Mean Difference	*SE*	Sig.
12-24	25-31	-3.82	0.76	0.00*
	32-39	-4.14	1.01	0.00*
25-31	12-24	3.82	0.76	0.00*
	32-39	-0.31	0.99	0.99
32-39	12-24	4.14	1.01	0.00*
	25-31	0.31	0.99	0.99

*$p<.05$

6.4.3 *Anxiety/Repetitive Behavior*

For the *Anxiety/Repetitive Behavior* subscale there was a significant interaction between Age and Diagnostic Groups, $F(4, 1877)=13.7$, $p<.05$, but no sex effects (Sex X Age, $F(2,1877)=.771$, $p>.05$; Sex X Diagnostic Group, $F(2, 1877)= 2.174$, $p>.05$; Sex X Age X Diagnostic Group, $F(4, 1877)=1.301$, $p>.05$), as can be seen in Table 11.

Table 11.
Tests of Between Subjects for Factorial ANOVA, Anxiety/Repetitive Behaviors

	df	*MS*	*F*	Sig.	η^2
Sex X Age	2	61.774	0.771	0.463	0.001
Sex X Diagnostic Group	2	174.128	2.174	0.114	0.002
Age X Diagnostic Group	4	1097.749	13.706	.000*	0.029
Sex X Age X Diagnostic Group	4	104.243	1.301	0.267	0.003
Error	1859	80.095			

* *$p<.05$*

Table 12 shows the means across gender for the factorial ANOVA of the *Anxiety/Repetitive Behaviors* subscale. Males tended to score higher than females, however this difference was not significant. Due to a lack of gender differences, Sex was removed to examine differences across Diagnostic Group and Age.

Table
12.
Descriptive Statistics in Factorial ANOVA, Anxiety/Repetitive Behaviors

		Male			Female		
Age		*M*	*SD*	*n*	*M*	*SD*	*n*
12-24	Autism	13.33	17.99	60	10.35	11.33	18
	PDD-NOS	4.91	8.5	88	3.25	4.1	21
	Atypical	0.8	2.63	371	0.87	3.31	182
25-31	Autism	20.5	22.53	92	17.91	20.48	33
	PDD-NOS	6.57	9.39	108	7.48	11.47	31
	Atypical	1.15	3.86	386	0.73	2.43	174
32-39	Autism	24.72	18.14	32	23.03	25.57	15
	PDD-NOS	11.69	17.29	28	17.05	16.13	16
	Atypical	2.21	5.67	156	0.62	2.51	66

Analyses show that the older children with autism scored higher on the *Anxiety/Repetitive Behaviors BISCUIT-Part 2* subscale than the younger children with autism (32-39 *M*=23.87, *SE*=1.40; 25-31 *M*=19.21, *SE*=0.91; 12-24 *M*=11.84, *SE*=1.20).

Additionally, the older children with PDD-NOS scored higher than the younger children with PDD-NOS (32-39 *M*=14.37, *SE*=1.40; 25-31 *M*=7.02, *SE*=0.91; 12-24 *M*=4.08, *SE*=1.09); with the same trend for those with atypical development (32-39 *M*=1.42, *SE*= 0.66; 25-31 *M*=0.94, *SE*=0.41; 12-24 *M*=0.84, *SE*=0.40). Mean comparisons can be seen in Table 13. Graphic Representations are shown in Figures 4 and 5.

Table 13.
Estimated Marginal Means of the Interaction of Diagnostic Groups and Age Groups, Anxiety/Repetitive Behavior

Diagnostic Groups	Age	*M*	*SE*
Autism	12-24	11.84	1.2
	25-31	19.21	0.91
	32-39	23.87	1.4
PDD-NOS	12-24	4.08	1.09
	25-31	7.02	0.91
	32-39	14.37	1.4
Atypical	12-24	0.84	0.4
	25-31	0.94	0.41
	32-39	1.42	0.66

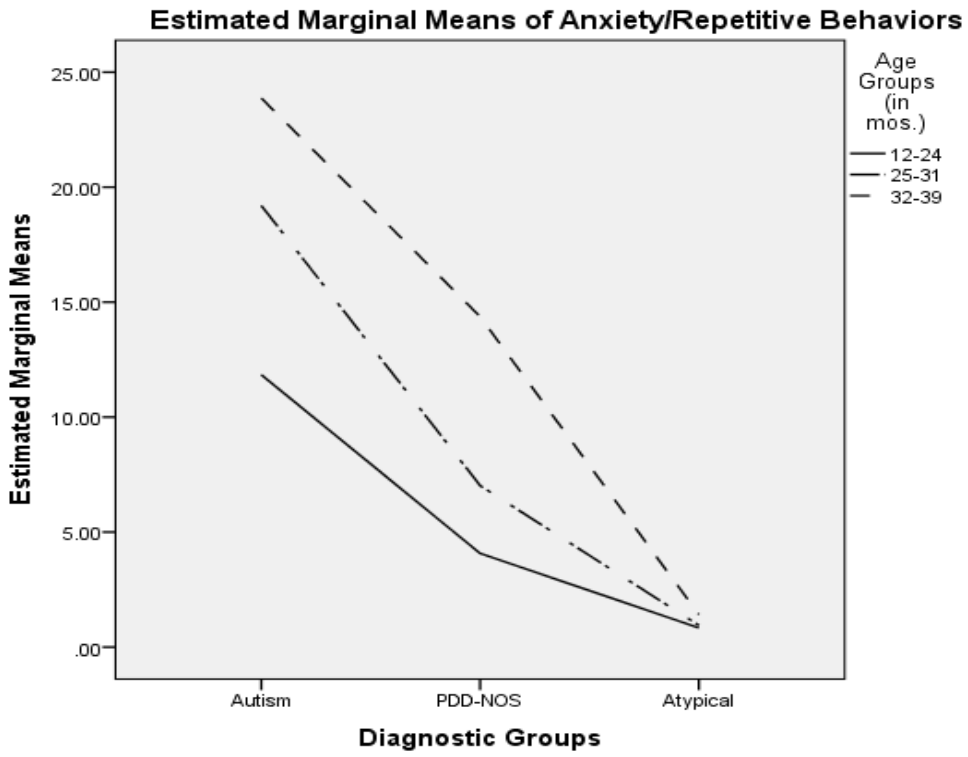

Figure 4. Estimated Marginal Means of *Anxiety/Repetitive Behaviors* comparing Diagnostic Group and Age.

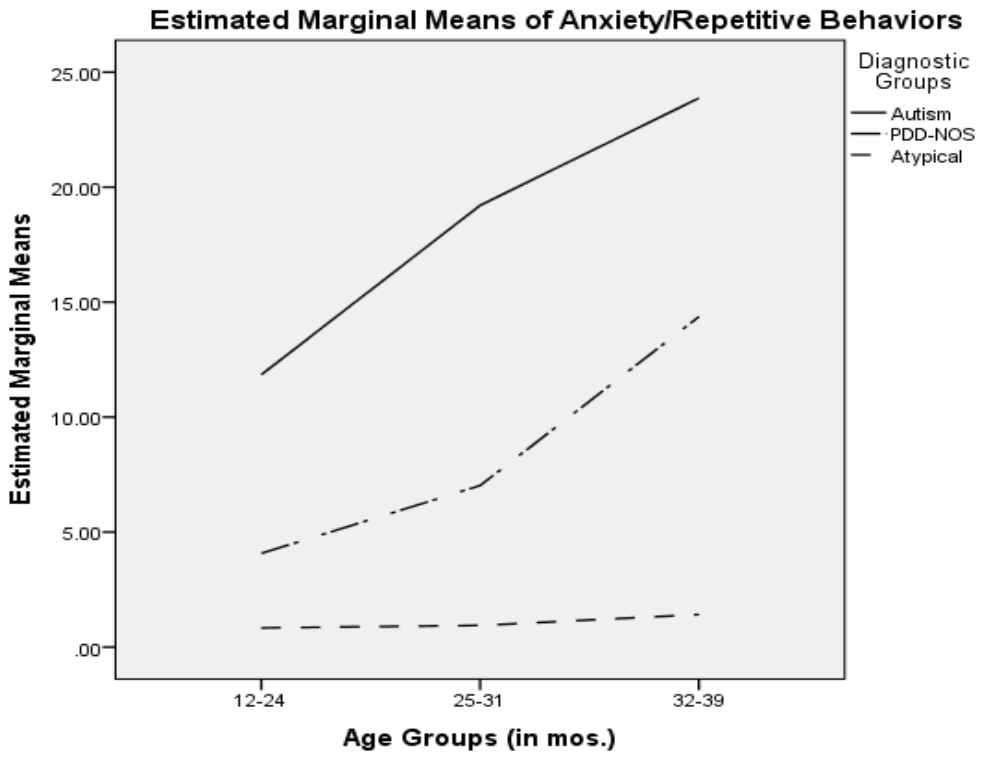

Figure 5. Estimated Marginal Means of *Anxiety/Repetitive Behaviors* comparing Age and Diagnostic Group.

Post hoc analyses were run using the Hochberg procedure, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Diagnostic Groups demonstrate that children with autism score significantly higher than individuals with PDD-NOS in presentation of *Anxiety/Repetitive Behaviors* (*MD*=11.44, *SE*=0.77, $p<.05$). Children with autism score significantly higher than individuals with atypical development in presentation of *Anxiety/Repetitive Behaviors* (*MD*=17.34, *SE*=0.62,

$p<.05$). Additionally, children with PDD-NOS score higher on the *Anxiety/Repetitive Behaviors BISCUIT-Part 2* subscale than the children in the atypical development diagnostic group (*MD*=5.93, *SE*=0.58, $p<.05$), which can be seen in Table 14.

Table 14.
Post Hoc Hochberg Multiple Comparisons of Diagnostic Groups, Anxiety/Repetitive Behavior

Diagnostic Groups		Mean Difference	*SE*	Sig.
Autism	PDD-NOS	11.41	0.77	0.00*
	Atypical	17.34	0.62	0.00*
PDD-NOS	Autism	-11.41	0.77	0.00*
	Atypical	5.93	0.58	0.00*
Atypical	Autism	-17.34	0.62	0.00*
	PDD-NOS	-5.93	0.58	0.00*

*$p<.05$

Post hoc analyses were run using the Hochberg analysis, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Age demonstrate that older children score significantly higher than younger children in presentation of *Anxiety/Repetitive Behaviors* (32-39 to 12-24 *MD*=4.16, *SE*=0.60, $p<.05$; 25-31 to 12-24 *MD*=2.22, *SE*=0.45, $p<.05$). Post hoc analyses can be seen in Table 15.

Table 15.
Post Hoc Hochberg Multiple Comparisons of Age Groups, Anxiety/Repetitive Behavior

Age Groups (in mos.)		Mean Difference	*SE*	Sig.
12-24	25-31	-2.22	0.45	0.00*
	32-39	-4.16	0.6	0.00*
25-31	12-24	2.22	0.45	0.00*
	32-39	-1.94	0.59	0.00*
32-39	12-24	4.16	0.6	0.00*
	25-31	1.94	0.59	0.00*

*$p<.05$

6.4.4 *Eat/Sleep Problems*

For the *Eat/Sleep Problems* subscale, there was a significant interaction between Age and Diagnostic Groups, $F(4, 2142)=2.4$, $p<.05$, but no sex effects (Sex X Age, $F(2, 2142)=1.294$, $p>.05$; Sex X Diagnostic Group, $F(2, 2142)=.381$, $p>.05$; Sex X Age X Diagnostic Group, $F(4, 2142)=1.503$, $p>.05$), as can be seen in Table 16.

Table 16.
Tests of Between Subjects for Factorial ANOVA, Eat/Sleep Problems

	df	*MS*	*F*	Sig.	η^2
Sex X Age	2	471.959	1.294	0.274	0.001
Sex X Diagnostic Group	2	139.005	0.381	0.683	0
Age X Diagnostic Group	4	880.543	2.414	.047*	0.005
Sex X Age X Diagnostic Group	4	548.16	1.503	0.199	0.003
Error	2123	364.722			

* *$p<.05$*

Table 17 shows the means across gender for the factorial ANOVA of the *Eat/Sleep Problems* subscale. Males tended to score higher than females, however this difference was not significant. Due to a lack of gender differences, Sex was removed to examine differences across Diagnostic Group and Age.

Table 17.
Descriptive Statistics in Factorial ANOVA, Eat/Sleep Problems

		Male			Female		
Age	Diagnostic Category	*M*	*SD*	*n*	*M*	*SD*	*n*
12-24	Autism	22.92	26.38	78	28.8	32.52	23
	PDD-NOS	12.37	20.74	98	16.48	19.82	22
	Atypical	6.12	13.44	421	7.95	17.04	209
25-31	Autism	31.57	30.47	118	26.32	33.24	38
	PDD-NOS	15.37	22.37	122	18.15	28.05	42
	Atypical	6.71	15.21	425	7.68	14.53	197
32-39	Autism	25.34	26.6	37	33.55	36.1	19
	PDD-NOS	26.14	31.31	33	25	22.96	17
	Atypical	7.26	13.39	174	6.25	12.12	68

Analyses show that the older children with autism scored higher on the *Eat/Sleep Problems BISCUIT-Part 2* subscale than the younger children with autism (32-39 M=29.45, SE=2.70; 25-31 M=28.94, SE=1.78; 12-24 M=25.86, SE=2.27). Additionally, the older children with PDD-NOS scored higher than the younger children with PDD-

NOS (32-39 *M*=25.57, *SE*=2.85; 25-31 *M*=11.17, *SE*=6.47; 12-24 *M*=25.86, *SE*=2.27); with the same trend for those with atypical development (32-39 *M*=6.75, *SE*=1.37; 25-31 *M*=7.19, *SE*=0.82; 12-24 *M*=7.04, *SE*=0.81). Mean comparisons can be seen in Table 18. Graphic Representations are shown in Figures 6 and 7.

Table 18.
Estimated Marginal Means of the Interaction of Diagnostic Groups and Age Groups, Eat/Sleep Problems

Diagnostic Groups	Age	*M*	*SE*
Autism	12-24	25.86	2.27
	25-31	28.94	1.78
	32-39	29.45	2.7
PDD-NOS	12-24	14.43	2.25
	25-31	11.17	6.47
	32-39	25.57	2.85
Atypical	12-24	7.04	0.81
	25-31	7.19	0.82
	32-39	6.75	1.37

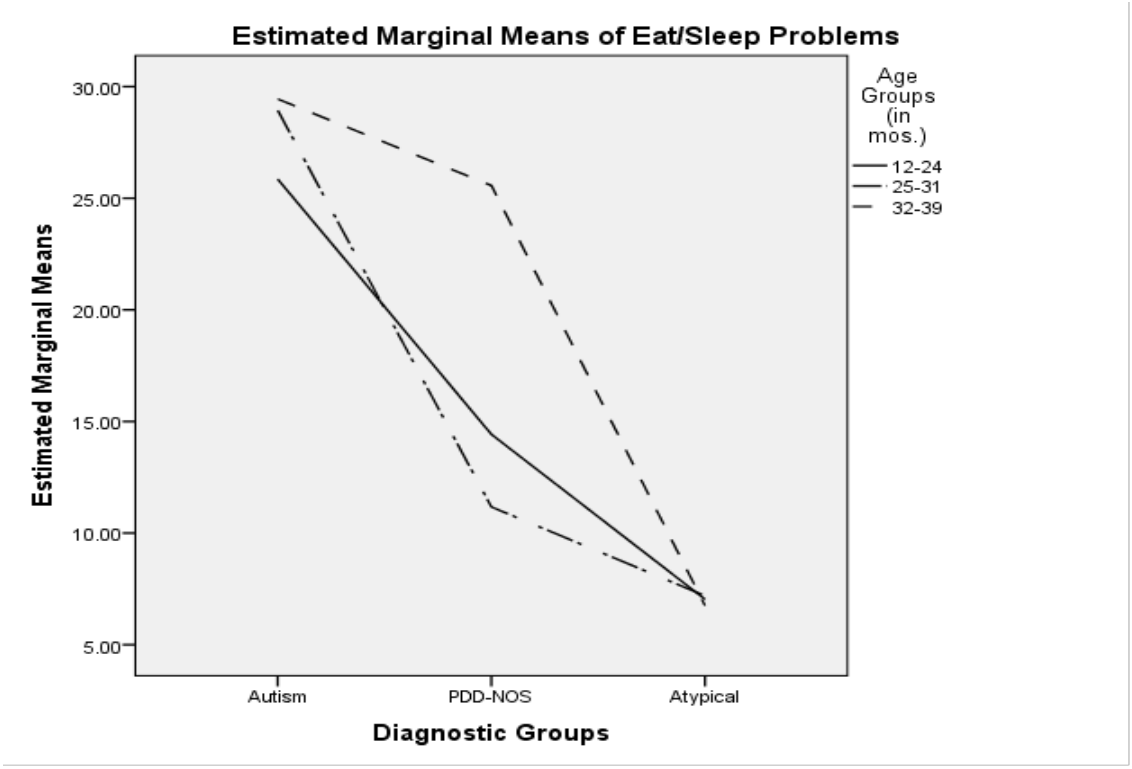

Figure 6. Estimated Marginal Means of *Eat/Sleep Problems* comparing Diagnostic Group and Age.

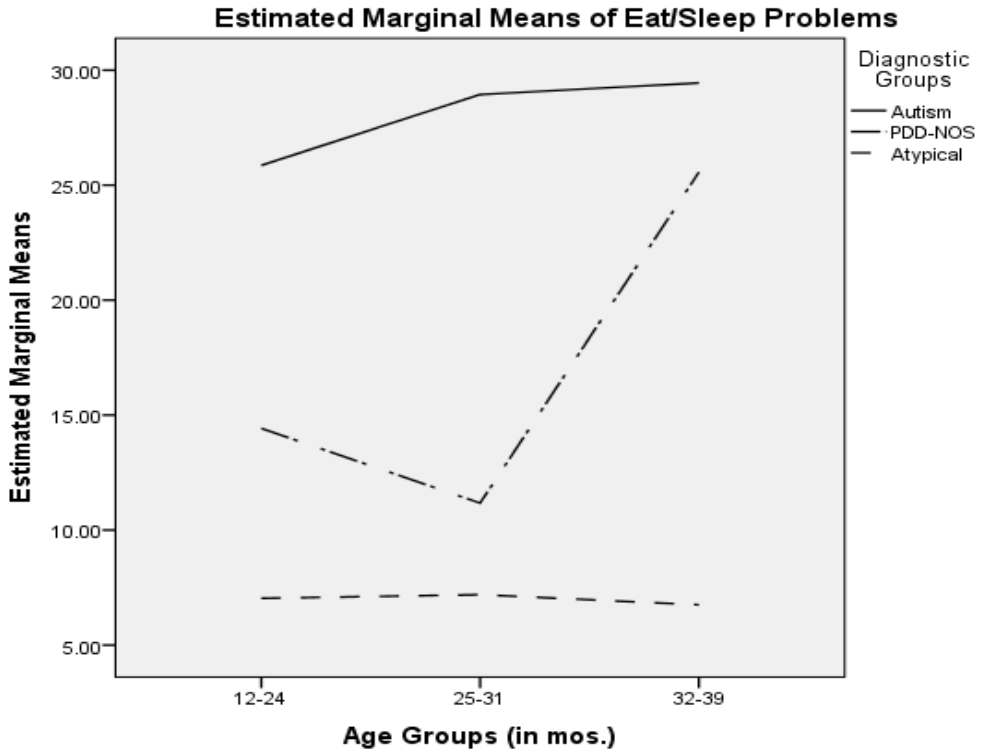

Figure 7. Estimated Marginal Means of *Eat/Sleep Problems* comparing Age and Diagnostic Group.

Post hoc analyses were run using the Hochberg procedure, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Diagnostic Groups demonstrate that children with autism score significantly higher than individuals with PDD-NOS in presentation of *Eat/Sleep Problems* (*MD*=11.54, *SE*=1.50, $p<.05$). Children with autism score significantly higher than individuals with atypical development in presentation of *Eat/Sleep Problems* (*MD*=21.07, *SE*=1.19, $p<.05$). Additionally, children

with PDD-NOS score higher on the *Eat/Sleep Problems BISCUIT-Part 2* subscale than the children in the atypical development diagnostic group (*MD*=9.53, *SE*=1.15, $p<.05$), which can be seen in Table 19.

Table 19.
Post Hoc Hochberg Multiple Comparisons of Diagnostic Groups, Eat/Sleep Problems

Diagnostic Groups		Mean Difference	*SE*	Sig.
Autism	PDD-NOS	11.54	1.5	0.00*
	Atypical	21.07	1.19	0.00*
PDD-NOS	Autism	-11.54	1.5	0.00*
	Atypical	9.53	1.15	0.00*
Atypical	Autism	-21.07	1.19	0.00*
	PDD-NOS	-9.53	1.15	0.00*

*$p<.05$

Post Hoc analyses were run using the Hochberg analysis, used due to its sensitivity to unequal sample sizes. The results of the post hoc for Age demonstrate that older children score significantly higher than younger children in presentation of *Eat/Sleep Problems* (32-39 to 12-24 *MD*=3.37, *SE*=1.22, $p<.05$; 25-31 to 12-24 *MD*=2.72, *SE*=0.90, $p<.05$). Post hoc analyses can be seen in Table 20.

Table 20.

Post Hoc Hochberg Multiple Comparisons of Age Groups, Eat/Sleep Problems

Age Groups (in mos.)		Mean Difference	*SE*	Sig.
12-24	25-31	-2.72	0.9	.01*
	32-39	-3.37	1.22	.02*
25-31	12-24	2.72	0.9	.01*
	32-39	-0.64	1.2	0.93
32-39	12-24	3.37	1.22	.02*
	25-31	0.64	1.2	0.93

*$p<.05$

7. Discussion

The study examined the ages at which symptoms of comorbid psychopathologies begin to emerge in children with a developmental delay. The assessment of the comorbid psychopathologies was based on parent report. Each of the five types of psychopathology assessed could be seen in some children as young as 12 months. However, psychopathologies did not all emerge at the same time. Not all children who develop autism begin to show these symptoms at age 12 months. As children get older, parents begin to notice these behaviors more consistently. Of the ages at which the children were assessed, there was no clear indication of a specific age that children with autism begin to show a particular comorbid diagnosis. It was clear that *BISCUIT-Part 2* scores tended to increase with age. As children continue to develop, behaviors reflecting a comorbid diagnosis become prevalent. The children in this study, at ages younger than 39 months did not reliably show comorbid behaviors. Although the psychopathologies were beginning to emerge, it is more likely and beneficial to delay diagnosis until children are older. Children younger than 39 months are too young to reliably diagnose a comorbid disorder. With this sample, we were unable to clearly mark at what age symptoms of comorbid psychopathologies begin to show.

Although we found a triple interaction effect for the factors Sex x Age x Diagnostic group (albeit with a minimum effect size), subsequent analyses failed to

identify a significant effect of factor Sex, as opposed to the factors Age and Diagnostic Groups. In other words, with our sample of infants and toddlers with developmental delay, there was no clear gender effect on any of the five types of psychopathology assessed by the *BISCUIT-Part 2*. Male and female children did not show significantly different behaviors. Although it has been shown that females are more likely to have certain disorders compared to males (as described earlier) at this young age, these effects were not present.

This study also looked at the differences in symptom presentation of comorbid psychopathologies across our three diagnostic groups. The autism group had the highest *BISCUIT-Part 2* scores for all five subscales, followed by the PDD-NOS group, followed by the atypically developing group. For the behaviors tested in the *BISCUIT-Part 2* (*Tantrum/Conduct Problem Behaviors, Anxiety/Repetitive Behaviors, Avoidance, Inattention/Impulsivity, and Eat/Sleep Problems)* the participants with autism showed more of these behaviors. Children with autism who were in the older age group showed more comorbid symptomology compared to the younger children with autism for the subgroups of *Tantrum/Conduct Problem Behaviors, Anxiety/Repetitive Behaviors* and *Eat/Sleep Problems.* This same pattern was shown for individuals with PDD-NOS.

The overall findings demonstrate that some behaviors seen in children under the age of 39 months can suggest a comorbid diagnosis, yet there is no specific age (younger than 39 months) where all children can be diagnosed. For those children showing atypical behaviors, it is beneficial to begin early intervention services. However, a true comorbid

diagnosis may not be made until the child is older. Individuals with autism are likely to show more of these behaviors compared to children with other atypical development.

7.1 Limitations: Circular Reasoning

The *BISCUIT-Part 1* was developed as a screening tool for autism in infants and toddlers. As such it was designed to capture core symptoms of autism, such as socialization/nonverbal communication, repetitive behavior/restricted interests, and communication behaviors. *BISCUIT-Part 2*, on the other hand, was designed to screen for behavioral manifestations that are symptomatic of some mental or emotional vulnerability or psychopathology that is theoretically independent of the core autism symptoms. In other words, *BISCUIT-Part 1* and *Part 2* are supposed to measure two separate constructs.

However, taking a closer look at some *BISCUIT-Part 2* items suggests that a child's behavioral manifestations that are assessed by *BISCUIT-Part 2* may also reflect the construct underlying *BISCUIT-Part 1*. The question arises, therefore, whether the *Parts 1* and *2* of the *BISCUIT* indeed measure independent constructs, or whether those constructs are more or less overlapping and indistinguishable. If *BISCUIT-Part 1* and *Part 2* were indistinguishable, the conclusion that children with autism have a higher likelihood to also show more emotional vulnerabilities would be fallacious, due to circular reasoning.

Items from the *BISCUIT-Part 2* could actually reflect autism core symptoms, rather than reflecting something additional to the analysis. For example, the factor of

Inattention/Impulsivity, the behavior of "compliance with demand" could be assessing the core autism symptom of impairment in communication and understanding language. Some items on the factor *Avoidance* include, "unreasonable fear of approaching or touching specific objects, people, or animals," and "exposure to specific object/situation provokes immediate distress that is not age appropriate." These symptoms could be present in a child without avoidance behaviors but instead a child that has difficulty with interpreting sensory information. Additionally, the *BISCUIT-Part 2* item of "avoids specific objects, persons, or situations causing interferences with his/her performance" could be addressing the core symptoms of autism of impairments in socialization and understanding social cues. Under the factor of *Tantrum/Conduct Problem Behaviors,* items such as "easily becomes upset," "irritable mood," and "tearful or weepy" are all items that could describe a young child with an autism diagnosis. These behaviors are common in children with autism, even when not presenting tantrum or conduct problem behaviors.

7.2 Limitations: Statistics

Although the ANOVA strategy was used for this data there were some limitations. The assumptions of the ANOVA were not fully met. The assumption of a normal distribution was violated. Although the *F* test is robust with respect to Type I error, power could be a concern. Proofs have shown that Type I error probability associated with the *F* test is not much affected by sampling from non-normal populations

unless the samples are very small and there is extreme departure from normality (Myers & Well, 2003).

An assumption of the MANOVA is that the observed covariance matrices of the dependent variables are the same across groups (determined by levels of the independent variable) in the population. Box's M tests that assumption and is a sensitive test. In the case at hand the *p* value of .000 suggests that the hypothesis of equal covariance matrices was rejected, Box's M = 4325.8, $F(255, 58949.67) = 15.923$, $p<.001$. So the assumption of the equal covariance matrices had been violated. The robustness of the MANOVA is questionable. When Box's test finds that the covariance matrices are significantly different across levels of the independent variable that may indicate an increased possibility of Type I error. This is less of a problem, as the sample sizes are large suggesting substantial power for the analysis.

7.3 Implications

Johnson and colleagues (2007) have created a process for surveillance of children leading to diagnosis and early intervention for those presenting with autism symptoms. The process begins with regular screening for autism and other atypical developmental behaviors at pediatric preventative care visits. Physicians should examine risk factors, such as if there is a sibling with an ASD and parental, caregiver or physician concerns. Parents and caregivers should be asked open-ended questions about behaviors that would signify risk to typical development. Additionally, examining developmental milestone achievement can indicate atypical development. If a child has several risk factors, then

screening for an ASD should happen immediately. A formal standardized screening tool should be completed, chosen by the level of risk a child is presenting with.

When ASD is found by screening, parents should be educated about the developmental disorder and how to access a comprehensive evaluation for their child. Professionals should present parents with peer-reviewed and consensus-driven information that is evidence-based, rather than non-peer reviewed sources that can be quickly located through an Internet search (Johnson et al., 2007). It is important that the parent can understand this material, as their educational and vocational backgrounds will vary. The child should then have a complete and comprehensive ASD evaluation, followed by early intervention or early childhood education services. As soon as an infant or toddler is suspected to have atypical development or be at risk for a developmental disorder, he should be immediately recommended to an early intervention program that serves children with special needs. Intervention is important and can be effective when implemented at an early age (Johnson et al., 2007). Follow-up visits should be conducted regularly to assess the child's progress and development.

7.4 Future Research

Future research could focus on older children with similar diagnoses. It will be beneficial to find an age where such behaviors are clearly presenting in most children. This can aid clinicians in determining a standard age at which to test children for comorbid diagnoses. Early intervention is an important aspect for proper treatment for children. The earlier and more reliably a clinician can diagnose a comorbid condition, the

sooner the child can receive treatment. General practitioners should listen carefully to parental and teacher concerns about children's development. In particular, there should be a focus on language development, as parents can be a reliable source of information about their child's development and behavior (Samms-Vaughan & Franklyn-Banton, 2008).

Additionally, general public education about child development and signs of abnormality should be developed further. Focus on social and behavioral abnormalities can aid parents in their interactions with their children on the autism spectrum. Education professionals should also be informed about the core symptoms of autism and the potential comorbid challenges that a young child with autism may face. Methods on treatment and best practices of increasing skills in social, communication and behavioral areas should be emphasized.

Continued research into the symptoms of anxiety, depression, eat, and sleep problems in young children can also benefit clinicians and parents as they assist in the development of young children. Coordination of treatment services for children with autism is another area to be developed. The total environment will affect the development of a young child, which signals the importance of coordination across home, school and other treatment environments. Research should continue to focus on how to provide comprehensive services that work together across these environments. For young children who are diagnosed with a comorbid disorder, the treatments provided will require specialists from a variety of areas, and thus the treatment must be coordinated across those environments.

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Curriculum Vitae

Erica M. Buchholz grew up in Pennsylvania. She attended Wilkes University, where she received her Bachelor of Arts in Psychology with a minor in Neuroscience in 2006. She then received her Doctorate in Psychology with a concentration in Applied Developmental Psychology from George Mason University in 2012. She has worked with College Living Experience since March of 2011 and will continue in that position following graduation.