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Gender differences in children with Autism Spectrum Disorders and comorbid psychopathology

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GENDER DIFFERENCES IN CHILDREN WITH AUTISM SPECTRUM DISORDERS AND COMORBID PSYCHOPATHOLOGY

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Abstract

Children and adolescents diagnosed with Autism Spectrum Disorders (ASD) frequently exhibit symptoms that are not associated with the core features of ASD. These symptoms may meet criteria for an additional diagnosis; however, accurate assessment of comorbid psychiatric conditions in ASD has been hindered by a lack of measures designed for this specific purpose. The newly constructed assessment measure, *Autism Spectrum Disorders-Comorbid for Children (ASD-CC)* has been developed specifically for examining comorbid psychiatric disorders in ASD. Therefore, this study set out to assess differences in the endorsement rates of psychiatric symptoms in children and adolescents diagnosed with ASD compared to their same aged typically developing peers, utilizing the *ASD-CC*. Additionally, an examination of gender differences of psychiatric symptom endorsements was conducted. Results of the analyses indicated that there are no significant differences between males and females in regards to psychiatric symptom endorsement. However, the *ASD-CC* did reveal significant differences between children and adolescents diagnosed with ASD compared to those without ASD. The subscales (i.e., of the *ASD-CC)* worry/depressed, under-eating, over-eating, avoidant behavior, and repetitive behavior all contributed to the significant difference between groups. The implications of the significant and non-significant results as well as directions for future research are discussed.

Introduction

Previously, the sole diagnosis of an Autism Spectrum Disorder (ASD) was thought to preclude any additional psychiatric symptoms present (Lainhart, 1999), and therefore, no further diagnostic considerations were made. However, in addition to the core features and associated symptomatology that children with ASD experience, they often suffer from comorbid psychiatric conditions (Lainhart, 1999; Matson & Nebel-Schwalm, 2007). Researchers have noted the necessity for further development in this area since ASD and other comorbid disorders are difficult to tease apart (Gillberg & Billstedt, 2000). To date, research in this area has been narrow in scope since measures designed to assess comorbid symptomatology among this population are limited (Matson & Nebel-Schwalm, 2007; Matson, Nebel-Schwalm, & Matson, 2007; Tsai, 1996). Accurate assessment of psychiatric symptoms comorbid with ASD can be achieved through the combination of empirical measures that assess symptoms, interviews, observations, and an acquisition of information pertaining to developmental milestones (Nebel-Schwalm & Matson, 2008). Additionally, since symptoms associated with psychiatric disorders wax and wane; repeated assessments may help identify symptoms that are stable and associated with the diagnosis of the ASD versus those that may be related to a comorbid psychiatric disorder (Matson & Neal, 2009; Matson & Nebel-Schwalm, 2007).

The aim of the present study was to utilize a newly developed measure, the *Autism Spectrum Disorders-Comorbidity for Children (ASD-CC),* to assess comorbid psychiatric symptomatology present in children with ASD. Additionally, the *ASD-CC* was utilized to investigate gender differences among this population in regards to psychiatric symptomatology. The history and core features of ASD are discussed followed by a review of common comorbid psychiatric disorders in children with ASD and current assessment techniques of the same.

Autism Spectrum Disorders

History

In 1943, Leo Kanner encountered a group of children, eight boys and three girls, whose presentation was uniquely different from children with any other known psychiatric condition at that time. A detailed description of these children was outlined in Kanner's (1943) original paper "Autistic Disturbances of Affective Contact." Although differences among these 11 children were noted, commonalities existed across three areas of impairment including: social detachment, communication deficits, and requiring sameness in their daily routines. In 1944, Kanner (1965) began referring to this syndrome as "early infantile autism" and this syndrome has since received much attention.

First, Kanner (1943) described these children as having an "inability to relate themselves in the ordinary way to people and situations from the beginning of life" (p. 242). Observations of these children suggested that they tended to be drawn towards objects more than people. The children became upset when interrupted from playing with a preferred object or while engaging in a preferred activity. These children were amused with certain objects or activities for an extended amount of time. The specific objects most appealing to them were often those that did not interest typically developing children. For example, one of the children that Kanner discussed had a fascination with toilets.

Secondly, all 11 children had some sort of language impairment or delay in linguistic maturity. Of the 11 children, 3 of them never developed any verbal communicative abilities. The remaining children were able to verbally communicate with those around them; however, their communication was often meaningless to others. Words or phrases were inconsistent with the content of the conversation at the time they were spoken. Their speech often consisted of exact repetitions of language they had heard previously (e.g., strings of words, songs, and phrases).

These repetitions were not always immediate, which was an indicator that the children possessed good rote memory. This echolalic speech often resulted in the inaccurate use of first and third person pronouns, often switching the "I" and "You" during speech production.

The last area of major impairment noted by Kanner (1943) was in their "anxiously obsessive desire for the maintenance of sameness" (p. 245). These children were insistent on being surrounded by a routine and predictable environment, which lacked unstructured activity. If the monotony of their schedules varied, the children's behavioral responses were marked by panic, crying spells, aggression, and tantrums.

Additionally, play tended to be repetitive as Kanner (1943) noted that as these children played, it was done in a repetitious manner with precision to keep consistency. Furthermore, items that were played with had to remain the same; therefore broken toys could be a source of distress for the child. The only time sameness could vary, then, was if the children themselves were responsible for the change (Kanner, 1951). This desire for sameness caused the children to act in an obsessive manner.

At first, the prevalence of "early infantile autism" may have been underrepresented simply because children were initially misdiagnosed. For example, these children may have been inaccurately diagnosed with schizophrenia or labeled as feebleminded. However, in Kanner's (1943) review he comments on the children's decent and intact cognitive abilities. He concluded that there were no intellectual disabilities as the children he observed had excellent memories and vocabularies.

Although Kanner was the first to describe the behavior presentation of what is now known as Autistic Disorder (AD), the term autism was actually first coined in 1908, by Swiss Psychiatrist, Eugene Bleuler. Bleuler (1913) utilized this term to describe what he considered a core feature of schizophrenia. This description included a withdrawal from reality into a fantasy

life while decreasing the amount of interaction with others (Bleuler, 1913). In other words, relationships with others do exist, but at some point in time that individual withdraws from these pre-existing relationships. Kanner's (1965) usage of the term departs from that of Bleuler's in that Kanner is referring to a disorder, not just a symptom. Furthermore, Kanner's (1965) definition involves a failure to ever develop close relationships with others. He explains that this lack of development can be detected early in life. Further defining and differentiating Kanner's definition of autism includes, having limited facial expressions, an absence of eye contact, and decreased attachments to parents (Rutter & Bartak, 1971).

Leo Kanner's decision to utilize the term autism for this syndrome was unfortunate, as it caused confusion amongst professionals. Initially, many thought that autism was the childhood form of schizophrenia (Kanner, 1965; Rutter, 1968). However, this was rejected once distinctions between the two disorders were outlined. Rutter (1968, 1971, 1972, 1978) outlined the differences in the two disorders as including: sex ratio (more males in autism), presentation of hallucinations and delusions (absent in autism), family history of the illness (infrequent in autism), social class (higher socioeconomic status for autism), stability of the course of illness over time (stable for those with autism), and the presence of intellectual disability (ID) (in those with autism). Additionally, there was a peak onset of autism in infancy and for schizophrenia it was in adolescence with a clear discontinuation between these two ages of onset. This difference was another indicator that autism was not the childhood expression of schizophrenia (Rutter, 1972; Rutter & Schopler, 1988).

Once this distinction between the two conditions was made, it also assisted in decreasing the use of the term childhood schizophrenia as a broad and interchangeable label when referring to other disorders and syndromes that are present in children. Rutter (1972) noted the overuse of the term childhood schizophrenia to describe various disorders including: "infantile autism, the

atypical child, symbiotic psychosis, dementia praecocissima, dementia infantilis, schizophrenic syndrome of childhood, pseudo-psychopathic schizophrenia, and latent schizophrenia" (p. 315). Additionally, he aimed at redefining autism, as variations in diagnostic criteria over time were adopted. Rutter (1978) systematically found that the main areas of impairment first noted by Kanner were consistent and accurate. His findings supported the claim that children with autism differ markedly from typically developing children in these three core areas: language development, social development, and insistence on sameness. Additionally he noted that these deficits in development must be present prior to 30 months. Furthermore, Rutter and Lockyer (1967) made additional contributions to redefining features of this disorder, as they discounted Kanner's early claim that children with autism are not intellectually disabled. Rutter and Lockyer's (1967) findings indicated that about one half of children with ASD have IQ's that are within the subaverage range.

Differential Diagnosis

Early on, it was debated if diagnostic differentiation within syndrome of autism was warranted. For example, some children with autism developed normally and then regressed, whereas others never developed abilities in certain areas. Some children had intact cognitive abilities while others did not (Rutter and Schopler, 1988), and some had symptoms of greater severity. We now know that these differences encompass five different disorders that lie on a spectrum, commonly referred to as the ASD. These disorders are described in the *Diagnostic and Statistical Manual (4th Edition, Text Revision; DSM-IV-TR*) as Pervasive Developmental Disorders (PDD; American Psychiatric Association [APA], 2000). In the 1990's, AD, Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), and Asperger's syndrome (AS) started being referred to as ASD due largely in part to the belief that these disorders exist on a spectrum that ranges in severity (Matson & Minshawi, 2006) and because of the many

overlapping similarities between them (Matson & Minshawi, 2006; Nebel-Schwalm & Matson, 2008; Steyn & Le Couteur, 2003). Diagnostic difficulties arise because of these overlapping symptoms, and furthermore, because symptom expression varies from individual to individual (Volkmar & Klin, 2005). Differential diagnosis is also problematic due to the majority of research being conducted solely on AD.

PDD were first introduced in the *DSM-III* (APA, 1980) and disorders under this umbrella included: Infantile Autism, Residual Infantile Autism, Childhood Onset Pervasive Developmental Disorder (COPDD), Residual COPDD, and Atypical Autism (Volkmar & Klin, 2005). Childhood schizophrenia and autism were now officially considered distinct disorders (Volkmar, Klin, & Cohen, 1997). Over time revisions were made to address concerns regarding the lifetime course of the illness, age of onset, broader diagnostic categories, and grouping of criteria into these categories. Aside from grouping criteria into broad diagnostic categories, noteworthy revisions in the *DSM-III-R* (APA, 1987) included: infantile autism was changed to AD, COPDD and residual infantile autism were dropped, PDD-NOS was added, and the criteria for age of onset was dropped. Age of onset was again added when revisions were made for the *DSM-IV* (APA, 1994; Volkmar & Klin, 2005). This version of the *DSM* also included the five disorders that remain in the most current version, the *DSM-IV-TR* (APA, 2000).

The *DSM-IV-TR* lists AD, AS, Rett's Disorder, Childhood Disintegrative Disorder (CDD), PDD-NOS under the umbrella of PDD (APA, 2000). These five neurodevelopmental disorders will be described below, however due to the rarity of CDD and Rett's Disorder, the ASD definition for purposed of this study will include only AD, AS, and PDD-NOS.

Autistic Disorder. AD is considered to be the most severe of all the ASDs. According to the *DSM-IV-TR*, for a diagnosis of AD, criteria from the three core areas of impairment must be met. These three areas include: qualitative impairment in social interaction, in communication,

and restricted and repetitive patterns of behavior/interests. At least two impairments must be present in the social interaction domain including: "impairment in the use of multiple nonverbal behaviors; failure to develop peer relationships; lack of spontaneous seeking to share enjoyment; and lack of social or emotional reciprocity" (APA, 2000, p. 75).

Communication impairments can include: "delay in, or total lack of, the development of spoken language; in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others; repetitive use of language or idiosyncratic language; and lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level." At least one impairment must be present within the communication domain (APA, 2000, p. 75).

Last, at least one impairment must be present in the category of restricted repetitive and stereotyped patterns of behavior/interests. Impairments in this category can include: "preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal in intensity or focus; apparently inflexible adherence to specific, nonfunctional routines or rituals; stereotyped and repetitive motor mannerisms; and persistent preoccupation with parts of objects" (APA, 2000, p.75). Overall, at least six impairments within these three categories must be present, following within the guidelines just reviewed, and these impairments must be present prior to the age of 3 (APA, 2000).

Asperger's syndrome. In 1944, a Viennese physician, Hans Asperger, encountered a number of children whose presentations were different from any other group of children, and he referred to this group of children as having "autistic psychopathology" (Frith, 1991). Interestingly, this encounter occurred only one year after Kanner's (1943) first description of the children he encountered. Lorna Wing later referred to these individuals as having "Asperger's syndrome" (Attwood, 2007). The children described by Asperger had typical cognitive

development and verbal linguistic abilities, isolated themselves, had social oddities, and presented with delays in social development and reasoning (Attwood, 2007; Myles & Simpson, 2002). Van Krevelen (1971) explained that in regards to linguistic interpretation, these children lacked the ability to understand the emotional intent of language (e.g., joking versus serious) and additionally took the literal meaning of words when spoken. In comparison to children with AD, those with AS do not have intellectual disabilities or delays in their development of language (APA, 2000). In their original papers both Kanner (1943) and Asperger (1944/1991) described the language of the children they encountered. According to Frith (1991) those described by Kanner presented with "echolalia, pronoun reversal, and difficulties in generalizing word meanings" and for those presented by Asperger "clever-sounding language, invented words and generally spoke more like grown-ups" (p. 10). Current diagnostic criteria for AS include two impairments in the area of social interaction and one impairment in repetitive and stereotyped patterns of behavior/interests (APA, 2000). Although distinctions between AS and AD have been noted, debate continues as to whether AS is simply a form of high functioning autism.

Pervasive Developmental Disorder-Not Otherwise Specified. Unlike AD and AS, no specific set of guidelines exist to diagnose this disorder, which is somewhat problematic given that it is the most commonly diagnosed ASD (Matson & Boisjoli, 2007). Individuals falling into this diagnostic category are those who present with deficits in socialization and communication and who may also present with stereotyped patterns of behavior/interests, but do not meet criteria for any other ASD (APA, 2000). PDD-NOS is often defined by the fact that it is not autism (Matson & Boisjoli, 2007).

Childhood Disintegrative Disorder. Some children develop normally until one or two years of age and then experience a regression in abilities. In 1908, Theodore Heller was the first to describe this condition and it was initially referred to as *dementia infantilis* (Volkmar & Klin,

2005). The *DSM-IV-TR* refers to this disorder as CDD (APA, 2000). To obtain a diagnosis of CDD, a child must develop typically for at least 2 years, which is then followed by a loss of two or more of the following skills: language, social skills, bladder/bowel control, play skills, and motor skills. Also, deficits must be observed in two of the following, social interactions, communication, or restricted or repetitive behavior patterns (APA, 2000). This condition is rare, with epidemiological studies indicating that for every 65 cases of AD, there will be one case of CDD (Fombonne, 2005a). Differences in the frequency of AD and CDD diagnoses provide some evidence that the two should be separate disorders despite debate from others. For example, Hendry (2000) argues that aside from the age of onset, those diagnosed with CDD and AD present with the same behavioral patterns and therefore should not be considered separate diagnoses. Due to the rarity of this diagnosis, research is limited, but needed to resolve these issues.

Rett's Disorder. In 1966, Andreas Rett described 22 girls who presented with "stereotypic hand movements, dementia, autistic behavior, cortical atrophy, and hyperammonemia" (Van Acker, Loncola, & Van Acker, 2005, p. 126). Less common than the other ASDs previously discussed, this disorder is characterized by a period of normal development followed by the development of multiple impairments. Furthermore, the *DSM-IV-TR* notes that Rett's Disorder only occurs in females and has an onset before age four (APA, 2000). Genetic mutations of the gene MECP2 is the cause of Rett's disorder (Amir et al., 1999). The *DSM-IV-TR* contains the following diagnostic criteria for Rett's Disorder: "normal prenatal and perinatal development; normal psychomotor development through the first 5 months after birth; deceleration of head growth between ages 5 and 48 months; loss of previously acquired purposeful hand skills between ages 5 and 48 months with the subsequent development of stereotyped hand movements; loss of social engagement early in the course; appearance of poorly coordinated gait

or trunk movements; severely impaired expressive and receptive language development with severe psychomotor retardation" (APA, 2000, p. 77). Charman et al. (2002) found that by the age of 16 months, regression occurred in 50% of females diagnosed with Rett's Disorder, with skill loss most significant in regards to hand use and communication.

Prevalence

ASDs are not as rare as once believed (Gillberg & Billstedt, 2000). Diagnostic criteria adjustments, greater awareness of ASD, comprehensive assessment measures, and better training for clinicians may account for some or all of the observed increase (Fombonne, 2005a; Fombonne, 2005b; Matson & Neal, 2009). Therefore, careful consideration needs to be used before inferring that the statistics for prevalence are accurately representing an increase and not simply representing the aforementioned. Current prevalence rates reported by the Center for Disease Control are 1 in 150 children.

Core Features of ASD

Social Interaction. Limitations in socialization are first noted during infancy and early childhood and initially, the absence of social interaction with others causes concern that a child is deaf or hearing impaired (Eveloff, 1960). Compared to typically developing infants, those with ASD fail to make and maintain eye contact, have a resistance to being held or touched, lack attachments to their parents, and may not respond to facial expressions (Folstein, 1999; Volkmar, Carter, Grossman, & Klin, 1997). As children with ASD age, they will develop some attachment to their parents (Carter, Davis, Klin, & Volkmar, 2005); however, these attachments are different from children who are typically developing. Carter et al. (2005) explain that interaction is commenced not for the purposes of engaging others, but to obtain something that is nonsocial in nature (e.g., food, toys). Another skill deficit in nonverbal interaction is joint attention (Jones & Carr, 2004; Mundy & Crowson, 1997). Jones and Carr (2004) explain that joint attention consists

of the simultaneous sharing of an event or experience between two people. The sequences of eye gazes and attention between the child and another enables the child to learn how to interact with others. Furthermore, Jones and Carr (2004) explain that impairments in joint attention contribute to a child's lack of awareness while in social encounters.

Deficits are also seen with a lack of empathy and the inability to engage in cooperative play with other children (Rutter, 1978). When discussing impairments in social imagination, Wing (1988) explains, "it interferes with the development of pretend play that involves the imaginative act of putting oneself in the position of another person, real or fictional, and of experiencing their thoughts and feelings, as distinct from empty copying of their actions" (p. 94). Deficits in this area often become more apparent as children with ASD get older and social demands increase (Lainhart, 1999). Individuals with AS may continue into their adolescence without the development of social competence (Gutstein & Whitney, 2002).

Communication. Initial concern of a child's development may occur in response to deficits in communication or loss of such skills (Charman, Drew, Baird, & Baird, 2003). Those with ASD may have impairments in nonverbal and verbal communication. Some children with ASD may never develop the ability to speak (APA, 2000). Children who do possess verbal abilities may substitute pronouns, lack meaning to their language, and have impairments in pragmatics (Folstein, 1999). According to teacher reports, children and adolescents diagnosed with ASD incorrectly substitute pronouns more than children diagnosed solely with an ID: however, their ability to comprehend and produce the pronouns did not differ significantly between groups (Lee, Hobson, & Chiat, 1994). Also, children with ASD present with echolalic speech, which includes a repetition of stored words, songs, and phrases that may be immediate or delayed (Eveloff, 1960). Immediate recall may occur if the child does not understand what has been spoken, however, delayed recall may serve as functional communication (Folstein, 1999).

Prizant and Duchan (as cited in Tager-Flusberg, Paul, & Lord, 2005) noted that other potential benefits of echolalia include "turn taking, assertions, affirmative answers, requests, rehearsal to aid processing and self regulation" (p. 346).

The aforementioned deficits in nonverbal communication can negatively impact the development of receptive language. When examining delays in receptive language development, Charman et al. (2003) found that as nonverbal mental age increases, so does the comprehension of phrases and the understanding of words. Also, compared to typically developing children, those with ASD are less likely to orient to their name and respond less to their mother's voice (Klin, 1991; Osterling & Dawson, 1994).

Behavior. A third theme to those diagnosed with ASD is their restricted interests, insistence on sameness, and repetitive behaviors. Children with ASD often develop strong interests in specific objects and become preoccupied with them (Rutter & Schopler, 1988). These interests are often unusual and unappealing for typically developing children of the same age (Van Krevelen, 1971). For example, in Kanner's (1943) original description of children with autism, one child had a fixation on toilets. Also, children with ASD may become fixated on certain parts of objects (APA, 2000); for example a child may love to play with his toy truck, only because he or she can repeatedly spin the wheels (Volkmar et al., 1997).

Secondly, these children need to have their environments and routines remain the same. Any deviation from the norm can cause distress to the child. Such a deviation can be as simple as having their rooms rearranged. These routines are impractical and serve no other purpose except to satisfy the child's desire for sameness (APA, 2000).

Lastly, children with ASD engage in repetitive movements, including stereotypies. The *DSM-IV-TR* explains that stereotypies can include finger tapping, body rocking, and hand flapping (APA, 2000). In Asperger's (1944/1991) account of one child he encountered, he noted

the non-purposeful tendency for this child to repeatedly bang on tables, walls, and his legs. Younger children often engage in the aforementioned stereotypies, while older children with ASD are more likely to engage in multifaceted activities, some which may resemble symptoms of children with Obsessive Compulsive Disorder (OCD; Loveland & Tunali-Kotoski, 2005).

Comorbid Psychopathology in ASD

Background

In addition to the core deficits described above, symptoms associated with other psychiatric disorders were observed in the children that Kanner (1943) described, including: inattention (often due to obsessions with specific topics and objects), fixation on details, specific fears (e.g., vacuum cleaner), and anxiety (experienced until sameness in their environment and routine was achieved). Despite Kanner's observations, psychiatric symptoms present in those with ASD were given considerably less attention than they currently receive. Previously, psychiatric symptoms exhibited by a person with ASD were considered part of the ASD itself (Tsai, 2000). Impairments in communication impede accurate assessment of comorbid conditions and even if a child with ASD is able to verbally communicate, comprehension may be limited, causing further complications (Lainhart, 1999). Additionally, differences in the topography of psychiatric symptoms in those with ASD coupled with intellectual disabilities make the assessment of psychiatric comorbidity complex (Tsai, 2000). Despite this complexity, accurate assessment of these symptoms is necessary as they may allow for a diagnosis of an additional disorder (Gillberg & Billstedt, 2000; Tsai, 1996).

Since children with ASD exhibit additional symptoms that are not wholly account for by their diagnosis of ASD, comorbid conditions in ASD have been given more attention (Gillberg & Billstedt, 2000). Comorbidity relates to the presence of at least two different types of psychopathology – as discussed here, a psychiatric disorder and ASD (Matson, 2007; Matson & Nebel-Schwalm, 2007; Matson & Wilkins, 2008). LeBlanc, Riley, and Goldsmith (2008) point out that families and professionals in contact with children with ASD should be attentive and responsive to the manifestation of additional psychiatric symptoms. According to Volkmar and

Klin (2005), if symptoms exhibited by a person with ASD also meet diagnostic criteria for another disorder, a hierarchical approach should be taken to categorizing the symptoms.

In addition to psychiatric comorbidity with ASD, medical disorders are also found to co-occur at high rates. Common comorbid medical conditions with ASD include hypothyroidism, seizure disorder, tuberous sclerosis, fragile X syndrome, visual impairments, hearing impairments, and sleep disorders (Gillberg & Billstedt, 2000; Morgan, Roy, & Chance, 2003; Richdale, 1999; Tsai, 1996; Wiznitzer, 2004)). A change in the frequency of challenging behaviors exhibited by a child with ASD may serve as an indicator that something medically is affecting them. Lainhart (1999) illustrates this point with an example of a challenging behavior of head banging that may be representative of a sinus problem.

Comorbid psychiatric disorders of ASD often include social anxiety, phobias, depression, OCD, and Attention Deficit/Hyperactivity Disorder (ADHD; Steyn & Le Couteur, 2003). Findings have suggested that rates of psychiatric comorbidity with ASD can range from 41% to about 81% (De Bruin, Ferdinand, Meester, De Nijs, & Verheij, 2007; Morgan et al., 2003). In a study that specifically examined children and adolescents with AS, Ghaziuddin, Weidmar-Mikhail, and Ghaziuddin (1998) reported overall psychiatric comorbidity rates at 65%, with mood disorders and ADHD co-existing at the highest frequencies. Prior to making a comorbid diagnosis, a clinician needs to ensure that the ASD diagnosis alone does not better account for the symptoms presented by the individual. As Nebel-Schwalm and Matson (2008) explain "some disorders mimic symptoms and/or features of ASD such as intellectual deficits, language problems, tics, feeding problems, sleeping problems, repetitive behaviors, and hyperactivity, further complexity is added when comorbidity is considered" (p. 109). Corroborating the above statement, Spence, Sharifi, and Wiznitzer (2004) explain that the social impairments found as a

core feature of those diagnosed with ASD are also common symptoms of other psychiatric disorders such as social anxiety, mood disorders, and ADHD.

Common Comorbid Disorders in ASD

Intellectual Disability. Although initial reports from Kanner (1943, 1951, 1971) indicated that the children he identified had intact cognitive abilities, ID has recently been reported to occur in about 75% of those diagnosed with AD (Folstein, 1999; Gillberg & Billstedt, 2000; Lainhart, 1999). Initially it was indicated that children who met diagnostic criteria for autism were misdiagnosed as having an ID (or as it was then called, feeblemindedness; Kanner 1943, 1951). However, later on, Rutter (1978) indicated that autism and ID commonly co-occur. During infancy and early childhood it may be difficult to separate developmental delays that are associated with ASD versus those with ID (Frith, 1991; Osterling & Dawson, 1994). In children with severe cognitive impairments, the absence of social skills and presence of communication deficits is difficult to tease apart from ASD, ID only, or the co-occurrence of both conditions (Howlin, 1998). However, since researchers (e.g., Folstein, 1999; Gillberg & Billstedt, 2000; Lainhart, 1999) have indicated that not all individuals diagnosed with ASD have an ID serves as evidence that these two disorders are distinct (Rutter & Schopler, 1988).

The presence of ID may further complicate an accurate diagnosis of ASD (Steyn & Le Couteur, 2003) and furthermore, psychiatric symptoms in those with ASD and ID may present differently and be of greater intensity (Matson & Nebel-Schwalm, 2007; Morgan et al., 2003; Steyn and Le Couteur, 2003). The study by Morgan et al. (2003) indicates that those with mild ID are more likely to suffer from a comorbid psychiatric disorder with ASD compared to those with moderate, severe, or profound ID. However, reports of psychiatric symptoms may be endorsed at a higher rate for those with mild ID, simply because these individuals are able to verbally communicate their symptoms (Tsai, 1996).

Depression. Some researchers have suggested that the most common co-occurring psychiatric condition of ASD is depression (Ghaziuddin, Ghaziuddin, & Greden, 2002; Ghaziuddin, Tsai, Ghaziuddin, 1992). In order to determine if criteria for depression are present, it is essential that a baseline of functioning has been established for accurate comparison (Lainhart & Folstein, 1994). Accurate assessment is important in that those with ASD and depression may exhibit suicidal ideation, sadness, and irritability (Ghaziuddin et al., 2002). Diagnosing depression in ASD is difficult, as symptom presentation may be markedly different from those without ASD and measures to assess these comorbid conditions have not been available (Stewart, Barnard, Pearson, Hasan, O'Brien 2006). Findings from Lainhart and Folstein's (1994) review of mood disorders in ASD showed that individuals were most often referred because of an increase in the frequency of challenging behaviors, changes in the level of social interaction, and changes in their level of agitation. Self injurious behaviors coupled with a decrease in adaptive functioning have also been linked to the presence of depression in those with ASD (Stewart et al., 2006).

It has been suggested that those with ASD who are aware of their disorder (i.e., higher functioning autism or AS) may be more susceptible to develop a depressive disorder (Volkmar & Klin, 2005). For example, in a sample of children with average cognitive abilities (i.e., 68 and above), those with ASD scored significantly higher on a measure of depression than typically developing children (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000). Also, Munesue (2008) conducted a study of adolescents and adults with high functioning ASD and found that one third of the participants had a mood disorder. Of these comorbid mood disorders, 25% of the participants had Major Depressive Disorder. Elsewhere, Stewart et al. (2006) reviewed 27 articles that examined depression in ASD and noted that symptoms of depression were endorsed mostly through parent/caretaker report of changes in facial expressions and a change in exhibited

behavior. These third party reports are often necessary, as self-reporting is difficult due to language impairments associated with the core features of ASD (Kim et al., 2000; Lainhart & Folstein, 1994; Stewart et al., 2006).

Conduct Disorder. Hans Asperger (1944/1991) observed conduct problems in some of the children he encountered. More specifically, he noted that conduct problems increased in frequency when a child was attempting to escape an unwanted task request. Evans, Canavera, Kleinpeter, Maccubbin, and Taga (2005) found significant interactions between conduct problems and fears of both situations and harm. Higher levels of fear resulted in more conduct problems. More recently, De Bruin et al. (2007) found that symptoms associated with disruptive behavior disorders were the most commonly endorsed compared to symptoms of other psychiatric disorders in their sample of children with ASD. In their study, disruptive behavior disorders included Oppositional Defiant Disorder and ADHD, in addition to Conduct Disorder. Elsewhere, Green, Gilchrist, Burton, and Cox (2000) compared social functioning in a groups of boys diagnosed with either AS or Conduct Disorder. Their results indicated that the AS group had more deficits in interpersonal functioning and activities of daily living; however psychiatric symptom endorsement was similar in both groups. Overlapping symptom endorsements for both groups included: aggression (physical), lying, decreased attention levels, temper tantrums, irritability, defiance towards parents, and chronic unhappiness. Additionally, self reported differences in the area of relationships and friendships emerged, indicating that those with AS were less likely to report that they ever had a typical friendship, whereas about half of those in the CD group reported having normal friendships. Although those with AS have more difficulties in their relationships, boys with Conduct Disorder had higher incidence of forensic involvement.

Attention Deficit/Hyperactivity Disorder. Findings indicate that children with ASD often meet criteria for an additional diagnosis of ADHD (Gadow, De Vincent, Pomeroy, & Azizan,

2004; Leyfer et al. 2006; Nicholas et al., 2008; Yoshida & Uchiyama, 2004). This is a complicated issue since the *DSM-IV-TR* indicates that although a child with ASD will often experience symptoms of hyperactivity and inattention, he or she cannot be given an additional diagnosis of ADHD (APA, 2000). There has been debate about this limitation (Goldstein & Schweback, 2004; Yoshida & Uchiyama, 2004), and therefore, some research in this area has continued. In Yoshida and Uchiyama's (2004) research, they found that just fewer than 70% of their sample met criteria for both ASD and ADHD. In one of their case studies it was expressed that a child with both conditions treated with medication for his diagnosis of ADHD experienced improvements in his levels of inattention and impulsivity. Still evident, however, were his impairments in social interactions and the presence of repetitive and stereotyped patterns, which supported the diagnosis of PDD-NOS.

Other researchers have also made efforts to ascertain if children with ASD met criteria for ADHD. Kim et al. (2000) found that children with AD and AS, ages four to six, scored significantly higher than typically developing children on an ADHD measure. In another study, Goldstein and Schwebach (2004) found that 59% of their sample with ASD also met criteria for ADHD. Interestingly, they also found that symptoms and impairments in children meeting criteria for both conditions were very similar to a group of children with a sole diagnosis of ADHD. Furthermore, these researchers suggest that evidence for the ability to diagnose ADHD comorbid with ASD is that not all children with ASD meet criteria for ADHD. Hattori et al. (2006) examined children who had a sole diagnosis of either ADHD or ASD with the intention of determining if there was a clear distinction between the two disorders. On an autism screening questionnaire, they noted significant differences between all groups in their study (i.e., ASD, ADHD, and typically developing controls) in overall scores and on the social interaction domain. Additionally, on an ADHD rating scale, there were significant differences between all

groups in the overall score. However, in the domains reflecting communication problems and restricted and repetitive behaviors (on the autism scale) and inattention and hyperactivity (on the ADHD rating scale), there was a failure to find significant differences between the ASD and ADHD groups. Furthermore, the overall and domain scores for both scales/questionnaires were higher for both the ADHD and ASD groups, when compared to the control group, indicating that those with ADHD have more symptoms of ASD than the controls and those with ASD have more symptoms of ADHD than the controls (Hattori et al., 2006).

Obsessive Compulsive Disorder. It has been reported that a higher rate of OCD symptoms may be present in those who suffer from both depression and ASD (Ghaziuddin et al., 2002); however, even in the absence of depression, OCD can be a comorbid condition of ASD. Anxiety in general has been found to occur at a higher frequency in children with autism compared to those without (Gillott, Furniss, & Walter, 2001). Additionally, Gillott et al. (2001) found that children diagnosed with autism scored the highest on measures of separation anxiety and OCD. Some researchers have found ASD and OCD to co-occur at a rate of 37% (Leyfer et al., 2006). Associated features of both ASD and OCD, such as engaging in repetitive behaviors, causes these two disorders to have overlapping diagnostic criteria (Ivarsson & Melin, 2008). Ivarsson and Melin (2008) indicate that although autistic traits were found to be common among those diagnosed with OCD, the behaviors stemming from OCD serve different functions (i.e., to alleviate anxiety). On the other hand, individuals with ASD are not troubled by their repetitive behavior (Wing & Atwood, 1987). Taking the former information into account, it is imperative that both of these disorders are fully considered to determine if a comorbid diagnosis is warranted, or if the repetitive behaviors are more likely due to the ASD itself.

Specific Phobia. A paucity of research exists comparing the fears of children with ASD compared to their typically developing peers as only a handful of studies have appeared in the

literature (Evans et al., 2005). This is concerning given that researchers have found that specific phobias were most common comorbid condition over the lifetime in those with ASD (Leyfer et al., 2006). Matson and Love (1990) completed the first systematic study of this nature and found that children with ASD had a higher mean number of fears endorsed. Furthermore, between group differences were also found concerning the type of fear exhibited, as children with ASD were more likely to have fears of thunderstorms, dark places, crowds, going to bed in the dark, and closed spaces. In contrast, typically developing children were more likely to have fears of getting lost, looking foolish, ghosts, snakes, sharp objects, and deep water (Matson & Love, 1990). More recently, Evans et al. (2005) conducted their study examining differences in the fears of children with ASD, Down's syndrome, a chronological age matched control group, and a mental age matched control group. These children's fears were examined along the following factors: fears of situation and places, harm, medical situations, social situations, environment, strangers, and of animals. Results of this study indicated that children with ASD were more fearful of certain places and situations and had more medically related fears. They were less likely to experience fear in relation to harm and animals compared to the control groups. In yet another study, De Bruin et al. (2007) that about 38% of children with ASD endorsed symptoms of simple phobias. These children were fearful of insects, needles and injections, and of the dark.

Eating Difficulties. Eating difficulties among those with ASD were first described by Kanner (1943; 1953), as he observed children who vomited, had specific food preferences, and small appetites. Additionally, Asperger (1944/1991) encountered a child who engaged in pica (e.g., eating pencils and paper). Given the aforementioned observations and research conducted in this area since, it is acknowledged that children with ASD exhibit a variety of eating difficulties including pica, refusing food, overeating, ordering of food, and food selectivity (Gillberg & Billstedt, 2000; Lainhart, 1999). In a study examining food acceptance in children

with ASD, Ahearn, Castine, Nault, and Green (2001) found that 57% of children with ASD had food selectivity relating to the type or consistency of food and 13% of the children refused the food altogether. Elsewhere, Schreck, Williams, and Smith (2004) assessed differences in the eating habits of children with and without ASD and found that those with ASD had more feeding problems and were more likely to eat food of low texture and ate a smaller variety of food.

Tic Disorders. The *DSM-IV-TR* outlines four different Tic Disorders including: Tourette's Disorder, Chronic Motor or Vocal Tic Disorder, Transient Tic Disorder, and Tic Disorder Not Otherwise Specified (APA, 2000). Accurate assessment of Tic Disorders comorbid with ASD is essential for two reasons. First, social difficulties are associated with Tic Disorders. Therefore, the diagnosis of a Tic Disorder comorbid with ASD may further exacerbate social impairments associated with the ASD diagnosis (Nass & Gutman, 1997). Secondly, the *DSM-IV-TR* explains that stereotypies, an associated feature of ASD, should be considered prior to the diagnosis of a Tic Disorder (APA, 2000). Stereotypies are rhythmic, self-stimulating, and intentional, whereas, tics are characterized by involuntary movements, occur in clusters, and cause frustration to the individual (APA, 2000). Additionally, stereotypies usually involve hand movements (e.g., hand flapping) (Steyn & Le Couteur, 2003), whereas tics tend to occur in the neck, face, and shoulders (Lainhart, 1999). Stern & Robertson (1997) outline further differential diagnostic criteria, indicating that the typical age of onset for Tic Disorders is around seven, whereas, for a diagnosis of ASD symptoms are present prior to the age of three. The first report of a Tic disorder comorbid with ASD was by Realmuto and Main (1982). A young boy began slapping his legs, head tilting, excessive blinking, and flexion of his wrists. Additionally, he experienced vocal tics that were brief and often incomprehensible. The symptoms associated with Tourette's Disorder could be control for a short amount of time, only to return. After treatment with haloperidol, these symptoms subsided.

Gender Differences

As discussed, comorbid symptomatology in children with ASD has a limited research base; even more scant is an examination of gender differences of the same. Kanner (1943) first noticed that gender differences existed during the initial review of the 11 children with autism, in which 8 of the initial 11 cases reported were male. Higher prevalence rates in males was further corroborated after Kanner (1943; 1971) identified an additional 89 cases of the syndrome and the male to female ratio was 4:1.

Gender Differences in the Core Features of ASD

While some researchers have been unsuccessful in locating gender differences within the core features of ASD (Holtmann, Bolte, & Poustka, 2007), other researchers have found that females are less likely to engage in restricted, repetitive and stereotyped patterns of behaviors and interests (Lord, Schopler, & Revicki, 1982; Nicholas et al. 2008). More specifically, Nicholas et al. (2008) found that females are less likely to be preoccupied with parts of objects and adhere to the same routines and rituals. McLennon, Lord, and Schopler (1993) that males had significantly more deficits in areas of social interaction (e.g., seeking and offering comfort and social imitative play).

Gender Differences in Comorbid Disorders of ASD

Gender differences have also been found among an associated feature of ASD, ID. Many researchers have found that males with ASD tend to have higher cognitive abilities, whereas females have more severe intellectual disabilities (Lord & Schopler, 1985; Lord, Schopler, & Revicki, 1982; Nicholas, et al., 2008; Volkmar, Szatmari, & Sparrow, 1993). In contrast, few researchers have examined gender differences of psychiatric symptom endorsement in ASD. One study that included such results was conducted by Matson and Love (1990) when they examined phobias in children with ASD. When considering all females in their study (i.e., girls diagnosed

with autism and typically developing girls), they had a higher mean score of reported fears by their parents when compared to all the males in the study. More recently, Holtmann et al. (2007) found significant differences when examining high functioning males and females with ASD. Females scored significantly higher in social problems, thought problems, and inattention.

Gender Differences in Typically Developing Children

A sizable research base exists in the examination of psychiatric symptoms in children, who are not developmentally delayed, with some examinations of gender differences. To assist in developing hypothesis for the current study, a brief review will be conducted to examine gender differences in psychiatric disorders that are commonly comorbid in ASD including: depression, phobias, eating difficulties, Conduct Disorder, ADHD, OCD, and Tic Disorder. Although psychiatric disorders in children with ASD compared to those without ASD may manifest themselves differently, the supposition is that in both populations they are conceptually alike (Lainhart, 1999).

A review of the literature indicates that in typically developing children and adolescents, depression and phobias are more prevalent among females. First, the *DSM-IV-TR* characterizes depression as depressed mood, loss of energy, suicidal thoughts, insomnia, psychomotor agitation or retardation, changes in eating habits and weight, and loss of interest in previously pleasurable activities (APA, 2000). Furthermore, the *DSM-IV-TR* indicates that women are more likely to suffer from depression than men (APA, 2000). Hankin et al. (1998) found a 2:1 female to male ratio for new cases of depression. In another study examining the same, Herrington (2005) found that prevalence of depression for female children was 2% compared to only 1% for males.

Second, diagnostic criteria for phobias includes: fear that is excessive, the feared stimuli triggers anxiety, distress stemming from this fear interferes with normal routines, and awareness

that the fear is unreasonable (APA, 2000). Point and lifetime prevalence rates indicate that adolescent girls suffer from phobias significantly more than adolescent boys (Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993). In all areas of phobias specified in the *DSM-IV-TR* (i.e., animal type, natural environment type, blood-injection type, and situational type) females are more fearful (APA. 2000).

In contrast to the abovementioned disorders, findings have indicated that Conduct Disorder, ADHD, OCD, and Tic Disorders are more prevalent in males. First, diagnostic criteria for Conduct Disorder according to the *DSM-IV-TR* includes: aggression, property destruction, theft, deceitfulness, breaking rules, and clear disregard for others or society rules (APA, 2000). Hinshaw & Lee (2003) acknowledge the existence of sex differences in the diagnosis of conduct disorder, but emphasize the importance in examining the underlying patterns of this difference instead of focusing solely on the rates of symptom endorsement. Males are more likely to meet criteria for conduct disorder by engaging in fights with others, stealing, and vandalizing property, whereas, females are more likely to lie, be promiscuous, and run away (APA, 2000).

Second, Hermans, Kohn, Clarke, Gordon, and Williams (2005) examined sex differences in adolescents with ADHD and found the male to female ratio was 2.2:1. Although males with ADHD were more prevalent in their sample, Hermans et al. note that this difference may be an underrepresentation as the male to female sex difference in other studies they reviewed was more pronounced. The *DSM-IV-TR* indicates that sex ratio differences for ADHD range from 2:1-9:1% (APA, 2000).

Next, OCD is characterized by the *DSM-IV-TR* as recurrent thoughts or impulses and repetitive behaviors that cause anxiety, are time consuming, and are distressing (APA, 2000). The prevalence of OCD in children ranges from 1 - 2.3%, with higher prevalence rates in boys than girls (APA, 2000). Further supporting gender differences in OCD, Last and Strauss (1989)

conducted a study examining demographic variables and symptomatology in children with OCD and found a male to female ratio of 3:2, with males having an earlier age of onset.

Fourth, gender differences have been found in Tourette's Disorder, with male to female ratios ranging from 2:1 to 5:1 (APA, 2000). *The DSM-IV-TR* outlines four tic disorders (APA, 2000). Prevalence rates and gender differences for all four of these disorders have been examined in Swedish school children by Khalifa and Von Knorring (2003). Khalifa and Von Knorring found the largest gender differences in Tourette's Disorder as the male to female ratio was 9:1. In comparison, the smallest difference between the same was found for Chronic Motor Tics, with a male to female ratio at 2:1.

The *DSM-IV-TR* delineates three different feeding disorders including: Pica, Rumination Disorder, and Feeding Disorder of Infancy or Early Childhood (APA, 2000). There have been no gender differences reported in Rumination Disorder or Feeding Disorder of Infancy or Early Childhood (APA, 2000). In contrast, Pica has been diagnosed more frequently in males than in females (APA, 2000).

Assessment of Psychiatric Comorbidity in ASD

Background

Most research conducted on psychiatric disorders comorbid with ASD have relied on observations, subjective information, and case studies, rather than on results from empirically validated assessment measures (Matson & Nebel-Schwalm, 2007; Matson & Wilkins, 2008). Measures that have been used to assess psychiatric symptoms comorbid in ASD have not been tested for reliability and validity for such purposes. As explained by Lainhart and Folstein (1994), "No operational criteria for diagnosing mood disorders in people with autism and/or mental retardation have yet been tested" (p. 598). Mostly, this continues to remain true for mood disorders along with other commonly occurring psychiatric disorders in ASD. To date, a few measures have been psychometrically investigated to enable an accurate and valid assessment of psychiatric symptomatology in ASD and they are reviewed below.

Measures

Autism Comorbidity Interview-Present and Lifetime Perspective (ACI-PL). Leyfer et al. (2006) developed the *ACI-PL*, a semi-structured interview modified from The Kiddie Schedule for Affective Disorders and Schizophrenia. This modification allows for a systematic examination and subsequently the diagnosis of psychiatric disorders in those with autism. The expansion from the original instrument included "observable features that are common presenting concerns expressed by caregivers when individuals with autism have particular psychiatric disorders (p. 851). The authors of the *ACI-PL* indicate that it is necessary to obtain a baseline of functioning, in order to determine if present symptomatology is indicative of an additional disorder, and as an example "because individuals with autism may have unusual attention patterns, the coding for ADHD distinguishes between attention to special interests and attention in general (p. 852). Initial psychometric properties were investigated for Major

Depressive Disorder (MDD), OCD, and ADHD and kappa values were .8, .7, .7 respectively for inter-rater reliability. Test-retest reliability was also established and kappa values were .61 (MDD) and .75 (OCD). ADHD test-retest kappa value could not be determined as data were not available. Criterion validity was established for MDD and ADHD, with the criterion of the participant having previously received treatment for the disorder. Sensitivity was at 100% for both ADHD and MDD. Specificity ranged from 83% to 93.7% for MDD and was 93% for ADHD. Concurrent validity was established for OCD, by determining correlations between endorsed compulsion items on this scale and items from the compulsion cluster on the *ADI-R*. Leyfer et al.'s findings indicated that the items from their scale correlated well with similar ones from the *ADI-R*. Given that validity and reliability of this assessment have only been established for the comorbid diagnoses of OCD, ADHD and MDD, this assessment would not be appropriate to use for the purposes of this study.

Behavior Assessment System for Children-2 (BASC-2). Developed by Reynolds and Kamphaus (2004), the BASC-2 is a broad-band assessment that evaluates behaviors and self perceptions. It was designed to classify a range of behavioral and emotional disorders and can be used for children and adults ages 2 to 25. This assessment has sound psychometric properties with internal consistency for the clinical sample ranging from α = .89 to .96 and for the general sample from .85 to .95. Inter-rater reliability is .70 to .88 and test-retest reliability ranges from .77 to .92. Clinical subscales on this assessment include: hyperactivity, aggression, conduct problems, anxiety, depression, somatization, atypicality, withdrawal, and attention problems. There are three different components to this assessment, which include teacher-rating forms, parents-rating forms, and self-rating forms. Additionally, there are three forms for each of these components, preschool, child, and adolescent. For this broad-band assessment, clinical profiles were found for children who have various emotional or behavioral problems. These profiles

contain the mean scores for each dimensioned measured by this assessment. Clinical profiles include: conduct disorder, behavior disorder, depression, emotional disturbance, attention-deficit/hyperactivity disorder, learning disability, mild ID, and PDD. The PDD group for which the norms are available included children with AS and AD. Although clinical profiles are available for children with PDD, this scale was not purposefully developed to assess psychiatric comorbidity in children and adolescents with ASD, and therefore will not be utilized in this study.

Autism Spectrum Disorders-Comorbid for Children (ASD-CC*).* This is a 39 item scale that is a component of a larger ASD battery. The other components of this battery assist in diagnosing AD, AS, and PDD-NOS (Matson, Gonzalez, Wilkins, & Rivet, 2008), as well as identifying challenging behaviors (Matson, Gonzalez, Rivet, 2008). The *ASD-CC* assesses for the presence of symptoms associated with psychiatric disorders that most commonly co-occur in those with ASD. These disorders include: depression, Conduct Disorder, Tic Disorder, OCD, ADHD, eating problems, and Specific Phobias (Matson & Wilkins, 2008). The *ASD-CC* items loaded onto seven factors: 1) tantrum behavior, 2) repetitive behavior, 3) worry/depressed, 4) avoidant behavior, 5) under-eating, 6) conduct, and 7) over-eating (Matson, LoVullo, Rivet, & Boisjoli, 2009). The relationship of these factors to the clinical subscales of the BASC-2 was examined. Tantrum behavior was associated with the BASC-2 subscales hyperactivity and aggression. The second factor, repetitive behavior, was associated with atypicality and hyperactivity. Worry/depressed had a strong relationship with anxiety, depression, and somatization. The fourth factor of the ASD-CC, avoidant behavior was associated with the withdrawal subscale. Under-eating was weakly associated with the subscales conduct problems and somatization. The sixth factor, conduct, had the strongest relationship with the depression subscale of the BASC-2; however it was also associated with anxiety, conduct problems,

aggression, hyperactivity, somatization, and atypicality. The final factor of the ASD-CC, over-eating, showed moderately strong relationships with conduct problems, atypicality, and hyperactivity subscales (Matson et al., 2009). Matson and Wilkins (2008) found that this measure has moderately good inter-rater and test-retest reliability. The mean kappa coefficient for inter-rater reliability was .46 and for test-retest reliability is .51. Additionally, the internal consistency was very good with $\alpha = .91$. This scale will be utilized for this study since psychometric properties have been investigated and the scale was designed specifically to assess psychiatric symptoms comorbid in children with ASD.

Purpose

To date, the vast majority of research conducted on psychiatric comorbidity in ASD has been accomplished through the use of measures with psychometric properties that have not been investigated for use with those diagnosed with ASD. The rationale behind this study was to investigate psychiatric symptoms in ASD using a newly developed scale that has been validated and found reliable for such purposes. The *ASD-CC* was utilized to assess psychiatric symptom endorsements in children and adolescents diagnosed with ASD, as it includes symptoms for the most commonly occurring psychiatric disorders in children with ASD. The rate of psychiatric symptom endorsement was compared between children diagnosed with ASD and typically developing children. Additionally, gender differences in psychiatric symptom endorsement were examined. This study may have important implications in the treatment of children with ASD, who also present with symptoms of a comorbid condition. Thus, accurate diagnosis enables improvements to be made in psychopharmacology research (Leyfer et al., 2006). As Morgan et al. (2003) found, 40% of the participants in their study were diagnosed with ASD and no further psychiatric conditions, but were nonetheless being treated with psychotropic medication. This study would also delineate comorbid symptomatology that is more prevalent for males or females, further aiding in treatment approaches and effectiveness. Additionally, such data may give valuable information pertaining to the etiology of ASD and the co-occurring disorders which accompany it.

Based on the literature of psychiatric symptoms in children with ASD and gender differences found in psychiatric disorders in typically developing children, several predictions were made regarding the outcome of this study. First, it was hypothesized that there would be significant difference for group membership on total symptom endorsement. Psychiatric

symptom endorsement would be higher for children and adolescents diagnosed with ASD (De Bruin et al., 2007; Gillott et al., 2001; Hattori et al., 2006; Kim et al., 2000; Schreck et al., 2004).

When examining follow-up analyses for the significant differences between groups, it was hypothesized that children with ASD would evince more psychiatric symptoms than the control group of typically developing children on all seven factors (De Bruin et al., 2007; Gillott et al., 2001; Hattori et al., 2006; Kim et al., 2000; Schreck et al., 2004). Next, it was hypothesized that there would be a significant interaction between group membership and gender on the seven factors of the *ASD-CC*. Based on research of gender differences in typically developing children, it was predicted that males with ASD would score higher on factors of repetitive behaviors, conduct, and tantrum behavior (APA, 2000; Hermans et al., 2005; Last & Strauss, 1989). Females with ASD were predicted to score higher on the worry/depressed and avoidant behavior factors (APA, 2000; Hankin et al, 1998; Lewinsohn et al., 1993). Lastly, it was hypothesized that there would be no significant differences between males and females on the under-eating and over-eating factors (APA, 2000).

Methods

Participants

One hundred and thirty-seven children and adolescents classified as having an ASD (i.e., AD, PDD-NOS, or AS) or as typically developing served as participants. Recruitment for the study was conducted via community organizations, schools, and outpatient clinics throughout the United States. Informed consent was obtained from the child's parent or primary caregiver. This study was approved by the LSU Institutional Review Board. Participants ranged in age from 4-16 years (M = 8.34; SD = 3.09). All participants in this study have an IQ greater than 70; therefore, indicating that no individual diagnosed with an intellectual disability (ID) was included. This inclusion criteria was selected because a diagnosis of ID further complicates the accurate assessment of symptoms, therefore, adding complexity to diagnostic decision-making (Steyn & Le Couteur, 2003).

A 19 item composite symptom checklist from the *DSM-IV-TR* (APA, 2000) and the *International Classification of Diseases, Tenth Edition* (ICD-10; World Health Organization, 1992) was used to assess all participants. Parents or caretakers completed the *DSM-IV-TR/ICD-10* checklist via a "yes" if the symptom was applicable to their child or a "no" if it was not. Based on previous research, this checklist has been shown to have strong inter-rater reliability (r = .89), test-retest reliability (r = .96), and internal consistency (α = .99) (Matson et al., 2008). Under the supervision of a licensed doctoral level clinical psychologist, research criteria were set to clearly define the designation of ASD. Two impairments in social interaction and one in either communication or repetitive, stereotyped, or restricted patterns were required (Matson, Gonzalez, Wilkins, et al., 2008).

Out of the 137 participants selected for inclusion into this study, 65 were diagnosed as having an ASD (i.e., AD, PDD-NOS, or AS). The remaining 72 participants had no previous

Axis I diagnosis and, therefore, were placed into the control group. The mean age for the ASD group was 8.69 (SD = 3.46) with an age range of 4 – 16 years. Within the ASD group, 62.9% of the sample were male and 37.1% were female. Furthermore, 5.7% were African American, 55.7% were Caucasian, 4.3% were Hispanic, 4.3% identified themselves as 'other', and 30% did not specify. The mean age for the control group was 7.93 years old (SD = 2.56), with an age range of 4 – 14 years. Additionally, 45.8% of the control sample were male and 54.2% were female. Within the control group, 10.2% of the participants were African American, 79.7% were Caucasian, 5.1% were Hispanic, and 5.1% did not specify. Since gender was utilized as an independent variable in this study, the demographic information in Table 1, regarding age and ethnicity is displayed based on gender and group membership.

Table 1
Demographic Characteristics per Diagnostic Group and Gender

Demographic characteristics	Diagnostic group			
	Males ASD (n = 39)	Males Control (n = 37)	Females ASD (n = 26)	Females Control (n = 35)
Age (in years), Mean (SD)	8.7 (3.4)	7.59 (2.72)	8.22 (2.42)	8.31 (2.62)
Race/ethnicity, %				
Caucasian	63.3%	77.8%	81.2%	80.0%
African American	4.5%	18.5%	3.1%	2.9%
Hispanic	6.8%	0.0%	9.4%	11.4%
'Other'	4.5%	0.0%	0.0%	0.0%
Non-Specified	20.5%	3.7%	6.2%	5.7%

Measures

Autism Spectrum Disorders-Comorbid for Children (ASD-CC). The *ASD-CC* is a 39 item informant-based rating scale that will assess for the presence of common comorbid psychiatric symptoms in children with ASD 3-16 years of age. Informants rate each item of the ASD-CC on a 3-point Likert system with respect to severity of the behavior as either 0 (not different; no impairment), 1 (somewhat different; mild impairment), or 2 (very different; severe impairment). The measure can be administered and scored in approximately 15-20 minutes. The factor structure has been tested and a 7 factor solution has been established and includes tantrum behavior, repetitive behavior, worry/depressed, avoidant behavior, under-eating, conduct, and over-eating (Matson et al., 2009). This measure was found to have very good internal validity (α = .91), good test-retest reliability (κ = .51) and good inter-rater reliability (κ = .46) (Matson & Wilkins, 2008). Examples of items from this measure include irritable mood, eats things that are not meant to be eaten, lies to obtain goods or favors, engages in repetitive behavior for no apparent reason or to reduce stress, feelings of worthlessness or excessive guilt, avoids specific situations, people, or events, eats too little, and eats too quickly.

Procedure

The *ASD-CC* was completed independently by the parent or primary caregiver of each child/adolescent. The scoring procedures were printed at the top of the scale. Trained professionals with a master's degree in psychology or with at least one year post-bachelor's degree experience were available to further clarify any questions for the informant.

Research Design

An apriori analysis showed that the groups did not significantly differ on the following: age, ethnicity, and gender. Additionally, data was examined prior to conducting any analyses to ensure robustness. That is, missing data points were found, outliers were removed, and the

assumptions of statistical tests were controlled for. Subjects within the database were removed prior to any analyses if they had any missing data points. Replacing these data points with the mean would have resulted in a higher number of participants for this study, however doing so may have resulted in decreasing the variance, and therefore, this procedure was avoided (Tabachnick & Fidell, 2007). Next, to ensure the accuracy of the data points with the scoring criterion for the *ASD-CC*, all remaining item values were inspected and were 0, 1, or 2. Lastly, after examining each item in the dataset, within each group, cases deemed to be outliers through the use of box plots were removed (Field, 2005). A total of 49 cases were determined to be outliers, and therefore were removed from the dataset (i.e., 18 within the ASD group and 31 within the control group), leaving the abovementioned 137 participants. A multivariate analysis of variance (MANOVA) was conducted to assess whether males and females with or without an ASD diagnosis endorse more symptoms of psychopathology, and whether there was an interaction between gender and group membership. Prior to this analysis, assumptions of MANOVA were examined and corrected. That is, homogeneity of variance and multivariate normality were controlled for by having equal sample sizes. Although the sample sizes were not completely equal, no one group was more than 1.5 times the size of another group (Leech, Barrett, & Morgan, 2008), therefore ensuring robustness.

To conduct the MANOVA, group and gender were entered as the independent variables and the seven subscales of the *ASD-CC* were entered as the dependent variables (i.e., tantrum behavior, repetitive behavior, worry/depressed, avoidant behavior, under-eating, conduct, and over-eating). Subscale scores were calculated for participants by summing item scores contained within each factor derived during factor analysis. A MANOVA was employed because this test allows for the examination of possible existing relationships between the dependent variables (DV) without inflating alpha error (Field, 2005). Additionally, there is a theoretical basis for

including all the DVs in this analysis, as they all measure symptoms of psychopathology (Field, 2005). An a priori power analysis was conducted for the MANOVA using GPOWER to determine the necessary sample size to detect a large effect size of .8, power of .8, and 7 response variables. According to GPOWER, a sample size of 26 per group is needed when assessing the global effects. With a large sample size it is easy to find significant differences between groups; therefore we wanted to find at least a medium effect size (Hinkle, Wiersma, & Jurs, 2003). According to Cohen (1965) a large effect size is .80 (as cited in Hinkle et al., 2003). Additionally, in the behavioral sciences, the level of significance is usually set at $\alpha = .05$ and therefore, power was .80 (Hinkle et al., 2003).

Next, the difference in the total symptom endorsement between groups on the *ASD-CC* was analyzed with an independent t-test. The seven subscale scores were summed for the groups to provide an overall total score for the *ASD-CC*. For a one tailed t-test with a power of .8, a sample size of 21 is needed for each group to detect a large effect (i.e., .8). Percent item endorsement by each group on the *ACD-CC* is included in the results.

Lastly, significant results from the MANOVA were followed up with a Roy-Bargmann stepdown analysis. The stepdown analysis measures the contributions of the DV's to any significant main effects or interaction from the MANOVA (Tabachnick & Fidell, 2007). This method was chosen over univariate analyses because a stepdown analysis controls for the inflation of alpha error, while accounting for correlations among the DV's used in the analyses (Tabachnick & Fidell, 2007). Since the correlations between the seven DV's used in this study ranged from -0.02 to 0.52 (Matson et al., 2009) a stepdown analysis was more appropriate. Therefore, the stepdown analysis identifies any significant differences between those with and without ASD, between males and females, and the interaction of the two, across the seven subscales of the *ASD-CC*.

Homogeneity of regression was examined for each step of the stepdown analysis (Tabachnick & Fidell, 2007). Results of these analyses indicated that homogeneity of regression was confirmed for all steps, and therefore, results are robust. To conduct the Roy-Bargmann stepdown analysis, the highest priority DV was analyzed in an ANOVA. Subsequently, each higher priority DV was then utilized as a covariate in an ANCOVA to examine the impact of the lower priority DV's (Stevens, 2009; Tabachnick & Fidell, 2007). The priority, and therefore, order of entry for each of the dependent variables was decided upon according to the results of prevalence rates from previous research findings. For example, depression has been reported to be the most commonly occurring psychiatric disorder in those diagnosed with ASD (Ghaziuddin, Ghaziuddin, & Greden, 2002; Ghaziuddin, Tsai, Ghaziuddin, 1992). Also, because the participants included in this study were not diagnosed with ID (i.e., IQ > 70), they might be at an increased risk for depression given their cognitive capacity to understand their deficits (Volkmar & Klin, 2005). Researchers have also established that challenging behaviors occur concomitantly with ASD (McClintock, Oliver, & Hall, 2003), and symptoms associated with disruptive behavior disorders are the most commonly endorsed compared to symptoms of other psychiatric disorders in samples of children with ASD (De Bruin et al., 2007). Additionally, the topography of psychiatric symptoms in those diagnosed with ASD may present in the form of challenging behaviors (Lainhart & Folstein, 1994). Therefore, to control for the possible shared variance of symptoms of internalizing psychiatric disorders and of externalizing behavior disorders, tantrum behavior and conduct DV's were entered into the analysis last.

The abovementioned research results provided the foundation for the basis of the order in which DVs were entered into the stepdown analysis. Consideration was also given to the pooled within-cell correlations among the seven DVs. Refer to Table 2 for the pooled within-cell correlations between the DVs. Given that depressive symptoms are potentially high-risk for this

sample of participants with ASD, the worry/depressed factor was entered first. Following the entry of the worry/depressed DV, the remaining DV's were prioritized as follows: 2) Under-Eating, 3) Over-Eating, 4) Avoidant Behavior, 5) Repetitive Behavior, 6) Conduct, and 7) Tantrum Behavior (Ahearn, Castine, Nault, and Green, 2001; De Bruin et al., 2007; Leyfer et al., 2006). The DVs which were representative of externalizing disorders (i.e., conduct and tantrum behavior) were entered last in the Roy-Bargmann procedure to assist in determining if psychiatric symptoms present in the form of challenging behaviors. Furthermore, tantrum behavior had the highest pooled within-cell correlations among all the DVs (i.e., ranging from .31-.62). Therefore, the higher priority DV's accounted for overlapping variance with tantrum behavior and conduct. Again, using GPOWER, it was determined that to detect a large effect size of .8, with a power of .8, 1 predictor, and 7 response variables a sample size of 26 is needed when assessing these special effects.

Table 2
Pooled within-cell correlations between dependent variables

	Worry/Depressed	Under-Eating	Over-Eating	Avoidant Behavior	Repetitive Behavior	Conduct	Tantrum Behavior
Worry/Depressed	2.41						
Under-Eating	.09	.81					
Over-eating	.31	-.26	1.42				
Avoidant behavior	.53	.16	.21	2.13			
Repetitive Behavior	.33	.24	.32	.41	2.13		
Conduct	.47	.16	.46	.31	.44	1.48	
Tantrum Behavior	.58	.33	.31	.51	.47	.62	3.70

Results

Using SPSS 16.0 to conduct this analysis, group membership and gender were entered as the independent variables with the seven subscales of the *ASD-CC* (i.e., tantrum behavior, repetitive behavior, worry/depressed, avoidant behavior, under-eating, conduct, and over-eating) entered as the dependent variables. The interaction of gender and group membership was not significant, Wilks' $\Lambda = .958$, F (7, 111) = .698, $p = .674$. Additionally, the main effect for gender was not significant, Wilks' $\Lambda = .955$, F (7, 111) = .753, $p = .628$. However, the main effect for group membership was significant, Wilks' $\Lambda = .467$, F (7, 111) = 18.107, $p < .001$. This result signifies that the linear combination of the seven subscales of the *ASD-CC* differs for those diagnosed with ASD compared to those who are not. The percentage of item endorsement for each diagnostic group, and additionally, for males and females within each diagnostic group are displayed in Table 3. Table 4 contains the mean (and standard deviation) endorsements for the two diagnostic groups, and again, for males and females within each of these groups on the seven factors of the *ASD-CC*.

Table 3
Percent item endorsement

Item	Group					
	ASD Total	ASD Male	ASD Female	**Control Total**	Control Male	Control Female
1: Easily becomes upset	**85.7%**	81.9%	92.4%	**23.7%**	25.9 %	21.9 %
2: Eats too much	**38.6%**	43.2%	30.8%	**6.8%**	7.4%	6.2%
3: Fear of being around others in school, at home, or social situations	**34.3%**	36.4%	30.8%	**3.4%**	3.7%	3.1%
4: Sudden rapid, repetitive movements or vocalizations that are not associated with a physical disability	**37.2%**	36.3%	38.5%	**0.0%**	0.0%	0.0%
5: Crying	**48.6%**	50.0%	46.2%	**11.9%**	11.1 %	12.5 %
6: Will eat only certain foods	**47.2%**	52.3%	38.4%	**8.5%**	7.4%	9.4%
7: Destroys other's property	**27.2%**	27.3%	26.9%	**1.7%**	0.0%	3.1%

(Table 3 continued below)

8. Blames others for his/her misdeeds	**45.8%**	50.0%	38.4%	**13.6%**	14.8%	12.5%
9: Lies to obtain goods or favors	**28.6%**	29.5%	26.9%	**5.1%**	3.7%	6.2%
11: Weight gain	**21.4%**	20.5%	23.0%	**3.4%**	3.7%	3.1%
12: Engages in repetitive behaviors	**58.6%**	56.8%	61.5%	**3.4%**	0.0%	6.2%
13: Compliance with demands	**61.4%**	65.9%	53.8%	**10.2%**	7.4%	12.5%
14: Has a poor appetite	**18.5%**	15.9%	23.1%	**1.7%**	3.7%	0.0%
16: Has persistent or recurring thoughts that cause distress	**41.4%**	45.4%	34.6%	**6.8%**	11.1%	3.1%
17: Spiteful, vindictive, revengeful, or wants to get back at others	**25.8%**	25.0%	26.9%	**3.4%**	3.7%	3.1%
18: Eats too little	**22.8%**	20.4%	26.9%	**1.7%**	3.7%	0.0%
19: Withdraws or removes him/her self from social situations	**84.3%**	84.1%	84.6%	**8.5%**	7.4%	9.4%
20: Has trouble sleeping	**45.7%**	50.0%	38.5%	**8.5%**	11.1%	6.2%
21: Damages property	**28.5%**	27.3%	30.8%	**0.0%**	0.0%	0.0%
22: Loses belongings	**51.4%**	56.8%	42.3%	**22.0%**	18.5%	25.0%
23: Avoids specific situations, people, or events	**55.7%**	59.1%	50.0%	**6.8%**	7.4%	6.2%
25: Tearful or weepy	**41.4%**	40.9%	42.3%	**8.5%**	7.4%	9.4%
26: Feelings of worthlessness or excessive guilt	**28.5%**	25.0%	34.6%	**8.5%**	7.4%	9.4%
27. Avoids specific objects, persons, or situations causing interference with his/her normal routine.	**38.6%**	40.9%	34.6%	**0.0%**	0.0%	0.0%
28. Weight loss	**2.9%**	2.3%	3.8%	**0.0%**	0.0%	0.0%
29: Finishes assigned tasks	**78.6%**	79.6%	76.9%	**22.0%**	22.2%	21.9%
31. Engages in behavior that impair daily routine or activities	**42.9%**	40.9%	46.1%	**1.7%**	0.0%	3.1%
32. Easily becomes angry	**58.5%**	56.9%	61.6%	**13.6%**	11.1%	15.6%
33. Checking on play objects excessively	**28.6%**	29.6%	26.9%	**0.0%**	0.0%	0.0%
35. Tantrums	**55.7%**	59.1%	50.0%	**11.9%**	11.1%	12.5%
36. Fidgets or squirms	**67.2%**	70.4%	61.6%	**23.7%**	14.8%	31.3%
37. Low energy or fatigue	**32.9%**	29.5%	38.5%	**0.0%**	0.0%	0.0%
38. Persistent or recurring impulses that interfere with activities.	**42.8%**	40.9%	46.1%	**3.4%**	3.7%	3.1%
42. Eats things that are not meant to be eaten	**14.3%**	13.7%	15.4%	**0.0%**	0.0%	0.0%
44. Irritable mood	**50%**	47.7%	53.9%	**6.8%**	7.4%	6.2%
46. Experiences excessive worry or concern	**44.2%**	40.9%	50.0%	**10.2%**	14.8%	6.2%
47. Sudden, rapid, repetitive movement or vocalization that occurs for no apparent reason.,	**44.3%**	40.9%	50.0%	**1.7%**	0.0%	3.1%
48. Eats too quickly	**44.3%**	43.2%	46.1%	**3.4%**	0.0%	6.2%
49. Blurts out comments or words at inappropriate times.	**55.7%**	59.1%	50.0%	**6.8%**	7.4%	6.2%

* Higher endorsements indicated a larger problem.

Table 4
Factor Means (Standard Deviations)

Factor	Group					
	ASD Total	ASD Males	ASD Females	Control Total	Control Males	Control Females
1: Tantrum Behavior	6.61 (4.78)	6.39 (4.41)	7.05 (5.54)	1.09 (1.78)	1.04 (1.53)	1.13 (2.00)
2: Repetitive Behavior	4.73 (3.51)	4.52 (3.48)	5.13 (3.61)	.39 (.74)	.19 (.40)	.56 (.91)
3: Worry/ Depressed	3.52 (3.22)	3.23 (2.92)	4.15 (3.80)	.59 (.95)	.63 (.93)	.56 (.98)
4: Avoidant Behavior	4.05 (2.80)	4.18 (2.86)	3.77 (2.72)	.41 (.87)	.44 (.89)	.38 (.87)
5: Under-Eating	.52 (1.07)	.50 (1.05)	.55 (1.14)	.03 (.26)	.07 (.38)	.0 (.0)
6: Conduct	2.06 (1.94)	2.09 (1.89)	2.00 (2.10)	.29 (.59)	.30 (.54)	.28 (.63)
7: Over-Eating	1.52 (1.88)	1.43 (1.72)	1.71 (2.22)	.14 (.51)	.11 (.42)	.16 (.57)

Next, a two sample t-test was performed to follow-up the significant main effect of group membership. A homogeneity of variance test found that the variances of the two groups was significantly different, $F(61,58) = 55.113$, $p < .05$. Therefore, correctional formulas were used to compare the mean symptom endorsements by the ASD and control group. A two sample t-test showed that the mean number of symptom endorsements by the ASD group (M =23.26) was significantly higher from that of the control group (M = 2.93), t (72.24) = 11.00, p <.05.

Last, to determine the impact of the seven DVs on the significant main effect of group membership, a Roy-Bargmann stepdown analysis was conducted. Results of this analyses showed that the DV's of the first five factors entered into the analysis made a contribution to

predicting the differences between those in the ASD group and those in the control group. That is, when the depressed/worry DV was entered into the analyses first, the results were, stepdown $F(1, 117) = 43.36$, $p < .05$. After the pattern of differences measured by the depressed/worry DV was entered into the analyses as a covariate, a difference was also found on the factor under-eating, stepdown $F(1, 116) = 6.03$, $p < .05$. With worry/depressed and under-eating entered as covariates, overeating was also significant, with stepdown $F(1, 115) = 15.73$, $p < .05$. Additionally, with all three previously entered DVs (i.e., worry/depressed, under-eating, and over-eating) used as covariates, avoidant behavior was also significant, stepdown $F(1, 114) = 28.15$, $p < .05$. Lastly, after the pattern of differences measured by the worry/depressed, under-eating, over-eating, and avoidant behavior DVs were controlled for, a difference was also found on the DV repetitive behavior, stepdown $F(1, 113) = 6.92$, $p < .05$. However, after controlling for the abovementioned five DVs, no significant differences remained between groups on the conduct DV, stepdown $F(1, 112) = .20$, $p = .65$. Additionally, with all six higher priority DV's entered as covariates, tantrum behavior was also not significant, as stepdown $F(1,111) = .76$, $p = .39$. Therefore, the DV's conduct and tantrum behavior did not make a significant contribution to the differences between children and adolescents diagnosed with ASD compared to those without. The results indicate that these DVs (conduct and tantrum behavior) are redundant after the entry of higher priority DVs: when controlling for internalizing psychiatric symptoms, they do not make a significant contribution to the discrimination between groups.

Results from the univariate and stepdown analyses are shown in Table 5. As presented, all DVs are significant at the univariate level for the main effect of group. However, the statistical significance of these results is ambiguous given the high correlations between the DVs. Therefore, when using higher order DV's as covariates, shared variance between highly

correlated DVs is removed. That is to say, the variance of conduct and tantrum behavior is already accounted for through their overlap with the previously entered DVs.

Table 5
Univariate and stepdown F results for IV of group membership

IV	DV	Univariate F	df	Stepdown F	Df
Group	Worry/ Depressed	43.36*	1/117	43.36*	1/117
	Under-Eating	12.18*	1/117	6.03*	1/116
	Over-Eating	30.67*	1/117	15.73*	1/115
	Avoidant Behavior	92.98*	1/117	25.18*	1/114
	Repetitive Behavior	79.44*	1/117	6.92*	1/113
	Conduct	42.70*	1/117	.20	1/112
	Tantrum Behavior	71.36*	1/117	.76	1/111

* Indicates significance

Discussion

Currently, there is little empirical research that has been conducted on psychiatric symptoms comorbid with ASD. Assessment measures with adequate psychometrics for this purpose are practically non-existent. Thus, the aim of this study was to investigate psychiatric symptoms in children and adolescents with ASD utilizing the *ASD-CC*, a new measure intended for this purpose. Results of the analyses indicate that only one of the hypotheses was supported. That is, children and adolescents diagnosed with ASD endorsed a higher number of psychiatric symptoms compared to their same aged typically developing peers. Although this finding is in agreement with previous research (De Bruin et al., 2007; Gillott et al., 2001; Hattori et al., 2006; Kim et al., 2000; Schreck et al., 2004), these results are among the first that utilized a measure which has been validated and found reliable for this specific purpose.

Follow up analyses revealed that the factors of worry/depressed, under-eating, over-eating, avoidant behavior, and repetitive behavior contributed to the significant difference between the ASD and control group. That is, these five factors (i.e., worry/depressed, under-eating, over-eating, avoidant behavior, and repetitive behavior) contributed to the composite DV that best distinguished between those in the ASD group compared to those in the control group. However, after controlling for the abovementioned factors, the factors of conduct and tantrum behavior were not significantly different between groups. Therefore, the hypothesis that children and adolescents diagnosed with ASD would score significantly higher than their typically developing peers on all factors of the *ASD-CC* was not supported. This finding is somewhat unexpected given that researchers have provided evidence that ASD is considered a risk factor for the presence of challenging behaviors (McClintock, Hall, & Oliver, 2003). However, researchers have also indicated that psychiatric symptoms in those with ASD may present in the form of challenging behaviors (i.e., symptoms of externalizing disorders; Lainhart & Folstein,

1994). Given the aforementioned information, it is not unforeseen that when controlling for some psychiatric symptoms, those symptoms indicative of externalizing disorders (e.g., conduct and tantrum behavior) are redundant. A plausible explanation then, is that behavioral excesses may indeed be representative of symptoms of psychopathology in the ASD population.

Finally, the hypothesis that there would be a significant interaction between gender and group was not supported. Males and females with ASD were not found to significantly differ in rates of psychiatric symptom endorsements. To date, few researchers have examined gender differences within ASD. Studies that have been conducted primarily focused on detecting gender differences in the core features of ASD itself (Lord, Schopler, & Revicki, 1982; McLennon, Lord, & Schopler, 1993; Nicholas et al., 2008). Although no significant gender differences were found in this study, replication of these results is imperative given the importance such differences may have on assessment practices and treatment approaches. A potential explanation for this non-significant finding is that the age range utilized was too large. So, if specific age cohorts were examined, gender differences may be significant. For example, in typically developing adolescents (i.e., non-ASD), males and females significantly differed in regards to symptom endorsements for phobias. Therefore, future studies examining gender differences on psychiatric symptomatology in the ASD population should hone in on specific age cohorts.

A notable limitation of this study, and a possible second reason for the non-significant gender difference, is that the participants selected for inclusion were not representative of the ASD population as a whole. That is, inclusion criteria eliminated any child or adolescent who was diagnosed with ID, although research has shown that ID occurs in about 75% of those diagnosed with AD (Folstein, 1999; Gillberg & Billstedt, 2000; Lainhart, 1999). Even though this restriction may have decreased the generalizability of these results, this limitation was selected because the presence of ID may further complicate accurate diagnosing (Steyn & Le

Couteur, 2003). Since this study was one of the first conducted to use a valid and reliable tool to assess psychiatric symptoms in children and adolescents with ASD, further complexity was avoided. Future research may benefit from including participants who not only present with a diagnosis of ASD, but also ID.

Aside from a comorbid ID diagnosis, the assessment of psychiatric symptoms within the ASD population remains complex. Some researchers have argued that these psychiatric symptoms are part of the ASD itself (Tsai, 2000), whereas others suggest that these symptoms may meet criteria for an additional disorder. An assessment measure such as the *ASD-CC* may assist in determining whether comorbid symptoms in ASD are indicative of a comorbid disorder or are expressions of the ASD diagnosis solely. Since symptoms associated with psychiatric disorders wax and wane; repeated assessments with the *ASD-CC* may help identify symptoms that are associated with a comorbid psychiatric disorder, as more stable symptoms would likely then be associated with the diagnosis of the ASD (Matson & Neal, 2009; Matson & Nebel-Schwalm, 2007). Therefore, this assessment measure may help set the tone for the teasing apart of symptoms associated with psychiatric disorders versus ASD within this population.

In sum, future research on comorbid psychiatric symptoms in children and adolescents diagnosed with ASD is urgent. The presence of these symptoms not only potentiates the need for additional treatment, but may also impede the acquisition of skills in areas of deficits associated with the ASD diagnosis. Therefore, future directions of research should include replicating these results using assessments with sound psychometric properties with an additional focus on the effects of age cohorts. Not only will accurate assessment of psychiatric symptoms inform treatment approaches, but the replication of these findings may assist in the push for mandated insurance coverage. For example, research supporting the success of behavioral interventions (e.g., applied behavior analysis; Schreibman, 2000) has led some states to mandate insurance

companies to cover the assessment and treatment of ASD (Freudenheim, 2004; Peele et al., 2002). However, advocating for mandated insurance coverage reflects a more recent movement, since about a decade ago, a review of 46 health plans revealed diagnostic exclusions for autism in their coverage (Peele, Lave, & Kelleher, 2002). Therefore, replications of this study may provide empirical support that will justify the need for coverage for the assessment of psychiatric symptoms comorbid with ASD, and subsequently, treatment.

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