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Challenging Behaviors in Children with Comorbid Autism Spectrum Disorder and Attention-Deficit/ Hyperactivity Disorder

Katherine Margaret Macmillan
Louisiana State University and Agricultural and Mechanical College, macmillan.katherine@gmail.com

CHALLENGING BEHAVIORS IN CHILDREN WITH COMORBID AUTISM SPECTRUM DISORDER AND ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

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TABLE OF CONTENTS

ABSTRACT

Challenging behaviors, such as aggression, destruction, self-injurious behaviors, or stereotypic movements, affect the majority of individuals with Autism Spectrum Disorder. One factor that is known to influence the frequency at which challenging behaviors occur is the presence of a comorbid disorder. Attention deficit/hyperactivity disorder (ADHD) is thought to be one such disorder. This study aimed to compare the prevalence rates of challenging behaviors, according to the *Autism Spectrum Disorder-Behavior Problems, Child Version (ASD-BPC)*, in children ages 6-16 with parent reported symptoms of ASD, ADHD, comorbid ASD/ADHD, and no diagnosis. Differences existing overall were examined as well as differences on the *ASD-BPC*'s two factors, behaviors directed towards self and behaviors directed towards others. Results indicate that individuals with symptoms of ASD/ADHD display significantly higher rates of challenging behavior than those with symptoms of ADHD only and no diagnosis. They also indicate that those with symptoms of ADHD displayed higher rates of challenging behavior than those with no diagnosis. A better understanding of challenging behaviors in individuals with comorbid ASD/ADHD will assist in more accurate differential diagnoses.

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder beginning early in a person's life that results in social skills and communication deficits (American Psychiatric Association [APA], 2013). Those affected also show restricted or repetitive interests or behaviors, such as hand flapping, body rocking, counting, or other unusual rituals. Though challenging behaviors, such as aggression, destruction, and self-injurious behaviors, are not considered a diagnostic criterion, they affect the majority of individuals with ASD (Matson, Wilkins, & Macken, 2009). As a result, challenging behaviors have been researched extensively.

One area that has not yet been examined is the prevalence of challenging behaviors in individuals with comorbid ASD and Attention Deficit/Hyperactivity Disorder (ADHD). This can likely be attributed to the fact that neither the World Health Organization nor the APA's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)* allow for ADHD to be diagnosed as a comorbid disorder with ASD (APA, 2000; World Health Organization [WHO], 1992). Recently, however, researchers have begun to suggest that the comorbid diagnosis of ASD and ADHD is supported by their findings and should be allowed (Goldstein & Schwebach, 2004; Holtmann, Bölte, & Poustka, 2005; Ruggieri, 2006). With the publication of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*, the change was made to allow for the comorbid diagnosis of ASD and ADHD (APA, 2013).

Despite mounting evidence supporting the comorbid diagnosis of ASD and ADHD and the APA's recent change in position allowing for their comorbid diagnosis, there remains a sparseness of research focusing on the effects of a comorbid diagnosis of ASD and ADHD relative to other disorders that are comorbid with ADHD. The current study aims to address this

lack by examining the rate of challenging behaviors in individuals with comorbid ASD and ADHD when compared to individuals with only ASD, only ADHD, and individuals with no diagnosis. This research aims to improve diagnosis and treatment through a better understanding of challenging behaviors in individuals with ASD and ADHD. The history of ASDs, current research regarding challenging behaviors, and the comorbid diagnosis of ASD and ADHD will also be discussed.

AUTISM SPECTRUM DISORDER

Diagnostic Criteria

To receive the diagnosis of ASD, a person must meet a minimum of five criteria, distributed across two areas: social communication and restricted, repetitive behaviors or interests (APA 2013). All three criteria must be met from the social communication area, which includes (a) impaired non-verbal communication, (b) deficit in social-emotional reciprocity, and (c) deficits in developing, maintaining, and understanding relationships. The individual must also meet a minimum of two criteria in the area of restricted, repetitive behaviors or interests: (a) stereotyped and repetitive motor mannerisms, speech, or use of objects, (b) an insistence on sameness, routines, and rituals, both verbal and nonverbal, (c) interests that are highly restricted, or are abnormal in focus and intensity and (d) hypo- or hyper-reactivity to sensory stimuli (e.g., smell, light, touch). In addition to meeting at least five of the above criteria, the individual must have displayed some symptoms during the early developmental period. The deficits seen must also cause clinically significant impairment and must not be better explained by another psychiatric condition, specifically intellectual disability or global developmental delay.

A number of specifiers are used to add further clarity to the diagnosis. The severity level for both social communication and for restricted, repetitive behaviors and interests is specified, based on the level of support required by the individual. The levels of support include (1) requiring support, (2) requiring substantial support, and (3) requiring very substantial support, which should be determined separately for each domain. When applicable, any associated medical or genetic conditions, environmental factors, or psychological disorders should be listed as well. ASD should also be specified as being with or without language impairment and with or without intellectual impairment. If the child displays catatonia, that too should be noted. The

DSM-5 is also specific in its instructions regarding existing cases of ASD: individuals with well-established *DSM-IV-TR* diagnoses of autistic disorder, Asperger's disorder, or pervasive developmental disorder-not otherwise specified should be given a diagnosis of ASD. For those individuals who meet the social-communication criterion but who do not display restricted, repetitive behaviors and interests, social communication disorder should be considered as a more appropriate alternative.

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

Diagnostic Criteria

Symptoms of ADHD can be divided into two categories: inattention and hyperactivity-impulsivity (APA, 2013). Symptoms of inattention include (a) frequently making mistakes and an inattention to details, (b) having difficulty sustaining attention, (c) avoiding or strongly disliking tasks which involves sustained mental effort, (d) being easily distracted, (e) struggling with organization, (f) appearing to not listen when spoken to directly, (g) failure to follow through on responsibilities, such as schoolwork or chores, (h) losing necessary items, such as books or assignments, and (i) forgetfulness in daily activities and routines. Symptoms falling into the hyperactivity-impulsivity category include (a) frequently fidgeting or squirming, (b) often leaving his or her seat when the situation does not allow for it, (c) running or climbing excessively, when it is inappropriate, (d) talking excessively, (e) blurting out responses before the question has been fully asked, and having difficulty (f) waiting his or her turn and (g) spending leisure time quietly. Children with ADHD are frequently described as (h) being always "on the go" and (i) will often interrupt or intrude on others.

To receive a diagnosis of ADHD, a child must have at least six symptoms in either category, though commonly symptoms will be present in both. For individuals who are 17 years or older, five or more symptoms in either category are needed. The symptoms must have lasted at least 6 months and must interfere with or impair functioning in two or more areas, such as social relationships or occupation. Some symptoms must have been present prior to age 12 and must not be better explained by another mental disorder. According to the criteria given in the *DSM-5,* ADHD and ASD may be comorbid, which is a change from the *DSM-IV-TR* and the *ICD-10* (APA, 2000, 2013; WHO, 1992). Previously, a diagnosis of ADHD was not allowed if

the person was diagnosed with a Pervasive Developmental Disorder, including autistic disorder, Asperger's disorder, and pervasive developmental disorder-not otherwise specified.

COMORBIDITY OF AUTISM SPECTRUM DISORDER AND ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

Comorbid Diagnosis

One topic that remains an area of debate is the diagnosis of comorbid disorders, not entirely surprising given that in the recent past people debated if it was possible for people with Intellectual Disability (ID) to develop mental health disorders (Matson & Barrett, 1982). Similarly, as recently as 1978, professionals debated whether major depressive disorder could be diagnosed in children (Lefkowitz & Burton, 1978).

The condition found to have the highest rate of comorbidity in an autistic population is ID, with well above 50% of individuals with ASD showing some level of ID (Croen, Grether, & Selvin, 2002; Ritvo et al., 1989). The high prevalence of ID is significant since intelligence quotient (IQ) was found to be the best predictor for the severity of symptoms of autism (Mayes & Calhoun, 2011), gaining further significance in light of the implications this carries for challenging behaviors. For example as the severity of ID increases, so also does severity of language delays, stereotypies, and self-injurious behaviors (Wing & Gould, 1979). Ghaziuddin and colleagues found that roughly 2% of individuals with ASD have comorbid depression, with estimates increasing to 30% in individuals with Asperger's syndrome (Ghaziuddin, Ghaziuddin, & Greden, 2002; Ghaziuddin, Tsai, & Ghaziuddin, 1992; Ghaziuddin, Weidmer-Michail, & Ghaziuddin, 1998); however, the authors suspect that their estimate is low, due to a lack of available measures for assessing comorbidity in ASD populations (Ghaziuddin et al., 2002). Regarding anxiety, Evans, Canavera, Kleinpeter, Maccubbin, and Taga, (2005) found that medical, animal, and situational phobias are more common in children with ASD when compared to other children. Though many advances have been made, the debate on co-morbid disorders is not yet over. For example, debate still exists on whether Obsessive Compulsive

Disorder (OCD) can be separate from ASD or if these OCD-like symptoms are in reality manifestations of ASD symptomology (Matson & Nebel-Schwalm, 2007a).

Dual Diagnosis with Attention Deficit/Hyperactivity Disorder

Prior to the publication of the *DSM*-5, the dual diagnosis of ASD and ADHD was not allowed (APA, 2000, 2013; WHO, 1992). This change follows a recent trend in the research, in which it is increasingly argued that the comorbid diagnosis of ASD with ADHD as well as other psychopathology should be allowed (Simonoff et al., 2008). In fact, Amr and colleagues (2012) speculate that the initial decision to not allow the dual diagnosis of ASD with many disorders, including ADHD, can be attributed more to a professional "consensus of diagnostic procedures" than to available research. Evidence suggesting that people with ASDs have comorbid psychopathology abounds (e.g., Gjevik, Eldevik, Fjæran-Granum, & Sponheim, 2011; Mukaddes, Hergüner, & Tanidir, 2010; Sinzig, Walter, & Doepfner, 2009; Yerys et al., 2009). Why then is it often hard to diagnose comorbidity in this population? The difficulty lies in the nature of the disorder at hand. ASD is quite heterogeneous in nature, often resulting in limited communication abilities and a restricted range of speech or conversation (Lord & Paul, 1997; Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Wetherby, 1986). This in turn limits the clinician's ability to gain self-report information regarding comorbid symptomology, which can overlap with symptoms of ASD, creating a challenge in teasing the two apart. Finally, Matson and Nebel-Schwalm (2007a) note that the symptoms of the comorbid disorder can "vary from those seen in the general population" (p. 342).

Regarding the dual diagnosis of ADHD and ASD, Holtmann, Bölte, and Poustka (2007) noted that ADHD symptoms are frequently found in children with ASDs. Rates of ASD/ADHD comorbidity, which have risen in recent years, are estimated to be between 14-78% (Amr et al.,

2012; Gjevik et al., 2011; Holtmann et al., 2007; Lee & Ousley, 2006; Leyfer et al., 2006; Reiersen, Constantino, Volk, & Todd, 2007; Ruggieri, 2006; Simonoff et al., 2008; Sinzig et al., 2009; Yoshida & Uchiyama, 2004). These estimates place ADHD as a common comorbid disorder in individuals with an ASD, second only to ID (Simonoff et al., 2008). Prevalence rates of comorbidity found in individuals with ADHD paint a similar picture. Kadesjo and Gillberg (2001) found that as many as 87% of children with ADHD have a comorbid condition and as many as 67% have two or more comorbid conditions, leaving only a small minority of individuals with "pure" ADHD.

Following this trend in the research, many have argued for a reevaluation of the diagnostic criteria (Goldstein & Schwebach, 2004; Holtmann et al., 2005; Ruggieri, 2006). Gillberg and Billstedt (2000) point out that individuals with ASD frequently show evidence of comorbid disorders that affect the frontostriatal region of the brain, such as OCD, Tourette's syndrome, attention problems, and motor control deficits. Similarly, many examples exist of ADHD sharing a strong comorbidity with frontostriatal disorders including conduct disorder, OCD, Tourette's syndrome, and oppositional defiant disorder (Barkley, DuPaul, & McMurray 1990; Kadesjo & Gillberg, 2001). Thus, Gargaro, Rinehart, Bradshaw, Tonge, and Sheppard (2011) point out how unusual it is "that autism is the only frontostriatal disorder which is not …a valid comorbidity with ADHD according to the *DSM-IV-TR* and *ICD-10*" (p. 1082). Indeed, the change was made with the publication of the *DSM-5* to allow for such a dual diagnosis to be made (APA, 2013).

Considerable neuropsychological research exists in support of this change. When executive function in children with ASD and in children with ADHD is tested and split into its respective parts, the two groups show opposite patterns to their deficits (Gargaro et al., 2011).

For example, children with ASD show severe deficits in tasks requiring planning or shifting attention (Bramham et al., 2009; Corbett, Constantine, Hendren, Rocke, & Ozonoff, 2009), whereas children with ADHD did not show difficulty in tasks of planning or cognitive flexibility (Boliek & Obrzut, 1997; Ozonoff & Strayer, 1997). Additionally, the group with autism showed a tendency to perseverate within their conscious inhibitory function (Brian, Tipper, Weaver, & Bryson, 2003). Again this reflects an opposition to the pattern of responses by children with ADHD, who displayed difficulty with inhibition and sustained attention (Barkley, 1997, 2001; Happé, Booth, Charlton, & Hughes, 2006; Johnson et al., 2007). In line with this, Nydén et al. (2010) compared neurocognitive deficits in three groups: individuals with ADHD, with ASD, and with comorbid ASD/ADHD. They found that while the three groups shared most deficits, there were still deficits that distinguished the three groups. Most interestingly, however, the deficits evinced by the comorbid ASD/ADHD group were not equivalent to the deficits of the ASD group and the ADHD group when combined, but were distinct unto themselves.

Support for the comorbid diagnosis of ASD and ADHD can also be found in the field of psychopharmacology. Santosh and colleagues assert that children with comorbid ASD and ADHD respond to stimulant medications as well as children with ADHD alone (Santosh, Baird, Pityaratstian, Tavare, & Gringras, 2006). In fact, when stimulant medication is used by children with ASD and is effective, a reduction of ADHD symptoms such as hyperactivity and inattentiveness is seen, though the behavioral symptoms of ASD remain unchanged (Hazell, 2007). For example, in a double-blind placebo controlled study by Handen, Johnson, and Lubetsky (2000), methylphenidate, more commonly known as Ritalin, was administered to children with autism and comorbid ADHD symptoms. The result was that scores on the *Conner's Teacher Rating Scale* (Conners, 1997), a scale that measures ADHD symptomology,

were decreased by 50% while scores on the *Childhood Autism Rating Scale* (Schopler, Reichler, & Renner, 1986) remained unaffected. In considering available psychopharmacological evidence, such as that seen above, Gargaro et al. (2011) concluded that symptoms of hyperactivity or inattentiveness seen in children with ASD are not resultant of autistic symptomology but instead should be taken as symptoms of comorbid ADHD.

Not all researchers, however, are in support of the comorbid diagnosis of ADHD in individuals with ASD. Sinzig and colleagues (2008a,b) found that, while children with ASD and additional ADHD symptoms showed both similarities to and differences from children with ADHD alone, the response profiles of the two groups could not reliably be distinguished from each other (Sinzig, Morsch, Bruning, Schmidt, & Lehmkuhl, 2008a; Sinzig, Morsch, & Lehmkuhl, 2008b). Alternately, Reiersen and colleagues (2008) have suggested that a severe form of ADHD might exist in which clinically significant autism symptoms are present. The result being that a child with this type of ADHD would be more likely to end up with dually diagnosed ASD and ADHD. Similarly, Ruggieri (2006) proposes the need for further research to determine which distinction is more accurate: ASD with comorbid ADHD or a subtype of ASD, in which ADHD symptoms are elevated. More research is needed to clarify the situation, especially, as Gargaro and colleagues (2011) note, since the comorbid form of psychopathology is frequently less clear.

CHALLENGING BEHAVIORS IN AUTISM SPECTRUM DISORDER

Challenging behaviors, sometimes also known as aberrant, unwanted, or problem behaviors, occur at high rates in people with ASD (Cuccaro et al., 2003; Matson & Nebel-Schwalm, 2007b; Mudford et al., 2008). While no single definition of a "challenging behavior" exists, it is generally accepted that a behavior falls into this category if it occurs with a high level of frequency or intensity or if it interferes with the individual's learning and results in additional hardship for the parents or caregivers (Emerson et al., 2000; Mudford et al., 2008). The lack of an established definition is due in part to the heterogeneous nature of challenging behaviors, which makes it hard to establish a single, all-encompassing definition.

Despite not being a core feature of ASD, research indicates that having an ASD diagnosis predicts the presence of at least one challenging behavior (Dawson, Matson, & Cherry, 1998; Hill, Powlitch, & Furniss, 2008; McClintock, Hall, & Oliver, 2003). For instance, Baker and colleagues (2003) found that children with developmental delays were three times more likely than same-aged peers to be placed in the clinical range on assessments measuring challenging behaviors. Current estimates of the occurrence of at least one challenging behavior in individuals with an ASD range from 64.3% - 94.3% with no differences found between males and females in overall prevalence (Kozlowski & Matson, 2012; Matson, et al., 2009a; McTiernan, Leader, Healy, & Mannion, 2011; Murphy, Healy, & Leader, 2009). Prevalence of aberrant behaviors does, however, vary by population, with individuals diagnosed with an ASD showing rates of challenging behaviors higher than those found in individuals without an ASD (Kozlowski, Matson, Rieske, 2012; McClintock et al., 2003). This trend held true not only for typically developing peers (Matson, et al., 2009a; Nicholas et al., 2008) but also for individuals who are atypically developing, have an intellectual disability, or who have psychopathology

other than an ASD (Holden & Gitlesen, 2006; Matson & Nebel-Schwalm, 2007b; Murphy et al., 2005; Rojahn, Matson, Lott, Esbensen, & Smalls, 2001).

Furthermore, IQ and severity of ASD symptoms each carry an impact on challenging behaviors. Preliminary results suggest that the severity of ASD symptomology is related to the frequency, intensity, and number of challenging behaviors with higher prevalence rates seen in cases with more severe ASD symptomology (Matson, Dempsey & Fodstad, 2009; Matson, et al., 2009a; Rojahn et al., 2009). O'Brien and Pearson (2004) found IQ to have an inverse relationship between the severity of challenging behaviors and the individual's IQ. Taken in sum, the picture is further confounded by the high level of comorbid psychopathology and other related disorders common to individuals with ASDs, which can serve to further increase the likelihood of challenging behaviors (Crocker et al., 2006; Holtmann, et al., 2007; Matson, Hess, & Boisjoli, 2010; Matson & Shoemaker, 2010; Shattuck et al., 2007).

Consequent to their heterogeneous nature, aberrant behaviors are commonly broken into three sub-categories: self-injurious behaviors (SIB), aggressive and destructive behaviors, and stereotypic behaviors. SIB are behaviors that a person, generally with ID or autism, engages in by which the person does harm to him or herself (Petermann & Winkel, 2007a,b). This harm occurs through the consistent application of a movement that is typically repetitive or rhythmic in nature. It is important to note that these behaviors are not preplanned or predetermined. Common motivations for such behavior include frustration, anxiety, or the desire to escape from the environment or the current demands of the situation. As a point of clarification SIB in this context is not the same as deliberate non-suicidal self-harm, such as cutting or scratching oneself, which is more common to individuals with borderline personality disorder, depression, or who were abused in childhood (Glenn & Klonsky, 2011; Nock, Holmberg, Photos, & Michel, 2007;

Santa Mina et al., 2006). Matson and Turygin (2012) proposed that a more appropriate term may be "repetitive self-injurious behavior." While most often associated with increased levels of ID (Allen, 2000; McClintock, et al., 2003), it remains important to consider SIB in populations with ASD due to the high percentage of individuals with ASD who have comorbid ID (Fombonne, 1998; Gillberg & Coleman, 2000; Matson, Dempsey, LoVullo, & Wilkins, 2008; Noens & vanBerckelaer-Onnes, 2004). In fact Murphy, Healy, and Leader (2009) found that SIB in children with comorbid ASD and ID was more severe than SIB in children with high functioning autism alone.

In addition to SIB, individuals with ASD also commonly exhibit behaviors that are aggressive towards others or destructive towards property (Matson, Boisjoli, Rojahn, & Hess, 2009; Matson, Cooper, Malone, & Moskow, 2008; Matson, Fodstad, & Boisjoli, 2008). Matson, et al. (2009a) found that physical aggression, verbal aggression, and property destruction were endorsed by 40% or more of their sample on the *Autism Spectrum Disorder - Behavior Problems, Child Version* (*ASD-BPC*; Matson & González, 2007). Within typically developing individuals, gender differences in levels of aggression are well established, with boys displaying more physical aggression than girls (Alink et al., 2006; Lee, Baillargeon, Vermunt, Wu, & Tremblay, 2007). By 24 months of age, typically developing males are more physically aggressive than females, a fact that remains true even after the third birthday when a decrease in physical aggression is seen (Alink et al., 2006). Between the ages of 5 and 11, girls display a further decrease in physical aggression, from an estimated prevalence of 2.3% to 0.5%, respectively (Lee, et al., 2007). Boys on the other hand maintain a stable prevalence rate of 3.7% during the same years. This debate of gender differences for physical aggression and property destruction within the autistic population, however, has not yet been resolved. While some attest

that, like in a typically developing population, males with ASD or ID are more aggressive than females (McClintock, et al., 2003; Tyrer et al., 2006), still more have found no gender difference in prevalence of aggression or destruction (Hemmings, Gravestock, Pickard, & Bouras, 2006; Murphy et al., 2009; Tenneij & Koot, 2008; Kozlowski & Matson, 2012). Kozlowski & Matson (2012) speculate that the presence of ASD eliminates the presence of a gender difference, likely due to the overall elevation in levels of physically aggressive behaviors seen in this population.

The last category of challenging behaviors, stereotypic behaviors, sometimes called restricted or repetitive behaviors or interests (RRBI), is the only one to also qualify as a diagnostic criterion for ASD (APA, 2000). RRBIs include any behavior occurring on a regular basis that is both repetitive and nonfunctional and that interferes with daily functioning (Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005). Most common among the RRBIs are hand-flapping, mouthing objects, jumping up and down, head moving, jerking, echolalia, and hand movements, such as finger play (Bowley & Kerr, 2000; Noll & Barrett, 2004; Rojahn & Sisson, 1990; Symons, Sperry, Dropik, & Bodfish, 2005). Unfortunately stereotypies are often considered the least severe or least worrisome of the challenging behaviors, since evidence implicates them as a potential precursor to self-injury (Epstein, Doke, Sajuaj, Sorrell, & Rimmer, 1974; Guess & Carr, 1991; Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996; Morrison & Rosales-Ruiz, 1997; Schroeder, Rojahn, Mulick, & Schroeder, 1990). Matson, et al. (2009b) also point out that RRBIs are among the most difficult behaviors to treat.

The effect of challenging behaviors is made more impactful not only by their frequency of occurrence but also by their course. On the whole, challenging behaviors appear to be chronic, persisting throughout the lifetime (Matson, Mahan, Hess, Fodstad, & Neal, 2010; Murphy, et al., 2005; Murphy, et al., 2009). Limited evidence suggests that, left untreated, the

severity of these aberrant behaviors is likely to increase as the child ages and physically matures (Murphy et al., 2005). Challenging behaviors ultimately have a weighty impact on the lives of both the individual and his or her family, repeatedly interfering with peer interactions and other key opportunities for education and forays into the community (Luiselli, Blew, Keane, Thibadeau, & Holzman, 2000; Matson & Wilkins, 2007). The risk of injury to the individual and to others is also increased (Lee, Harrington, Chang, & Connors, 2008; Smith & Matson, 2010). As a result, physical restraints and long-term residential care are used more frequently (Harris, 1993; Sturmey, Lott, Laud, & Matson, 2005). Ultimately the parent or caregiver is left with significantly increased stress and burden (Heiman & Berger, 2008; Wong, 2008).

Considering the severe negative impact that challenging behaviors can have on a person's life, it is none too surprising that they are the primary reason for treatment referral and provision (Matson & Minshawi, 2006; Matson & Smith, 2008; Mudford et al., 2008; Plant & Sanders, 2007). Indicative of challenging behaviors' influence on individuals' lives is the high rate of medication use in these populations with the intent of managing them. Recent estimates suggest that medication is used in 52% of cases, with psychotropic medications being used in 35% of cases (Green et al., 2006; Matson & Dempsey, 2008; Rosenberg et al., 2010). Encouragingly, Harris and Hanndelman (2000), found that any form of behavioral intervention, used at any age, will yield improvement in challenging behaviors. Despite this finding, behavioral intervention should begin as early in the child's life as possible, which underscores the importance of identifying and carefully documenting factors associated with challenging behaviors (Lovaas, 1996; Matson, Bamburg, Cherry, & Paclawskyj, 1999; Matson & Wilkins, 2008; Peters-Scheffer, Didden, Mulders, & Korzilius, 2010).

PURPOSE

Neither the *DSM-IV-TR* nor the *ICD-10* allows for the comorbid diagnosis of ASD and ADHD (APA, 2000; WHO, 1992). More recently, professionals have argued for a reevaluation of this, citing findings in support of the comorbid diagnosis of the two disorders (Goldstein & Schwebach, 2004; Holtmann et al., 2005; Ruggieri, 2006). In response the recently released *DSM-5* does allow for the comorbid diagnosis of ASD and ADHD to be made (APA, 2013). Nydén et al. (2010) found that, contrary to expectations, the neurocognitive deficits seen in individuals with comorbid ASD and ADHD differ from the neurocognitive deficits associated both with ASD and with ADHD. Beyond this, the presentation of comorbid ASD/ADHD remains relatively unexamined. Specifically, the prevalence of challenging behaviors in individuals with comorbid ASD/ADHD is unknown. Challenging behaviors often result in a significant negative impact on the lives of both the individuals with ASD and the caretaker (Matson & Wilkins, 2007; Smith & Matson, 2010; Wong, 2008). Furthermore, individuals with a comorbid diagnosis of ASD and ID display elevated rates of challenging behaviors when compared to individuals with ASD alone (Fombonne, 1998; Gillberg & Coleman, 2000; O'Brien & Pearson, 2004). Recognizing that a comorbid diagnosis of ID impacts rates of challenging behaviors, it is feasible for a comorbid diagnosis of ADHD to have a similar effect. As a result, the proposed study aims to examine possible changes to the prevalence of challenging behaviors due to the symptoms of comorbid ASD and ADHD. This may ultimately aid in the identification of comorbid ASD/ADHD by improving the field's understanding of the differences between prevalence of challenging behaviors in individuals with ASD, ADHD, and ASD/ADHD.

HYPOTHESES

Following the currently available literature in the field, several predictions have been made. It is hypothesized that:

- Planned comparisons will indicate that the group with symptoms of comorbid ASD and ADHD will display significantly more severe challenging behaviors than all other groups (symptoms of ASD, symptoms of ADHD, and symptoms of no key diagnosis)
- Planned comparisons will indicate significantly higher rates of challenging behaviors in the group with symptoms of autism spectrum disorder than the group with symptoms of ADHD or symptoms of no key diagnosis
- Planned comparisons will indicate that the group with symptoms of ADHD will exhibit significantly higher rates of challenging behaviors than the group with symptoms of no key diagnosis

METHOD

Participants

To begin, a power analysis was run, to determine *a priori* the necessary minimum sample size of the study. A power of .80 and alpha level of .05 were used for the calculations, consistent with that suggested by Hinkle, Wiersma, and Jurs (2003). A medium effect size of .25 was also used, in line with Cohen's assertion (1988) that this is the maximum appropriate effect size for behavioral science studies. The power analysis was computed using GPower*3, a power analysis computer program, and resulted in a minimum sample size of 180 participants (Faul, Erdfelder, & Buchner, 2007).

Data collection resulted in a sample consisting of 92 children, between the ages of 6-16 years old (M = 9.86; SD = 2.62) with their parents or legal guardians acting as respondents for all measures. Participants include both typically developing and developmentally disabled children. They were recruited from various sites in the community, such as outpatient clinics, schools, and parent advocacy and support groups. Participants were divided into groups based on parent-reported symptomology (symptoms of ASD only, symptoms of ADHD only, symptoms of ASD with comorbid ADHD, and symptoms of no key diagnosis). The parent or legal guardian of all the participants consented to their child's participation in the study. When developmentally appropriate, assent was also obtained from the child. Participation in this study is subsumed within a larger research study, approved by the Louisiana State University Internal Review Board. Data collection is on-going and has taken place over multiple years.

Upon data collection, participants were categorized into group based on the symptoms reported by their parents or legal-guardians. This resulted in having participants in only three of the four groups. The size of the groups were as follows: Symptoms of no key diagnosis, 42

participants; symptoms of ASD, 0 participants; symptoms of ADHD, 44 participants; symptoms of comorbid ASD/ADHD, 6 participants. The children in the No Diagnosis group ranged in age from 6 to 16 years of age (M = 10.29; SD = 2.95) with 57.1% male and 38.1% female. The children in this group were 81.0% Caucasian, 16.7% African American, 0.0% Hispanic, and 0.0% other. As mentioned above, the ASD only group contained no participants, constituting 0% of the sample. The ADHD only group ranged in age from 6 to 14 years of age (M = 9.41; SD = 2.32). For this group, 51.1% of the group were male and 46.7% were female. The children in this group were 73.3% Caucasian, 17.8% African American, 4.4% Hispanic, and 0.0% other. Finally, the comorbid ASD/ADHD group ranged in age from 8 to 13 (M = 10.17; SD = 1.94) with 66.7% male and 16.7% female. The children in the comorbid group were 83.3% Caucasian, 16.7% African American, 0.0% Hispanic, and 0.0% other. All demographic information is represented in Table 1.

Table 1
Demographic characteristics (N=92)

	DIAGNOSTIC GROUP			
DEMOGRAPHIC CHARACTERISTICS	ASD only (n=0)	ADHD only (n=44)	ASD/ADHD (n=6)	No Diagnosis (n=42)
Age (in years)				
Mean (SD)	--	9.41(2.32)	10.17(1.94)	10.29(2.95)
Range	--	6-14	8-13	6-16
Gender, %				
Male	--	51.1%	66.7%	57.1%
Female	--	46.7%	16.7%	38.1%
Race/Ethnicity, %				
Caucasian	--	73.3%	83.3%	81.0%
African-American	--	17.8%	16.7%	16.7%
Hispanic	--	4.4%	0.0%	0.0%
'Other'	--	0.0%	0.0%	0.0%

Measures

Autism Spectrum Disorder-Behavior Problems, Child Version (ASD-BPC). The *ASD-BPC* is one part of a larger parent-report assessment battery designed to assess for symptoms of ASD with the goal of aiding in diagnosis of ASD, identification of commonly comorbid psychopathology, and identification of challenging behaviors (Matson & González, 2007). It is validated for use with children between the ages of 2-18 years. The *ASD-BPC* consists of 18 items, which measure both the presence and severity of challenging behaviors (see Appendix A for a listing of items). They are scored along a 0-2 scale, where 0=not different/no impairment, 1=somewhat different/mild impairment, and 2=very different/severe impairment. All items map onto two factors, internalizing behaviors and externalizing behaviors (Matson, González, & Rivet, 2008a). The *ASD-BPC* has been shown to have fair inter-rater reliability (K_ω=0.49), good test-retest reliability (K_ω=0.64), and excellent internal consistency (α=0.90; Matson et al., 2008a; Matson et al., 2008b). Mahan and Matson (2011) have also shown the *ASD-BPC* to have convergent and discriminant validity with the *Behavior Assessment System for Children, second edition* (*BASC-2*) for children and adolescents with ASD.

Anxiety Disorders Interview Schedule for DSM-IV-TR, parent interview (ADIS). The *ADIS* is a semi-structured diagnostic interview that is designed to assist the administrator in easily making diagnoses (Brown, DiNardo, & Barlow, 1994). It achieves this by mapping directly onto the criteria for the disorders listed in the *DSM-IV-TR*. The interview uses a screening structure, such that interviewees are asked initial screening questions, which if endorsed lead to further more detailed questioning. The ADIS has been shown to have good to excellent test-retest reliability (K_ω=0.66-1.00; Silverman, Saavedra, & Pina, 2001). Inter-rater reliability has been more variable, but overall has still been found to maintain acceptable levels

of agreement (K_ω=0.35-1.00; Rapee, Barrett, Dadds, & Evans, 1994; Silverman & Nelles, 1988). Pertinent to this study, Jarrett, Wolff, and Ollendick (2007) found the ADHD module of the *ADIS* to have concurrent validity with both the *Child Behavior Checklist* (Achenbach, 2001a) and the *Teacher Report Form* (Achenbach, 2001b).

DSM-IV/ICD-10 Checklist. The *DSM-IV/ICD-10 Checklist* is a 19-item checklist that includes diagnostic criteria from both the *DSM-IV-TR* and the *ICD-10.* One item on the checklist also assesses symptom onset by asking whether deficits in one of the core areas were seen prior to age three. For each item the respondent is asked to answer with "yes" or "no" whether the item is true of the individual in question. To assist respondents, examples from the texts are included with most of the items. Matson, et al. (2008b) have demonstrated that the checklist has good reliability, ranging from r=.89 to r=.96. Internal consistency was also found to be excellent (α = .95; González, 2008; Matson, et al., 2008b).

Procedure

The *ASD-Child Battery*, which includes the *ASD-BPC,* and the *DSM-IV/ICD-10 Checklist* along with printed directions were given to the primary caregivers of the children (Matson & González, 2007). The caregivers were given an opportunity to ask questions and subsequently filled out the measures. Following this, trained graduate students made follow-up calls as necessary to gather missing information and to clarify the provided information. Additionally, the *ADIS* was administered to the parents or caregivers by trained graduate students. Throughout data collection, the graduate students responsible for all data collection were supervised by a psychologist licensed in the state of Louisiana with more than twenty years of experience.

Participants were assigned to one of four diagnostic categories: ASD only, ADHD only, comorbid ASD/ADHD, or no key diagnosis. Symptoms of ASD were recorded using the *DSM-*

IV/ICD-10 Checklist, which ensured consistently across sites. The checklist includes all three of the social/communication diagnostic criteria and three of the four RRBI diagnostic criteria listed in the *DSM-5*. The RRBI criterion not included in the *DSM-IV/ICD-10 Checklist* is the criterion related to hypo- or hypersensitivity to sensory stimuli. To be assigned to the ASD only group, a minimum of five items had to be endorsed, three of which were social/communication items and two of which were items involving RRBIs. Because the *DSM-IV/ICD-10 Checklist* lacks one of the four RRBI diagnostic criteria, information regarding hypo- and hypersensitivity to sensory stimuli was missing. In the case that a parent reported that the participant met the three necessary social/communication criteria but only one of the criteria related to restricted interests or repetitive behaviors, the participant was not assigned to the ASD only group. Though this might exclude some from participation, a conservative stance was taken and the participants lacking the second RRBI criterion were excluded.

Participants were assigned to the ADHD only group if they met the diagnostic criteria for the disorder according to the parent report of symptoms given during the *ADIS*, which maps directly onto the criteria specified in the *DSM-IV-TR* (APA, 2000). This required the parent to report that a child displayed six symptoms that are clinically impairing in either category, inattention or hyperactivity/impulsivity. Additionally, some of the child's symptoms must have been present before the age of 12. Age of symptom onset was determined based on notes taken by the clinician performing the interview. For the purposes of this study, subtypes of ADHD were not specified out, but were all combined into the ADHD group. The diagnostic criteria used in the *ADIS* remain accurate with the release of the *DSM*-5.

Participants were assigned to the ASD only group if the parent reported symptoms sufficient for an ASD diagnosis, but did not report symptoms sufficient for an ADHD diagnosis.

The converse applied to the ADHD only group, which required parent reported symptoms sufficient for an ADHD diagnosis without sufficient symptoms for an ASD diagnosis. Participants were assigned to the comorbid ASD/ADHD group if the parent reported sufficient symptoms for the diagnostic criteria to be met for both ASD and ADHD. Lastly, participants were assigned to the no key diagnosis group if the parents did not report sufficient symptoms for the child to receive either an ASD diagnosis or an ADHD diagnosis.

STATISTICAL PROCEDURE AND RESULTS

Several adjustments were made due to the lack of participants in the ASD only group. The ASD only group was removed from all hypotheses, rendering the amended hypotheses to be as follows:

- Planned comparisons will indicate that the group with comorbid ASD and ADHD will display significantly more severe challenging behaviors than both the ADHD only group and the group with no key diagnosis
- Planned comparisons will indicate that the ADHD group will exhibit significantly higher rates of challenging behaviors than the control group

Furthermore, the number of groups was reduced from four to three for the purpose of all statistical analyses. *A priori* analyses were used to determine any differences in the three remaining groups (ASD/ADHD, ADHD only, and no key diagnosis) among the demographic variables (i.e., gender, ethnicity, and age). Chi-square analyses were run to examine race and gender, with results indicating that the groups did not differ significantly for either characteristic ($X^2_{race}(4) = 2.33$, $p > .05$ and $X^2_{gender}(2) = 1.63$, $p > .05$). A one-way between-subjects analysis of variance (ANOVA) was run to ensure that a significant difference does not exist between the mean age of the groups. Results indicate that there was no significant difference between the mean age of the groups ($F(2, 89) = 1.26$, $p > .05$) Subsequently, a *post hoc* power analysis based on a sample size of 93 was run to determine the power of the current study. Like with the *a priori* power analysis, an alpha level of .05 was used as was an effect size of .25. Based on this and a sample size of 93 with 3 groups (comorbid ASD/ADHD, ASD only, ADHD only, and no key diagnosis), the power of the current study was determined to be 0.55.

The assumption of normality was tested using the Kolmogorov-Smirnov Test of Normality. The results indicate that the total score on the *ASD-BPC* was significantly non-normal ($D(93) = 0.30$, $p < .05$). This outcome is not surprising because the sample is a clinical sample. Next, Levene's test was used to test the whether the assumption of homogeneity of variance was met for the total score on the *ASD-BPC*. According to Levene's test, this assumption was not met ($F(2,98) = 9.07$, $p < .05$). Despite these violations of the ANOVA assumptions, an ANOVA will be run, since it is a robust test that provides sufficient protection again violations of the assumptions.

To test the stated hypotheses, a series of planned comparisons were used. All planned contrasts used an unequal variances measure due to the violation of the assumption of homogeneity of variance. The planned comparisons were orthogonal. The first planned comparison compared the rates of problem behaviors as measured by the *ASD-BPC* between the comorbid ASD/ADHD group and all other groups (ADHD only and no key diagnosis). The prediction was that the ASD/ADHD group would display a significantly higher rate of challenging behaviors than the other groups. Planned contrasts supported the first hypothesis, indicating that *ASD-BPC* total scores were significantly higher for the comorbid ASD/ADHD group than for the ADHD only group and the no key diagnosis group ($t(5.39) = -3.42$, $p < .05$).

The final planned comparison compared the ADHD only group to the no key diagnosis group, with the expectation that the ADHD only group would display a significantly higher rate of challenging behavior. The second hypothesis was also supported with results indicating that *ASD-BPC* total scores for the ADHD only group were significantly higher than for the no key diagnosis group ($t(60.90) = -3.03$, $p < .01$). The effect size was measured at $r = .36$.

Because the hypotheses for this study are based in theory, the use of planned comparisons is supported, however an *F*-test, being statistically more conservative, was also run as a point of process. Because the assumption of homogeneity of variance was violated, the more conservative Welch's *F* was used to account for these violations. For this ANOVA, diagnostic group (i.e., ADHD, comorbid ASD/ADHD, and no key diagnosis) served as the independent variable and the total score on the *ASD-BPC* served as the dependent variable. Results of Welch's *F* indicate that there was a significant effect of diagnostic group on levels of problem behaviors, as measured by the *ASD-BPC* ($F(2, 12.79) = 11.35$, $p < .001$). The significant outcome of the ANOVA is commensurate with the results of the planned comparisons.

Because the initial analyses were significant, follow-up ANOVAs were run to determine group differences on each subscale of the *ASD-BPC* in accordance with the factor structure determined by Matson, Gonzalez, and Rivet (2008a; see Appendix B).) The items on the *ASD-BPC* fall onto two factors. Factor 1 consists of seven items that measure behaviors that are largely directed towards others, such as "kicking objects," "throwing objects at others," and "yelling or shouting at others." Factor 2 consists of 11 items that predominantly measure behaviors that are directed towards the self. Examples include "poking him/her self in the eye," "playing with own saliva," and "repeated and unusual body movements." For these analyses, diagnostic group served as the independent variable once again, while the factor score on the *ASD-BPC* served as the dependent variable.

To begin, Levene's test was used to test for homogeneity of variance. Levene's test indicates that homogeneity of variance does not exist for either factor 1 ($F(2,90) = 12.85$, $p < .05$) or for factor 2 ($F(2,90) = 6.85$, $p < .05$). Once again, Welch's *F* was used because homogeneity of variance was violated. The results of the one-way between subjects ANOVAs indicate that a

significant difference does exist between diagnostic groups for factor 1 scores ($F(2, 12.64) = 6.62$, $p < .05$) with an effect size of $\omega^2 = 0.12$ and for factor 2 scores ($F(2, 13.09) = 11.98$, $p < .05$) with an effect size of $\omega^2 = 0.21$.

Post hoc analyses were run to determine which groups differed significantly. All post hoc analyses were run using Scheffé's test (See Table 2 for a summary of group means). Scheffé's post hoc criterion for significance indicated that factor 1 scores on the *ASD-BPC* were significantly higher in the comorbid ASD/ADHD group ($M = 1.67$, $SD = 1.37$) than in the no diagnosis group ($M = 0.19$, $SD = 0.51$; Table 3). According to Scheffé's test, factor 1 scores did not differ between the comorbid ASD/ADHD group ($M = 1.67$, $SD = 1.37$) and the ADHD only group ($M = 0.78$, $SD = 1.31$). The ADHD group ($M = 0.78$, $SD = 1.31$) had significantly higher factor 1 scores than the no diagnosis group ($M = 0.19$, $SD = 0.51$).

Table 2
Group means for the *ASD-BPC*

	DIAGNOSTIC GROUP		
GROUP MEANS M (SD)	ADHD only	ASD/ADHD	No Diagnosis
Total Score	2.022 (2.880)	5.500 (2.950)	0.595 (1.251)
Factor 1 Score	0.778 (1.312)	1.667 (1.366)	0.190 (.506)
Factor 2 Score	1.244 (1.885)	3.833 (1.835)	0.405 (.964)

Table 3
Scheffe Post Hoc Tests per Diagnostic Group – *ASD-BPC* Factor 1 Score

Diagnostic Group	Comparison Diagnostic Group	P-Value	Mean Difference
No Diagnosis	ADHD Only	.034*	-.588
No Diagnosis	Comorbid ASD/ADHD	.006*	1.477
ADHD Only	No Diagnosis	.034*	.588
ADHD Only	Comorbid ASD/ADHD	.146	-.889

For factor 2, Scheffé's test indicated that the comorbid ASD/ADHD group ($M = 3.83$, $SD = 1.83$) had significantly higher factor 2 scores than either the ADHD only group ($M = 1.24$, $SD = 1.88$) or the no diagnosis group ($M = 0.41$, $SD = 0.96$). The ADHD group ($M = 1.24$, $SD =$

1.88) also had significantly higher factor 2 scores than the no diagnosis group ($M = 0.41$, $SD = 0.96$). A summary of these results can be found below in Table 4.

Table 4
Scheffe Post Hoc Tests per Diagnostic Group – *ASD-BPC* Factor 2 Score

Diagnostic Group	Comparison Diagnostic Group	P-Value	Mean Difference
No Diagnosis	ADHD Only	.043*	-.839
No Diagnosis	Comorbid ASD/ADHD	.000*	-3.428
ADHD Only	No Diagnosis	.043*	.839
ADHD Only	Comorbid ASD/ADHD	.001*	-2.589

DISCUSSION

ASD is a neurodevelopmental disorder that negatively impacts social skills and communication from an early age (APA, 2013). While not considered a diagnostic feature of ASD, challenging behaviors occur in the majority of cases (Matson et al., 2009a). In fact, the rate of challenging behaviors is so high, that having an ASD diagnosis is predictive of having at least one challenging behavior (Dawson et al., 1998; Hill et al., 2008; McClintock et al., 2003).

With the recent publication of the DSM-5, the change was made from previous diagnostic codes to allow for the comorbid diagnosis of ASD and ADHD (APA, 2010; APA, 2013; WHO, 1992). Because the change to allow for their dual diagnosis is relatively recent, there is, understandably, not much research on the topography of a dual diagnosis of ASD and ADHD. The research on this point has focused thus far on why the dual diagnosis should be allowed and its prevalence (Goldstein & Schweback, 2004; Holtmann et al., 2005; Ruggieri, 2006).

This study was run in an effort to contribute to a better understanding of challenging behaviors in those individuals who have a comorbid diagnosis of ASD/ADHD. Considering the severe negative impact that challenging behaviors can have on the lives of individuals with ASD and their caretakers, it is important to consider this topic fully (Matson & Wilkins, 2007; Smith & Matson, 2010; Wong, 2008). Ultimately the hope is that diagnosis and treatment will be improved by better understanding the rate of challenging behaviors in those with comorbid ASD/ADHD.

In comparing the rates of challenging behaviors, as measured by the *ASD-BPC* total score, in individuals with parent-reported symptoms of ASD only, ADHD only, comorbid ASD/ADHD, and no key diagnosis, it was predicted first that the group with parent-reported symptoms of comorbid ASD/ADHD would have significantly higher rates of challenging

behavior that all other groups. Upon data collection, the prediction had to be amended to leave out the group displaying symptoms of ASD only. With that change made, the prediction was confirmed. The group with parent-reported symptoms of comorbid ASD/ADHD displayed the highest rate of challenging behaviors. This is consistent with previous literature, which indicates that those diagnosed with ASD display higher rates of challenging behaviors than those without an ASD diagnosis (Kozlowski et al., 2012; McClintock et al., 2003).

The second hypothesis, stating that the group with parent-reported symptoms of ASD only would display higher rates of challenging behavior than the group displaying only symptoms of ADHD and the no key diagnosis group, was unable to be examined due to no participants falling into this category. This is of course disappointing and distinctly limits the conclusions that can be drawn from this study. It is possible that as we better determine the prevalence of comorbid ASD/ADHD this occurrence may become less surprising. Current estimates of comorbid ASD/ADHD fall between 14% and 78% of ASD cases (Amr et al., 2012; Gjevik et al., 2011; Holtmann et al., 2007; Lee & Ousley, 2006; Leyfer et al., 2006; Reiersen et al., 2007; Ruggieri, 2006; Simonoff et al., 2008; Sinzig et al., 2009; Yoshida & Uchiyama, 2004). The current sample, while not collected with the intention of determining prevalence, tends to suggest that the prevalence is closer to 78% than to 14%. It should be noted though that there is no way to determine prevalence from this study.

Another possible explanation for the high level of ADHD within our sample is the method of data collection. All data collected was parent-report. It is possible that in the current study the high number of individuals falling into the comorbid ASD/ADHD group is simply a reflection of parents or caregivers over-reporting symptoms, resulting in unwarranted assignations of participants to the comorbid ASD/ADHD group. Finally, we hypothesized that

the ADHD only group would display higher rates of challenging behaviors than the no key diagnosis group. This hypothesis was also supported by the current study.

Because the initial conclusions were supported, further analyses were run to determine whether group differences existed on each of the factor scores of the *ASD-BPC*. No hypotheses were made in regards to the results of these analyses. Factor 1 examines behaviors that are predominately directed towards others, such as hitting, kicking, or yelling at others. A full listing of the seven items that are a part of factor 1 can be found in Appendix B. Post hoc analyses indicate that the no diagnosis group endorsed significantly fewer factor 1 items than the ADHD only group and the group with symptoms of comorbid ASD/ADHD. That is to say that the no key diagnosis displayed significantly lower levels of challenging behaviors that are directed towards others when compared to individuals with symptoms of ADHD only and individuals with symptoms of comorbid ASD/ADHD. This is consistent with the main analyses, which found that the no key diagnosis group had significantly lower total scores on the *ASD-BPC* than the other two groups. This is also consistent with a study by Connor, Chartier, Preen, and Kaplan (2010), which found higher levels of aggression (overt, proactive, and reactive aggression) in children and adolescents with ADHD when compared to community controls with no ADHD diagnosis. Furthermore, they found that comorbid diagnoses contribute to levels of aggression in those with ADHD.

More interestingly, analyses indicated no significant difference in factor 1 scores between individuals with parent-reported symptoms of ADHD only and individuals with parent-reported symptoms of comorbid ASD/ADHD. Said another way, the ADHD only group and the comorbid ASD/ADHD group displayed levels of challenging behaviors directed toward others that were not significantly different from each other. This finding is in disagreement with a study by

Goldin, Matson, Tureck, Cervantes, and Jang (2013), who found that the comorbid ASD/ADHD group displayed higher rates of tantrum behavior than the ADHD only group. It is possible that the difference in outcomes can be attributed to the type of challenging or tantrum behavior considered in each study. Factor 1 of the *ASD-BPC* includes many items that focus on aggressive behaviors, such as hitting, kicking, or spitting on others, whereas Goldin et al. (2013) included a broader range of items, such as crying, irritable mood, and compliance with demands. The low power of the current study should also be taken into account. It tempers the results and limits what conclusions should be drawn.

Factor 2 consists of eleven items and measures challenging behaviors that are largely directed towards the self. A full listing of items included in factor 2 can be found in Appendix B. Post hoc analyses indicate that the group with parent-reported symptoms of no key diagnosis displayed the lowest level of challenging behaviors directed towards themselves, followed by the group with parent-reported symptoms of ADHD only, and finally the group with parent-reported symptoms of comorbid ASD/ADHD displayed the most challenging behaviors directed towards the self. These outcomes are unsurprising and consistent with previous research. At least one challenging behavior is present in the majority of individuals with ASD (Kozlowski & Matson, 2012; Matson et al., 2009a; McTiernan et al., 2011; Murphy et al., 2009). Additionally, some of the items included in factor 2 of the *ASD-BPC* are both challenging behaviors and part of the diagnostic criteria for ASD, such as "repetitive and unusual body movements."

Limitations to the current study include the small sample size and the resulting low power of the statistical analyses. Because the power of the current study was so low, caution should be used when considering the conclusions that can be drawn from this study. While statistical significance was achieved, it is questionable whether this translates to a practical significance.

One example of this is the statistically significant results for the ANOVAs' examining group differences for factors 1 and 2. For both ANOVAs, a statistical significant was found between the groups, however upon closer examination, the effect sizes for both were small, with the factor 1 ANOVA having an effect size of 0.12 and factor 2 having only a slightly better effect size at 0.21. Furthermore, the lack of a group with parent-reported symptoms of ASD only resulted in severe limitations to the conclusions that could be drawn from the results of the statistical analyses.

Future research will hopefully include re-running the study with a larger sample size and with an ASD only group. Additionally, future research should work to improve upon the methods used to assign participants to their respective groups within this study. Ideally, a clinician who is blind to the research question will make clinical diagnoses. This will help to protect against unwarranted diagnoses resulting from over-reporting of symptoms. Future research should also consider the impact of IQ on challenging behaviors within individuals with comorbid ASD/ADHD. It is known that the severity of certain challenging behaviors (i.e., stereotypies and self-injurious behaviors) increases as IQ decreases (Wing & Gould, 1979). Unclear as of yet is whether this would additively impact the rate of challenging behaviors in those with comorbid ASD/ADHD diagnoses or if a ceiling effect would occur, such that the rate of challenging behaviors would not increase beyond their already high level.

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APPENDIX A: ITEMS INCLUDED IN THE *ASD-BPC*

1. Poking him/her self in the eye
2. Harming self by hitting, pinching, scratching, etc.
3. Kicking objects (e.g., doors, walls)
4. Mouthing or swallowing objects causing bodily harm
5. Removal of clothing at inappropriate times
6. Unusual play with objects (e.g., twirling string, staring at a toy, etc.)
7. Inappropriate sexual behavior
8. Playing with own saliva
9. Throwing objects at others
10. Banging on objects (e.g., door, walls, windows) with hand
11. Smearing or playing with feces
12. Leaving the supervision of caregiver without permission (i.e. elopement)
13. Aggression towards others
14. Pulling others' hair
15. Yelling or shouting at others
16. Property destruction (e.g., ripping, breaking, tearing, crushing, etc.)
17. Repeated and unusual vocalizations (e.g., yelling, humming, etc.).
18. Repeated and unusual body movements (e.g., handflapping, waving arms, etc.)

APPENDIX B: FACTOR STRUCTURE OF THE *ASD-BPC*

Factor I (Directed towards others)
2. Harming self by hitting, pinching, scratching, etc.
3. Kicking objects
9. Throwing objects at others
10. Banging on objects with hand
13. Aggression towards others
15. Yelling or shouting at others
16. Property destruction

Factor II (Directed towards self)
1. Poking him/her self in the eye
4. Mouthing or swallowing objects causing bodily harm
5. Removal of clothing at inappropriate times
6. Unusual play with objects
7. Inappropriate sexual behavior
8. Playing with own saliva
11. Smearing or playing with feces
12. Leaving the supervision of caregiver without permission (i.e., elopement)
14. Pulling others' hair
17. Repeated and unusual vocalizations
18. Repeated and unusual body movements

APPENDIX C: IRB APPROVAL FORM

ACTION ON PROTOCOL CONTINUATION REQUEST

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

TO: Johnny Matson
Psychology

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: June 5, 2014
RE: **IRB#** 2609

TITLE: Developing the Autism Spectrum Disorder (ASD)

New Protocol/Modification/Continuation: Continuation

Review type: Full ___ Expedited X **Review date:** 6/5/2014

Risk Factor: Minimal X Uncertain _____ Greater Than Minimal_____

Approved X **Disapproved**_____

Approval Date: 6/5/2014 **Approval Expiration Date:** 6/4/2015

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 2000

LSU Proposal Number (if applicable): _____

Protocol Matches Scope of Work in Grant proposal: (if applicable) ___

By: Dennis Landin, Chairman Dlandin

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE:

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

VITA

Katherine Macmillan is a native of Houston, Texas. She received her Bachelor of Arts degree from Millsaps College in Psychology in 2011. Since then she has pursued her graduate degree in Clinical Psychology from Louisiana State University. She is planning to graduate with a Master of Arts degree in December 2014.