2010

Autism spectrum disorders: validation of the autism spectrum disorders - problem behavior for children (ASD-PBC), relationship between age and challenging behaviors, children and adolescents with autism spectrum disorders compared to typically developing controls on the Behavioral Assessment for Children, Second Edition (BASC-2)

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AUTISM SPECTRUM DISORDERS: VALIDATION OF THE AUTISM SPECTRUM
DISORDERS – PROBLEM BEHAVIOR FOR CHILDREN (ASD-PBC), RELATIONSHIP
BETWEEN AGE AND CHALLENGING BEHAVIORS, CHILDREN AND ADOLESCENTS
WITH AUTISM SPECTRUM DISORDERS COMPARED TO TYPICALLY DEVELOPING
CONTROLS ON THE BEHAVIORAL ASSESSMENT FOR CHILDREN, SECOND EDITION
(BASC-2)

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Arts

in

The Department of Psychology

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B.S., Pennsylvania State University, 2004
May 2010

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Abstract

Researchers found that Autism Spectrum Disorder (ASD) is a predictor for challenging behaviors. Since challenging behaviors are obstacles for social development and learning, it is important to determine if and what challenging behaviors are exhibited and how to best treat them. The Autism Spectrum Disorder – Problem Behavior for Children (ASD-PBC) is an 18 item informant based questionnaire specifically designed to measure challenging behaviors in children with ASD. Convergent and discriminant validity against the Behavioral Assessment System for Children, Second Edition (BASC-2), demonstrated the preliminary validity for the ASD-PBC for use among children and adolescents with ASD. Study 2 examined the relationship between age and challenging behaviors among children and adolescents with ASD. The ASD-PBC items, scales, and total score were used to investigate this relationship. Only one item, 'throwing items at others,' was significantly correlated with age, at $r_s = -.26$. As the BASC-2 is often used to aid in diagnosis, it is important to discern how children and adolescents with ASD score on the BASC-2 compared to typically developing controls. Study 3 did just this. Results indicated that on all clinical subscales and composites the ASD group scored significantly higher, except for the aggression, and anxiety subscales, as well as the internalizing composite. As predicted, the ASD group scored significantly lower on the adaptability composite and all subscales comprising this composite.

Introduction

Challenging behaviors have been included in the description of children diagnosed with Autism Spectrum Disorder (ASD) since the first descriptions by Kanner in 1943. Although challenging behaviors are not a core feature of ASD, they interfere with learning (Horner, Carr, Stram, Todd & Reed, 2002; Sturmey, Seiverling & Ward-Horner, 2008; Matson & Rivet, 2008), contribute to physical restraint and medication use, and predict residential care (Deb, Thomas, & Bright, 2001; Harris, 1993; McIntyre, Blacher, & Baker, 2002). As such, it is critical to assess for and treat challenging behaviors in children with ASD. Although challenging behaviors are exhibited by many children with ASD and can have great impact on their learning, there is a lack of assessments designed to assess for challenging behaviors in children with ASD (Matson, Gonzalez, Rivet, 2008). One of the first assessments designed to assess challenging behaviors in children with ASD is the Autism Spectrum Disorder-Problem Behavior for Children (ASD-PBC) (Matson, Gonzalez & Rivet, 2008). While there have been studies analyzing the reliability of the ASD-PBC, there have been none to examine its validity. The purpose of Study 1 was to analyze the validity of the ASD-PBC.

Although some research indicates that challenging behaviors are chronic in the ASD population (Murphy, Beadle-Brown, Wing, Gould, Shah & Holmes, 2005; Murphy, Healy & Leader, 2009), some studies have found that specific challenging behaviors decreased with age (Baghdadli, Pascal, Grisi & Aussilloux, 2003). Not only is some data inconsistent, but there is a paucity of research on this topic. Study 2 further examined whether the presentation of challenging behaviors was related to age. The Behavioral Assessment System for Children, Second Edition (BASC-2, Reynolds & Kamphaus, 2004) is often used to aid in diagnosis. Therefore, it is beneficial to determine if and how children with ASD score differently than typically developing children. There is some research comparing children and adolescents with

ASD to typically developing children and adolescents on the BASC-2 (Knoll, 2008). However, replication is warranted to further generalization. The purpose of Study 3 was to distinguish differences between the ASD and typically developing child and adolescent populations in regards to externalizing behaviors, internalizing behaviors, and adaptive behaviors as measured by the BASC-2. Before presenting these studies, there is an overview of the history of ASD, discussion regarding challenging behaviors as it relates to this population, as well as an overview of assessment of challenging behaviors among people with ASD.

<center>**Autism Spectrum Disorders**</center>

<u>History of ASD</u>

      Autistic Disorder (Autism). Although adjustments have been made to the definition of autism, Kanner's 1943 description of autism endures. In 1943 Leo Kanner provided the first clinical accounts of the current concept of autism when he gave a detailed description of 11 children who all shared common characteristics. These common characteristics consisted of deficits in language use and acquisition, insistence on sameness, and deficits in social relationships. Some of these children also evinced feeding problems and peculiar reactions to sensory stimuli. In 1944 Kanner went on to name this disorder 'early infantile autism' (Kanner, 1965). In Kanner (1943), 3 of the 11 children he described were mute. Although the other 8 children acquired the ability to speak, most language skills were nonfunctional. Nonfunctional speech consisted of repeating phrases or information that was previously heard without engaging in spontaneous conversation. Other oddities regarding speech included pronoun reversal (e.g. you and I) and difficulty generalizing word meaning. That is, word meanings were situation specific to the child.

      As well as deficits in language, Kanner (1943) also discussed the children's insistence on sameness and stereotypic behavior. These children showed a need for objects to be organized in specific formations and for routines to be performed in predictable sequences. These autistic children viewed things as complete when objects matched specific formations, and when the environment or actions matched specific routines. A break in the completion of a ritualized sequence of behaviors often caused the children to engage in challenging behaviors. Kanner (1943) suggested that insistence on sameness explains the autistic child's lack of spontaneous activity. In addition, he noted that these children engaged in stereotypic behavior, such as repetitive body movements or repetitive movement of objects.

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Kanner (1943) believed that the fundamental characteristic of autism was "extreme autistic aloneness," shown by the inability to relate to others and situations in typical ways. Kanner's use of the word autism to describe this new disorder demonstrates his belief that social withdrawal played an integral role. In the 1910s Bleuler coined the term autism to describe the loss of contact with reality to engage in fantasy for people diagnosed with Schizophrenia (Bleuler, 1913). All 11 children in the Kanner (1943) article demonstrated an inability to develop typical relationships with others and preferred to be alone. According to him, from birth, these children had no desire to attend to the outside world. These children did not play with others. Attempts by others to interact with the child with autism were ignored or greeted with challenging behaviors as children with autism only interacted with others to acquire something they wanted. Since there was social withdrawal from birth, parental interaction was unable to fully explain the occurrence of autism, and led Kanner (1943) to foresee the etiology of autism as partly genetic.

Kanner (1943) recognized that the social isolation seen in these 11 children was different from the withdrawal observed in children with schizophrenia. In children diagnosed with schizophrenia there is a period of time during which typical socialization takes place followed by regression. Regression is marked by withdrawal from the external world to engage in fantasy (Kanner, 1943; Kanner, 1965). However, children with autism demonstrated social withdrawal from birth (Kanner, 1943), and they did not seem to withdrawal to engage in fantasy. Moreover, the child with autism did engage in the external world. This engagement was with objects rather than people (Kanner, 1965). Due to the differences between schizophrenia and the common characteristics shared by these 11 children, Kanner advocated that autism was its own, distinct disorder, distinct from schizophrenia and intellectual disability (ID).

Even though as early as 1943, Kanner recognized early infantile autism as a distinct disorder, it was still diagnosed as childhood psychosis or schizophrenia through the 1970s. In Diagnostic and Statistical Manual, First Edition (DSM-I; APA, 1952) and Diagnostic and Statistical Manual, Second Edition (DSM-II; APA, 1968), childhood schizophrenia was the only official term available to describe children with autism. Even after much research differentiating autism and schizophrenia (Kolvin, 1971; Rutter & Bartak, 1971), in 1978, the International Classification of Diseases, Ninth edition (ICD-9; WHO, 1978) listed infantile autism under a childhood psychotic category (Volkmar & Klin, 2005). This demonstrates that in the 1970's many researchers and clinicians believed that infantile autism could be a form of childhood psychosis or schizophrenia. Perhaps Kanner's use of the word autism in his original description and name for this new disorder (early infantile autism) provided confusion and caused many to believe early infantile autism was a form of schizophrenia (Rutter, 1972; Rutter, 1978; Volkmar & Klin, 2005).

Kolvin (1971) demonstrated that autism and schizophrenia could be differentiated by the course of the disorder, development of hallucinations or delusions, development of language and cognitive skills, as well as age of onset. In a literature review of infantile autism, Rutter and Bartak (1971) supported Kolvin's conclusion. They concluded that autism and schizophrenia were distinct disorders since they differed in terms of sex distribution, social background, family history of schizophrenia, cognitive pattern, intellectual level, course of the disorder and presence of delusions and hallucinations. Rutter and Bartak (1971) refined the definition of infantile autism by providing 4 criteria: (1) impaired social relationships, (2) delays in language development, (3) compulsive and ritualistic phenomena of which there are four forms (attachment to unusual objects, preoccupation, resistance to change, and rituals), and (4) onset by 30 months of age. Stereotypies were not included as a diagnostic criteria since children with

mental retardation, blindness and people living in long term institutions also engaged in this behavior.

Whereas Rutter and Bartak (1971) and Rutter (1972) focused more on language and cognitive delays as the primary feature of infantile autism, Kanner (1943) focused on social withdrawal. In 1956 Kanner along with Eisenberg (Eisenberg & Kanner, 1956) developed a definition of infantile autism that did not include impairments in language as a core feature. Only extreme aloneness and insistence on sameness were considered core symptoms. However, Rutter and Bartak (1971) and Rutter (1972) suggested that autism stems from a central disorder of cognition where there are impairments in language comprehension, language use, and conceptual thinking. Social and other behavioral abnormalities were viewed as secondary, arising from the central disorder of cognition. Rutter and Bartak (1971) argued that language deficits can explain the low IQ observed in 75% of children with autism. This contrasts with Kanner's (1943) belief that children diagnosed with autism had good cognitive potential and did not have impairments in intellectual functioning.

In 1978, Rutter further refined the definition of autism into one of the most influential definitions to date (Matson & Minshawi, 2006; Volkmar & Klin, 2005). He provided four criteria for autism: (1) onset before 30 months of age (2) social impairments (3) impaired language development, and (4) insistence on sameness. Insistence on sameness included various stereotyped patterns of play including compulsions, rituals, unusual preoccupations, and resistance to change. Although similar to the definition developed with Bartak in 1971 (Rutter & Bartak, 1971), Rutter (1978) also highlighted some important differences. He felt it was important to analyze social deficits, impairments in language, and insistence on sameness in view of the child's intellectual level. He also thought that a multiaxial approach, where medical

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status, intellectual level, and neurological status was accounted for, was advantageous in gaining a clearer diagnostic picture.

Ritvo and Freeman, in conjunction with the National Society for Autistic Children (NSAC), formulated a competing definition of autism in 1978 (Ritvo and Freeman, 1977; Ritvo and Freeman, 1978; Matson & Minshawi, 2006; Volkmar & Klin, 2005). This definition included impairments in (1) rate of development (2) reactions to sensory stimuli (3) language cognition, nonverbal communication, and verbal communication (4) ability to relate to objects, people and events, and (5) age of onset before 30 months of age. Similarities between the competing definitions included the age of onset, impairments in communication, and impairments in social interactions. Both Rutter (1978), and Ritvo and Freeman (1977; 1978) did not include peculiar reactions to sensory stimuli as diagnostic criteria for autism. Although there are some similarities, there are also differences. Ritvo and Freeman (1977; 1978) did not include insistence on sameness as a feature of autism like Rutter (1978). Furthermore, Ritvo and Freeman (1977; 1978) focused on rate of development and reactions to sensory stimuli as features of autism, while Rutter (1978) utilized developmental level as a reference point for the core features of autism. These competing diagnostic criteria came to fruition in part due to differing goals. The NSAC definition was formulated to help gain more funding for treatment and research, as well as to raise public awareness of autism. However, the Rutter (1978) definition was formulated on the need for clarification of previous research, and was therefore based on empirical research (Matson & Minshawi, 2006; Schopler, 1978).

In developing the Diagnostic and Statistical Manual, Third Edition (*DSM-III*; APA, 1980), the APA relied on empirical research (Volkmar & Klin, 2005). As Rutter's 1978 definition of autism was based on empirical evidence, the diagnostic criteria for infantile autism in the *DSM-III* are more consistent with this definition. The *DSM-III* debuted in 1980 and

introduced the new category of Pervasive Developmental Disorders (PDD). This term was developed as an umbrella term for developmental disorders of childhood onset (Volkmar & Klin, 2005), and included infantile autism. Not only were the diagnostic criteria of autism consistent with Rutter's 1978 definition, but the *DSM-III* also employed a multiaxial approach to diagnose, and offered specific criteria for each disorder (Matson & Minshawi, 2006, Volkmar & Klin, 2005). In the Diagnostic and Statistical Manual, Third Edition, Revised (*DSM-III-R*; APA, 1987) the name of infantile autism changed to Autistic Disorder. Additionally, the criteria for autism changed so that a person had to demonstrate 8 out of 16 criteria, with a certain number of endorsements in each of three core areas of impairment (i.e., social, communication and restricted activities and interests; APA, 1987). Early onset was no longer a diagnostic criterion, enabling people who developed autistic like symptoms after 30 months of age to meet criteria for autism. Overall the *DSM-III-R* widened the diagnostic criteria and led to an increase in false positives.

New evidence from empirical research and attempts to form a consensus with International Classification of Diseases, Tenth Edition (*ICD-10*; WHO, 1992) led to refinement of the diagnostic criteria for autism in the Diagnostic and Statistical Manual, Fourth Edition (*DSM-IV*; APA, 1994). To meet criteria for autism according to *DSM-IV*, at least 6 criteria must be met, with a certain number of endorsements in three areas of impairment (social, communication and restricted activities and interests). Age of onset was re-instated in *DSM-IV* to 36 months of age (APA, 1994) rather than the previous 30 months of age in *DSM-III* (APA, 1987).

Rett's Disorder (RTT). RTT was first recognized internationally by the medical community in 1983 when Dr. Hagberg, a Swedish neurologist, wrote about 35 females with this disorder in English (Ghidoni, 2007). Hagberg named the disorder Rett in recognition of Dr.

Andreas Rett, an Austrian pediatrician, who first described this disorder in 1966 (Ghidoni, 2007; Hagberg, Aicardo, Dias & Ramos, 1983). All the girls described by Rett presented with rapid declines in language, cognition, decreased growth of head circumference, development of motor stereotypies and declines in gross motor movement after a period of seemingly normal development (Hagberg et al., 1983). There was a loss in purposeful hand movements that coincided with the development of hand stereotypies, where people with RTT would make hand washing motions. Hagberg and colleagues (1983) also noted that only females presented with RTT, and as such he foresaw the etiology as genetic. Despite debate as to whether RTT should be included under a neurological disorder or PDD in *DSM-IV* (Volkmar & Klin, 2005), RTT's was listed under the PDD category (APA, 1994).

Childhood Disintegrative Disorder (CDD). In 1908 Heller, an Austrian special education teacher, described a condition where children developed normally up to 3 to 4 years of age whereupon regression took place (Volkmar & Klin, 2005). There was a loss in language use, comprehension, and interpersonal skills. Furthermore, stereotypies developed (Rutter, 1972). Heller named this disorder dementia infantilis, which also became known as disintegrative psychosis or Heller's syndrome. In 1978, the *ICD-9* (WHO, 1978) listed disintegrative psychosis in a childhood psychotic category. In 1980, a disorder named childhood onset pervasive developmental disorder (COPDD) was included under the PDDs in *DSM-III* (APA, 1980). Although this disorder was not meant to be equivalent with disintegrative psychosis, its description was similar to CDD. COPDD was meant to account for children who developed an autistic like disorder after 30 months of age. COPDD was not included in *DSM-III-R* (APA, 1987), and individuals with this diagnosis were placed in a residual category called Pervasive

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Developmental Disorder Not Otherwise Specified (PDD-NOS; Volkmar & Klin, 2005). In *DSM-IV* (APA, 1994), this condition was placed under the PDDs, and renamed CDD.

Asperger's Disorder (AS). Hans Asperger, an Austrian physician first described this disorder in a series of case studies published in 1944 (Asperger, 1944). Although Asperger had no knowledge of Kanner's 1943 article, he named this disorder autistic psychopathology because of observed social impairments these children faced. Asperger (1944) considered autistic psychopathology to be a type of personality disorder and not a form of or precursor to schizophrenia. He also described these children as having high intelligence (Asperger, 1944). Furthermore, based on findings revealing greater prevalence of AS among males and greater prevalence of AS symptoms among families, he concluded that this disorder's etiology was genetic (Asperger, 1944).

Through his case studies, Asperger described 5 shared characteristics that are noticeable from two years of age onward among people with autistic psychopathology: (1) social deficits, (2) nonverbal language deficits (3) lack of humor (4) stereotypies, and (5) insistence on sameness (Asperger, 1944; Matson & Minshawi, 2006). According to Asperger (1944), the core deficit, which can explain all other symptoms, was not just social interaction, but interaction with the environment in general. In regards to nonverbal language impairments, these children lacked eye gaze, facial expression, gestures, and a typical voice tone. These children also focused conversation on particular interests and did not understand jokes. Additionally, these children engaged in stereotyped and repetitive patterns of behavior, such as body rocking, lining up toys in a particular order, and focusing 'play' on a particular item for long periods of time. The children with autistic psychopathology also showed a preference for strict adherence to routines. Not only were these children able to speak, Asperger (1944) considered them creative, original

and capable of introspection. Furthermore, he reported that these children had great route memory, impairments in motor coordination, and abnormal reactions to some sensory stimuli.

Although Asperger gave an in-depth account of autistic psychopathology, this disorder was not well recognized until Wing wrote about it in 1981 (Frith, 2004; Howlin, 2006; Matson & Boisjoli, 2008). To assuage misunderstandings arising from the term psychopathology, Wing (1981) renamed autistic psychopathology, Asperger's syndrome. Wing (1981) described general characteristics that make up AS: (1) abnormalities in speech, such as abnormal incantation and tone, pedantic, and stereotyped speech (2) deficits in nonverbal communication, such as lack of eye gaze, gestures, and facial expression (3) deficits in social interactions, such as withdrawal from contact with others, lack of play, and lack of interactions with other people (4) repetitive activities (5) stereotyped motor movements (6) impairments in motor coordination (7) resistance to change (8) decreased empathy, and (9) circumscribed interests, such as having an abnormal preoccupation with a particular subject.

Similarly to Asperger (1944), Wing (1981) noted that this disorder was more prevalent among males, and that people with AS evinced great abilities in route memory. However, she disagreed with Asperger's observations regarding language. Wing argued that although people with AS eventually speak in full sentences, the content is impoverished, often repeated from other sources, and there are impairments in language comprehension (Wing, 1981). In contrast to Asperger (1944), Wing (1981) demonstrated that despite people with AS appearing capable of creative and introspective thought because of their atypical beginning points when analyzing a situation, they are not creative, original, nor capable of introspection. Wing (1981) also described Asperger's syndrome as a less severe form of infantile autism. This idea anticipates the future view of ASD, where the pervasive developmental disorders fall on a continuum from least to

most severe. Even though discussed in the literature as far back as 1944, AS was not listed as a PDD until *DSM-IV* (APA, 1994).

Pervasive Developmental Disorders Not Otherwise Specified (PDD-NOS). Although PDD-NOS was not included until the *DSM-III-R* (APA, 1994), *DSM-III* (APA, 1980) offered a diagnosis with a similar purpose. In *DSM-III* (APA, 1980), there was a diagnosis of atypical autism to account for people who did not quite meet criteria for a specific PDD diagnosis but who exhibited some similar impairments. Beginning with the *DSM-III-R* all sub-threshold categories were termed 'not otherwise specified' (NOS; APA, 1987), thereby offering the first official diagnoses of PDD-NOS. To meet criteria for PDD-NOS in *DSM-III-R*, a person had to have impairment in communication skills and social interaction. In the *DSM-IV* (APA, 1994) the diagnostic criteria for PDD-NOS changed slightly. To meet criteria for PDD-NOS according to *DSM-IV* a person only had to have an impairment in one of the three core areas (social interaction, communication or stereotyped interests, behaviors and activities). By only requiring an impairment in one out of the three core areas, rather than two of the core areas, *DSM-IV* widened its definition of PDD-NOS.

Current Prevalence of ASD

Recently, there has been increased interest and much popular media coverage regarding ASD. This surge in interest can be explained in part by the reported increase in the prevalence of ASD over the last three decades (Howlin, 2006; Rutter, 2005; Schreibman, 2005). Shifting diagnostic criteria, definition widening, changing methodology in studies, improved services for individuals with ASD, and greater awareness of ASD help explain the increased prevalence of ASD (Wing & Potter, 2002). Regardless of the rationale for increases in prevalence, ASD is the second most frequent serious developmental disability in the United States (Nicholas, Charles, Carpenter, King, Jenner & Spratt, 2008), and, except for RTT, occurs in a greater number of

males (APA, 2000). Although ASDs occur at a rate of approximately 60 for every 10,000 children (Charman, 2002; Fombonne, 2005; Howlin, 2006; Nicholas et al., 2008), it is not the most frequent serious developmental disability. Intellectual disability (ID) is the most frequent serious developmental disability, occurring at a rate of 120 per 10,000 (Nicholas et al., 2008).

The most prevalent PDD is PDD-NOS, occurring at a rate of 20.8 to 31 per 10,000 people (Fombonne, 2005; Howlin, 2006). Autism is the next most prevalent out of the PDDs, occurring at a rate of approximately 13 to 19 per 10,000 people (Fombonne, 2005; Howlin, 2006). AS occurs at a rate of approximately 9.5 per 10,000 people (Howlin, 2006). Along with CDD, RTT is the least prevalent of the five PDDs (APA, 2000). In a review of epidemiological studies of ASD from fourteen countries, Fombonne (2005) indicates that the prevalence of CDD is approximately 2 per 10,000 people. RTT is the least prevalent of the PDDs, with prevalence rates ranging from 1 per 10,000 to 22,000 people (Ghidoni, 2007).

Current Diagnostic Criteria of ASD

Currently, clinicians use the Diagnostic and Statistical Manual fourth edition, text revision (*DSM-IV-TR*; APA, 2000), and the International Classification of Diseases, 10th Edition (*ICD-10*; WHO, 1992) to diagnose mental disorders. As the *DSM IV-TR* is the more commonly used tool to diagnose ASD in the United States, and as the criteria for diagnosing ASD is similar in the *DSM IV-TR* and the *ICD-10* (Volkmar & Klin, 2005), this discussion will focus on the *DSM-IV-TR* diagnostic criteria. ASD, otherwise referred to as PDD in the *DSM-IV-TR* (APA, 2000), is included in Axis I. The literature currently refers to the PDDs as ASDs due to the belief that these disorders have overlapping symptoms, are etiologically related, and occur on a continuum. PDD is an umbrella term consisting of five disorders, which include Autistic Disorder (Autism), RTT, CDD, AS and PDD-NOS.

The PDDs are neurodevelopment disorders characterized by three core symptoms which include restricted and stereotyped interests and activities, impairments in communication, and deficits in social interactions (APA, 2000). Restricted and stereotyped interests and activities include adherence to routines, resistance to change in the environment, daily schedule or play routine (Schreibman, 2005), focusing conversation on a select few topics, motor stereotypies (e.g., body rocking or hand flapping), and verbal stereotypies (e.g., immediate and delayed echolalia; Cunningham & Schreibman, 2008: MacDonald et al., 2007; Schreibman & Mills, 1983). Communication deficits include immediate and delayed echolalia, nonfunctional speech, pronoun switching and irregular speech tone (Schreibman, 2005). Through a study of home movies, Adrien, Perrot, Sauvage, Leddet, Larmande, Hameury and Barthelemy (1992) found that children with ASD also lack appropriate facial expressions and body posture. Deficits in social interaction include bonding less with others, ignoring others, seeking others out less often, and decreased eye contact (Schreibman, 2005; Adrien et al., 1992).

The *DSM-IV-TR* and other researchers note that PDD has associated features and comorbid diagnosis. Sensory issues and challenging behaviors, although not core symptoms of ASD, are associated with ASD (APA, 2000). In regards to comorbidity, ASDs are comorbid with ID, epilepsy and a variety of psychopathologies. Up to 75% of people with ASD have a comorbid diagnosis of ID (Matson & Nebel-Schwalm, 2007). Additionally, approximately 25% of people with ASD have epilepsy (APA, 2000; Howlin, 2006; Volkmar & Klin, 2005). People with ASD can also present with a variety of psychopathologies, including affective disorders (Ghaziuddin, Ghaziuddin & Greden, 2002; Ming, Brimacombe, Chaaban, Zimmerman-Bier & Wagner, 2008; Tsakanikos, Costello, Holt, Bouras, Sturmey & Newton, 2006), anxiety disorders (Ming et al., 2008; Tsakanikos et al., 2006), Attention Deficit Hyperactivity Disorder (Montes & Halterman, 2007), and to a lesser extent personality disorders (Tsakanikos et al., 2006).

Autism. As stated in *DSM- IV-TR* (APA, 2000), a diagnosis of Autism requires endorsement of at least six items from the socialization, communication, and restricted, repetitive, and stereotyped interests, activities or behavior domains. At least two item endorsements must come from the socialization domain, and at least one item endorsement must come from the communication domain, and the restricted, repetitive and stereotyped domain. Items in the socialization domain include: (1) impairment in non-verbal behaviors, (2) impairments in the development of peer relationships, (3) deficits in sharing achievements, feelings or interests with others, and (4) impairments in emotional or social reciprocity. Items in the communication domain include: (1) lack of or delay in verbal communication, (2) deficits in initiating or sustaining conversation if the individual has the ability to speak, (3) repetitive and stereotyped language, and (4) deficits in spontaneous make-believe play. Items in the restricted, repetitive and stereotyped domain include: (1) abnormally high intensity or frequency in regards to preoccupation with a topic, (2) inflexibility in regards to non-functional rituals or routines, (3) repetitive and stereotyped motor movements, and (4) preoccupation with parts of objects. Furthermore, there must be delays or impairments before the age of three in at least one of the following areas: (1) social interaction, (2) communication, or (3) imaginative or symbolic play. In addition, a diagnosis of Autism can only occur if RTT or CDD cannot better account for the individual's behavior and impairments.

RTT. According to the *DSM -IV-TR* (APA, 2000), RTT manifests after a period of seemingly normal development and includes specific abnormalities. All items listed in the normal functioning domain must be endorsed and include: (1) prenatal and perinatal development, (2) psychomotor development through the first 5 months of age, and (3) head circumference. All items listed in the specific abnormalities must be endorsed, and include: (1) decrease in head growth between 5 months and 48 months, (2) loss in hand skills between 5 and

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30 months along with the development of stereotyped hand movements, (3) decreases in social interaction, (4) poor gait or trunk movement coordination, and (5) severe psychomotor impairments with impaired receptive and expressive language development.

CDD. To meet *DSM -IV-TR* (APA, 2000) criteria for CDD, a person must demonstrate normal development up until two years of age as demonstrated by age appropriate communication (verbal and nonverbal), play, adaptive behavior, and social relationships. This normal development must be followed by a significant loss in previously acquired skills before ten years of age in at least two of the following areas: (1) receptive or expressive language, (2) adaptive or social behavior, (3) bladder or bowel control, (4) play, and (5) motor skills. There must also be deficits in two of the following: (1) social interaction, (2) communication, or (3) restricted, repetitive or stereotyped patterns of activities, behavior or interests. Furthermore criteria must not be met for another PDD or schizophrenia.

AS. According to *DSM- IV-TR* (APA, 2000) criteria for AS, a person must have no significant delays in cognitive development, verbal communication or adaptive skills development. In addition, the person must not meet criteria for another PDD or schizophrenia. A diagnosis of AS requires endorsement of at least two items from the social interaction domain and at least one item from the restricted interests and stereotypy domain. Items comprising the social interaction domain include: (1) deficits in non-verbal communication, (2) failure to develop developmentally appropriate relationships with peers (3) deficits in sharing achievements, interests or things that they enjoy, and (4) lacks emotional or social reciprocity. Items included in the restricted interests and stereotypy domain are: (1) fixation with restricted and stereotyped patterns of interest that are abnormal in focus or intensity, (2) strict adherence to nonfunctional rituals or routines , (3) motor stereotypies, and (4) fixation with parts of objects.

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PDD-NOS. To meet *DSM-IV-TR* (APA, 2000) criteria for PDD-NOS a person must have significant impairments in social interactions, and must have either impairments in verbal or nonverbal communication or evince repetitive, restricted or stereotyped interests, activities or behaviors. For a diagnosis of PDD-NOS, criteria must not be met for Avoidant Personality Disorder, Schizotypal Personality Disorder, schizophrenia, or a specific PDD.

Challenging Behaviors and ASD

<u>Background</u>

Challenging behaviors are often referred to as problem behaviors, behavior problems, aberrant behaviors, maladaptive behaviors, or externalizing behaviors. Before discussing challenging behaviors it is important to explain what this term means. Although current definitions of challenging behaviors may differ slightly, they all include or account for behaviors that are not socially acceptable, can physically harm someone and/or affect education or living placement. For example, Emerson, Robertson and Gregory (2000) define challenging behaviors as "…culturally abnormal behavior of such intensity, frequency, or duration that the physical safety of the person or others is placed in serious jeopardy or behavior which is likely to seriously limit or deny access to the use of ordinary community facilities" (as cited in Mudford, Arnold-Saritepe, Phillips, Locke, Ho & Taylor, 2008, p. 268).

Challenging behaviors are often divided into two groups: extrapersonal and intrapersonal (Sturmey et al., 2008). Extrapersonal challenging behaviors include property destruction, verbal threats, tantrum behaviors, aggression towards others, and self-injurious behaviors (SIB). These types of challenging behaviors are interfering to other people to a great extent. In contrast, intrapersonal challenging behaviors are less interfering to others. Intrapersonal challenging behaviors consist of fearful, anxious, and withdrawn behaviors that hinder learning and social interactions (Sturmey et al., 2008). Examples are stereotypies and other odd behaviors. Challenging behaviors such as SIB, aggressive behavior, and stereotypy are major impediments to social development and effective education (Horner et al., 2002; Sturmey et al., 2008; Matson & Rivet, 2008). Engagement in challenging behaviors often leads to exclusion from classrooms or schools, less community activities, and fewer interactions with peers. Furthermore,

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challenging behaviors predict residential care, physical restraint use, and the use of psychotropic medication (Murphy et al., 2005).

Challenging behaviors were discussed early in the ASD literature. As one of the core features of ASD is stereotypic behavior, the majority of the early literature describes types of stereotypic behavior. Discussions of other forms of challenging behaviors, although found in early literature, were rare. Out of the 11 children Kanner (1943) discussed in his original account of autism, about half evinced stereotypies. Five engaged in tantrum behaviors, 2 of who also displayed physical aggression and 1 who also exhibited property destruction. The children Asperger (1944) described also engaged in challenging behaviors other than stereotypies. Some of the children evinced property destruction, physical aggression, and verbal aggression.

Albeit challenging behaviors, minus stereotypies, are not considered a core feature of ASD, and not all children with ASD evince challenging behaviors, numerous studies report that many people with ASD engage in a variety of challenging behaviors (APA, 2000; Lecavalier, 2006; Matson 2007b; Matson & Dempsey, 2008a; Matson & Nebel-Schwalm, 2007; Matson, Wilkins, & Macken, 2009; Murphy et al., 2005). For example, Matson, Wilkins, and Macken (2009) found that 94.3% of 182 children with ASD reported some form of challenging behavior. Common challenging behaviors displayed by people with ASD include aggressive behaviors, SIBs, and stereotypies (APA, 2000; Sturmey et al., 2008; Matson & Nebel-Schwalm, 2007). Researchers have found that aggression towards others, property destruction, tantrums, verbal disruption, and stereotypic behaviors are the most common challenging behaviors displayed and identified for intervention among children with ASD (Horner et al., 2002; Machalicek, O'Reilly, Beretvas, Sigafoos & Luancioni, 2007; Matson & Nebel-Schwalm, 2007). Another common challenging behavior that children with ASD engage in is SIB (Horner et al., 2002; Matson & Nebel-Schwalm, 2007; Schreibman, 2005).

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Children with ASD are more likely to exhibit challenging behaviors compared to typically developing children (Gurney, McPheeters, & Davis, 2006, as cited in Mudford et al., 2008), children with psychopathology (Matson, Wilkins, & Macken, 2009), children with learning impairments (Dominick, Davis, Lainhart, Tager-Flusberg & Folstein, 2007), and children with ID alone (Holden & Gitlesen, 2006; Murphy et al., 2005). A study by Knoll (2008) comparing children with ASD to typically developing controls found that children with ASD scored significantly higher on composites relating to challenging behaviors. A recent telephone survey conducted by the United States National Survey of Children's Health found that 59% of children with ASD had a diagnosis of behavioral and conduct problems by a health professional (Gurney, McPheeters, & Davis, 2006, as cited in Mudford et al., 2008). This is 10% greater than children without a diagnosis of ASD (Gurney et al., 2006 as cited in Mudford et al., 2008), indicating that children with ASD are more likely to evince challenging behaviors. Holden and Gitlesen (2006) investigated 904 children and adults, living in Norway. All had a diagnosis of ID, 53 who also had a diagnosis of autism. They found that children and adults with a comorbid diagnosis of autism and ID exhibited greater frequencies of challenging behaviors than people with ID only. Other studies with adults demonstrated that adults with autism and ID also engaged in greater amounts of challenging behaviors compared to adults with ID only (Matson & Rivet, 2008).

ASD is also a risk factor for evincing challenging behaviors (McClintock, Hall, & Oliver, 2003). McClintock and colleagues (2003) conducted a meta-analysis focusing on aggression, SIB, property destruction and stereotyped behavior in people with ID. They also analyzed potential risk factors and found that autism, severe ID, and communication deficits were risk factors for exhibiting challenging behaviors. Recent research reports that children with more severe ASD are more likely to engage in some forms of challenging behaviors (Baghdadli et al.,

2003), and are more likely to exhibit a greater number of challenging behaviors (Matson, Wilkins, & Macken, 2009). This increased frequency of challenging behaviors among people with severe ASD, is also seen in adults with ASD (Matson & Rivet, 2008). Similar to McClintock and colleagues' (2003) finding, these findings suggest that ASD symptomotology may predispose people to engage in challenging behaviors.

Although research indicates there is something unique about people with ASD that leads to increased likelihood of engaging in challenging behaviors, not all children with ASD display challenging behaviors. Also, it is common for typically developing children to display challenging behaviors, especially at a young age. Yet, challenging behaviors in typically developing children generally improve with age, whereas in children with ASD, challenging behaviors decrease more slowly with age (Berkson, 2002). However, Berkson (2002) does not discuss whether the frequency or severity of challenging behaviors changes as people with ASD age. This topic is discussed more in-depth in further sections.

The majority of research concerning challenging behaviors in the ASD population focus on people with a comorbid ID diagnosis. Although there has been an increase in research concerning challenging behaviors among children and adolescents with ASD, this topic requires further study. There is also a paucity of research comparing children and adolescents with ASD to typically developing controls on frequently used broad band measures like the BASC-2. As such, replication is warranted.

Topography of Challenging Behaviors

Aggressive Behavior. Throughout the literature, different authors provide different operational definitions of aggressive behavior. Some researchers use the term to refer only to physical aggression (Dominick, Davis, Lainhart, Tager-Flusberg & Folstein 2007; Gerhardt, Weiss & Delmolino, 2004). In addition to physical aggression (Pelios, Morre, Tesch & Axelrod,

1999; Sturmey et al., 2008) other researchers also include property destruction (Pelios et al., 1999; Sturmey et al., 2008), temper tantrums (Sturmey et al., 2008), or a mixture of these in their definition of aggression. Physical aggression includes behaviors that physically harm others, such as hitting, kicking, biting and pinching others (Dominick et al., 2007; Gerhardt at al., 2004). Property destruction is commonly defined as behaviors that damage objects (Ando & Yoshimura, 1979). The definition of temper tantrum includes kicking at the floor and screaming (Ando & Yoshimura, 1979; Dominick et al., 2007; Sturmey et al., 2008). Verbal aggression is also often assessed for in measures of challenging behaviors (e.g., Aberrant Behavior Checklist, Nisonger Child Behavioral Rating Form, Overt Aggression Scale, Autism Spectrum Disorder-Problem Behavior Adult version, Autism Spectrum Disorder-Problem Behavior Child version). In measures of challenging behavior and in clinical practice verbal aggression has been labeled as yelling, screaming, cursing, threatening others, yelling insults at others, and arguing with others. For the purpose of this discussion, physical aggression, property destruction, temper tantrums, and verbal aggression will be discussed under the heading of aggressive behaviors.

Some studies analyzed the frequency of various aggressive behaviors among children with ASD (Dominick et al., 2007; Matson, &, Macken, 2009). The prevalence of physical aggression ranged from 26.2% (Dominick et al, 2007) to 50% (Matson, Wilkins, & Macken, 2009). In the Dominick and colleagues (2006) study, 46.4% of parents of children with ASD indicated current engagement in temper tantrums with a lifetime frequency of 64.3%. Matson, Wilkins, and Macken (2009) reported that out of 182 children with ASD, 44.3% engaged in verbal aggression, 42.6% displayed property destruction, 40.9% evinced banging on objects with hand, 36.9% engaged in throwing objects at others, 35.8% exhibited kicking objects, and 14.8% displayed pulling others' hair.

Research suggests that children with autism are more likely to engage in aggressive challenging behaviors than typically developing children (Nicholas et al., 2008), people with ID alone (McClintock et al., 2003), and children with a history of language impairment (Dominick et al., 2007). Nicholas and associates (2008) found that significantly more 8 year old children with ASD, living in South Carolina, engaged in physical aggression and temper tantrums compared to 8 year olds without ASD. McClintock and colleagues (2003) reported that people with a diagnosis of autism are significantly more likely to engage in physical aggression compared with people with ID alone. Furthermore, through their meta-analysis to assess risk markers for challenging behaviors among people with ID, McClintock and colleagues (2003) found that a diagnosis of autism was a risk factor for property destruction. McClintock and colleagues (2003) did not include temper tantrums in their analysis. Concerning temper tantrums, significantly more children with ASD evinced temper tantrums than children with a history of language impairment (Dominick et al., 2007). Although a greater percentage of children with ASD exhibited physical aggression compared to children with a history of learning impairment, this difference was not significant (Dominick et al., 2007).

Severity of ASD is also related to greater endorsements of certain aggressive behaviors. Matson, Wilkins, and Macken (2009) compared severity level of ASD (i.e., mild, moderate and severe) to all items on a measure of challenging behaviors. They found that throwing objects at others, banging on objects with hands, and pulling others' hair was more likely to be endorsed by children who met the cutoff score for severe ASD on a diagnostic measure. Furthermore, aggression towards others and property destruction were significantly more likely to be endorsed by children with severe as compared to moderate ASD (Matson, Wilkins, & Macken, 2009).

Stereotypies. Stereotypies are repetitive behaviors that are often rhythmic, topographically invariant and appear to have no purpose (Powell et al. 1999, as cited in Symons,

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Sperry, Droplk & Bodfish, 2005; Schreibman & Mills, 1983; Sturmey et al., 2008). There are

motor and vocal stereotypies. Motor stereotypies include body rocking, hand flapping, object

spinning, and walking on toes (Cunningham & Schreibman, 2008: MacDonald et al, 2007).

Fixation on a part of an object and strict adherence to routines are also forms of stereotypies. As

an example of adherence to routines, Cunningham and Schreibman (2008) describe a child

repeatedly lining up toys in a particular way. Vocal stereotypies include immediate and delayed

echolalia (Cunningham & Schreibman, 2008; Sturmey et al., 2008). Stereotypies, both motor and

vocal, although posing no threat of harm to others, oneself, or property, is considered a

challenging behavior because it interferes with learning, leads to stigmatization from peers, and

often leads to decreased interactions in the community (Cunningham & Schreibman, 2008).

As stereotyped behavior is one of the three core features of ASD (APA, 2000) most

people with ASD evince stereotypies of some type. Through a study involving adults living at a

developmental center, Bodfish and colleagues (2000) found that all participants in their study

diagnosed with ASD engaged in at least one form of stereotypy. Although the following studies

did not report 100% engagement of stereotypies among children with ASD as the Bodfish and

colleagues (2000) study did, differences in the sampled population (e.g., age, living situation,

severity of ASD, comorbid diagnoses, etc.) may account for these disparities. In a prevalence

study involving 295, 8 year olds from South Carolina with ASD, Nicholas and colleagues (2008)

found that 71.9% of males with ASD and 59.2% of females with ASD evince stereotyped

mannerisms. The only significant difference between males and females in regards to

stereotypies was with preoccupation with parts of objects, and adherence to routines. In both

cases significantly more males displayed those two forms of stereotypies than did females.

Although Matson, Wilkins, and Macken (2009) did not find any gender differences in regards to

stereotypies among children with ASD, they did find that stereotypies was the most frequently

endorsed challenging behavior for children with ASD. In regards to children with ASD, 60.2% endorsed repeated and unusual vocalizations, 54% endorsed repeated and unusual body movements, and 48.9% endorsed unusual play with objects (Matson, Wilkins, & Macken, 2009).

Even though typically developing toddlers display motor and vocal stereotypies, they are less varied with age compared to toddlers with autism or PDD-NOS. Vocal stereotypies observed in typically developing toddlers are directed to the examiner, are non-repetitive, and relate to the environment whereas vocal stereotypies in children with autism or PDD-NOS are not directed to the examiner, are repetitive, and do not relate to the environment. Compared to typically developing people, stereotypies evinced by people with autism are less socially and developmentally appropriate (Cunningham & Schreibman, 2008). In regards to frequency, children with ASD display greater amounts of stereotypies than typically developing children (MacDonald et al., 2007). Furthermore, adults with a comorbid diagnosis of ASD and ID evince greater frequencies of stereotypies than adults with ID only (Bodfish et al., 2000; Matson, Baglio, Smiroldo, Hamilton, Packlowskiyj, Williams & Kirkpatrick-Sanchez, 1996).

Not only are people diagnosed with ASD more likely to engage in stereotypic behavior, severity of ASD symptoms positively correlates with greater levels of stereotypies. The notion that people with more severe symptoms of a developmental disorder display greater amounts of certain behaviors is not novel. This has been found in the ID literature (Ando & Yoshimura, 1978). A more recent meta-analysis by McClintock and colleagues (2003) observed that people with severe or profound ID are more likely to engage in stereotypies than people with mild or moderate ID. Similar to the ID literature, research examining the ASD population found that people evincing more severe ASD symptoms are more likely to engage in stereotypic behaviors (Bodfish et al., 2000; Matson & Dempsey, 2008b; Matson, Wilkins, & Macken, 2009). Research indicates that severity of ASD among adults positively correlates with severity of stereotypes

(Bodfish at al., 2000), and greater endorsement of items relating to stereotypies (Matson & Dempsey, 2008b). Children with severe as compared to moderate or mild ASD are more likely to exhibit repeated and unusual vocalizations, repeated and unusual body movements, and unusual play with objects (Matson, Wilkins, & Macken, 2009).

     SIB. Even though definitions of SIB vary slightly, they all incorporate the concept that SIBs are activities where the person inflicts tissue damage on themselves (Rojahn et al., 2008). Rojahn and colleagues (2008) developed a comprehensive, four part definition of SIB: the behavior (1) requires intervention, (2) is rhythmic and repetitive, (3) can cause direct physical damage to one's self or if done over time can lead to physical harm, and (4) includes head banging, hitting body parts, banging other body parts into objects, self-biting, self-pinching, self-scratching, pulling finger or toe nails, stuffing items into body orifices, self-induced vomiting, teeth grinding, pica, drinking an excessive amount of liquids, and aerophagia. Eye poking or pressing, and hair pulling are also considered a form of SIB (Berkson, Tupa, & Sherman 2001; Berkson, 2002; Matson & LoVullo, 2008,). Some behaviors that comprise SIB, such as head banging, are also considered a form of stereotypy (Bodfish et al., 2005; Symons et al., 2005). However, due to the repetitive nature of the behavior, tissue damage may occur, therefore it is classified as an SIB. The topography, severity and duration of SIB is diverse within the ASD population (Baghdadli, et al., 2003) and the etiology is unknown (Symons et al., 2005).

     Prevalence studies for SIB among adults and children with ASD vary greatly. Differing methodologies and definitions of SIB account for some of these differences (Baghdadli et al., 2003). In one of the first prevalence studies of challenging behaviors among children with autism, Bartak and Rutter (1976) found that at the time of the study 6% engaged in SIB. However a reported 71% had previously evinced SIB. More current studies indicate that up to 53% of children with ASD engage in SIB (Baghdadli et al., 2003). Prevalence rates of self

hitting among children with ASD range from 15.9% (Lecavalier, 2006) to 35.8% (Matson, Wilkins, & Macken, 2009). The use of populations consisting of people of slightly different ages, severity level of ASD, and comorbid conditions may account for these discrepancies. In regards to other forms of SIB among children with ASD, 17% engage in mouthing or swallowing objects causing bodily harm (Matson, Wilkins, & Macken, 2009), 12.2% eat inedible items, 11% physically harm themselves (Lecavalier, 2006), 9.6% exhibit eye poking (Matson, Wilkins, & Macken, 2009), 8.5% self scratch or hair pull, and 5.9% self bite (Lecavalier, 2006). Research suggests that there are no gender differences regarding prevalence of SIB among children with ASD (Baghdadli et al., 2003; Lecavalier, 2006; Matson, Wilkins, & Macken, 2009; Rojahn et al., 2008).

Although typically developing children (Baghdadli et al., 2003; Berkson, 2002; Berkson & Tupa, 2000), children with language impairment (Dominick et al., 2007) and children with visual impairments (Berkson & Tupa, 2000) engage in SIB, they do so at lesser frequencies than children with ASD (Nicholas et al., 2008). Although typically developing children tend to engage in head banging (Berkson & Tupa., 2000), self- scratching (Baghdadli et al., 2003; Berkson, 2002), self-biting (Baghdadli et al., 2003), and more rarely eye poking or eye gouging (Berkson, 2002; Berkson & Tupa, 2000), past research observed that the frequency of SIB among typically developing children, ages 3 to 6, was 5 % (Sallustro & Atwell, 1978, as cited in Berkson & Tupa, 2000). More recent research analyzing SIB among 2 to 7 year olds observed that 12% of typically developing children engaged in SIB compared to 35% of children with ASD (Nicholas et al., 2008).

Correlated with SIB are greater impairments in daily living skills (Baghdadli et al., 2003), and greater severity of autism (Baghdadli et al., 2003; Matson, Wilkins, & Macken, 2009; McClintock et al., 2003). Matson, Wilkins, and Macken (2009) found that children with more

severe ASD were significantly more likely to endorse hitting, pinching, scratching self, and mouthing or swallowing objects causing bodily harm than children with mild ASD. Children with moderate ASD were significantly more likely to self eye poke than children with mild ASD (Matson, Wilkins, & Macken, 2009).

Age Differences of Challenging Behaviors in ASD

Overall, research suggests there are differences in age trends of challenging behaviors for children with developmental disabilities compared to typically developing children. However, research is scant and more is required to evaluate the process of how people with ASDs develop challenging behaviors and how this process differs from that of other groups. There is also a lack of research regarding how the occurrence and severity of challenging behaviors change throughout the lifespan for people with ASD. The limited research that has been conducted has some mixed results.

Developmental Trend Specific to Aggressive Behaviors. Although the age of onset for physical aggression and temper tantrums varies among children with ASD, Dominick and colleagues (2007) found that these challenging behaviors emerge from 0 to 11 years of age. Most children with ASD begin to engage in physical aggression or tantrum behaviors around 2 to 3 years of age. Furthermore, 20% of the children with ASD were noted to engage in temper tantrums by 1 year of age and 50% of children with ASD exhibit temper tantrums by 3 years of age. The mean age of onset for physical aggression was 3.5 years of age, with the range from 0 to 10 years of age (Dominick et al., 2007).

Developmental Trend Specific to Stereotypies. Although most typically developing children and children with ASD exhibit stereotypies at young ages, the course differs. A review of the literature by Berkson and Tupa (2000) conclude that repetitive motor behavior occurs early in development for typically and atypically developing people. Overall, both motor and

vocal stereotypies decrease with age in typically developing toddlers (Macdonald et al., 2007). However, among people with developmental disabilities, stereotypies continue past the preschool years (Berkson et al., 2000). For toddlers with autism or PDD-NOS, motor stereotypies increased from 7% at 2 years of age to 20% at 4 years of age (MacDonald et al., 2007). At 2 years of age the mean duration of vocal stereotypies for toddlers with autism or PDD-NOS was 5% compared to 32% at 4 years of age (MacDonald et al., 2007).

Developmental Trend Specific to SIB. SIBs observed in typically developing children present at about 8 months of age and eventually disappear at around 5 years of age (Berkson & Tupa, 2000; Krawitz & Boehm, 1971, as cited in Baghdadli et al., 2003). In comparison, those diagnosed with ASD typically engage in SIB into adulthood (Bodfish et al., 2000). Therefore, this disappearance of SIB generally seen in typically developing children does not seem to occur in the ASD population.

Age Differences. In regards to whether challenging behaviors tend to change across the lifespan in the ASD population, research is scant. Murphy and colleagues (2005; 2009), and Baghdadli and associates (2003) discuss the effect of age on challenging behaviors in the ASD population. Murphy and colleagues (2009) found no significant correlations between age and frequency or severity of aggressive behaviors, SIB, or stereotypies in 157 children 3 to 14 years of age with Autistic Disorder. The correlations for frequency were all very low for aggression, SIB, and stereotypies, with correlation coefficients of -.199, .001, and -.017, respectively. However, severity correlation coefficients ranged from very low to high, $r = .142, .700,$ and $.100$, respectively, for aggression, SIB, and stereotypies.

Murphy and colleagues (2005) looked at the change in percentages of challenging behaviors considered a marked problem after 12 years in a sample of 141 people, who were children with ID and/or ASD at the first time of testing. The age range at the first time of testing

was 2.2 to 18.1 years of age, and the age range at the second time of testing was 13.5 to 30.4 years of age. Although Murphy and associates (2005) reported that, overall, challenging behaviors increased in frequency with age, these challenging behaviors were not representative of aggressive behaviors, SIB, or stereotypies as operationalized in this thesis. When only comparing the percentages of marked problems in aggressive, destructive, tantrum behaviors, SIB, and stereotypies across 12 years, there were no reported significance levels. When comparing the percentages of aggressive, SIB and stereotypic behaviors across 12 years, Murphy and colleagues (2005) did not report the significance levels, perhaps because they were non-significant. For example, the percentage of SIB that was considered a marked problem increased form 9.3% to 11.5% after 12 years. For destructive behavior the percentage increased from 7.6% to 23.2%, for aggression the percentage increased from 7.6% to 16.3%, and for repetitive tapping at objects the percentage increased from 8.1% to 13.8%. However, for tantrum behavior the percentage decreased from 19.5% to 18.4% after 12 years. In contrast to Murphy and colleagues (2005; 2009), Baghdadli and associates (2003) found that for 222 children, 2 through 7 years of age with ASD, younger age was a risk factor for engaging in SIB. Yet, when Baghdadli and associates (2003) compared children who did not display SIB to children who did display SIB, there was no significant difference in age.

Although these studies all assessed aggressive behavior, SIB, and/or stereotypies among people with ASD, they used different age groups, people with various levels of comorbidity with ID, and different operational definitions of challenging behaviors which make it difficult to compare results. For example Murphy and associates (2005) did not report the percentage of participants without ID, Baghdadli and colleagues (2003) only had 4% without ID, and Murphy and associates (2009) study consisted of 14% without comorbid ID. As such, there are few studies examining how age affects challenging behaviors specifically in the ASD population.

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Varying operational definitions of specific challenging behaviors, samples that vary slightly in age and comorbidity, and the use of different statistical methods all likely contributed to the different findings; thus highlighting the need for further research on this topic.

Assessment of Challenging Behaviors in ASD

Despite the fact that challenging behaviors among children with ASD are common and debilitating, they have not been well studied (Matson, 2007b). As challenging behaviors are not considered a core symptom of ASD, most diagnostic tools do not assess for challenging behaviors. In fact, there is some speculation that test developers purposefully excluded challenging behaviors in diagnostic instruments so that challenging behaviors would not be viewed as a core feature of ASD (Matson & Nebel-Schwalm, 2007). However, some diagnostic measures of ASD, such as the ADI-R, have a few items that assess challenging behaviors (Matson & Nebel-Schwalm, 2007; Rojahn, Matson, Lott, Esbensen & Smalls, 2001).

Some current measures designed to assess challenging behaviors in people with developmental disabilities, including ASD and ID, are the Aberrant Behavior Checklist (ABC; Aman, Singh, Stewart & Field, 1985a; Aman, Singh, Stewart & Field, 1985b), Behavior Problem Inventory-01 (BPI-01; Rojahn et al., 2001), Developmental Behavior Checklist (DBC; Einfield & Tonge, 1995), Nisonger Child Behavior Rating Form (CBRF; Aman, Tasse, Rojahn & Hammer, 1996), Overt Aggression Scale (OAS; Hellings, Nickel, Weckbaugh, McCarter, Mosier & Schroeder, 2005), Behavioral Assessment System for Children, Second edition (BASC-2; Reynolds & Kamphaus, 2004), Autism Spectrum Disorder-Behavior Problem for adults (ASD-BPA; Matson & Rivet, 2008c), PDD Behavior Inventory (PDDBI; Cohen, 2003; Cohen, Schmidt-Lackner, Romanczyk & Sudhalter, 2003), and the Autism Spectrum Disorder –Problem Behavior for children (ASD-PBC; Matson, Gonzalez & Rivet, 2008).

Although the ABC was developed for treatment evaluation among people with ID, it has been used for the assessment of challenging behaviors in individuals with ID. To the best of this author's knowledge, this measure has not been used in studies involving the ASD population. The ABC is a respondent based measure comprised of five subscales: (1) irritability, agitation, and crying, (2) lethargy and social withdrawal, (3) stereotyped behavior, (4) hyperactivity, noncompliance, and (5) inappropriate speech (Aman et al., 1985a). The ABC was originally validated for use among adolescents and adults with ID living in residential facilities but has since been investigated in children with ID living in the community (Marshburn & Aman, 1992). The ABC has a mean internal reliability of .91, mean interrater reliability of .63, and test retest reliabilities ranging from .96 to .98 for all subscales (Aman et al., 1985b). Furthermore, the ABC, except for the hyperactivity subscale, demonstrated convergent validity against another measure of challenging behaviors (Aman et al., 1985b).

The BPI-01 measures challenging behaviors more in depth than the ABC (Rojahn et al., 2003). The first version of the BPI emerged in the early 1980s in German, and only included items relating to SIB and stereotypies. When it was translated to English, the BPI was further developed to include aggression and destructive behaviors (Rojahn et al., 2001). The BPI-01 is a 52 item respondent based measure designed to assess for frequency and severity of challenging behaviors, and is composed of three subscales: (1) aggression/property destruction, (2) SIB and, (3) stereotypies. Although Sturmey, Fink and Sevin (1993), did not find support for the inclusion of the stereotypies subscale, future research found support through factor analysis for all three subscales (Hill, Powlitch and Furniss, 2008). Overall, internal reliability for the BPI-01 is .83, overall interrater reliability for the BPI-01 is .91, and overall test retest reliability for the BPI-01 is .76 (Rojahn et al., 2001). Rojahn and colleagues (2001) also found the BPI-01 to be a valid measure for assessing challenging behaviors in adolescents and adults with ID and

developmental disabilities. This study included 432 participants, 29 who had a diagnosis of ID and ASD. Hill and associates (2008) confirmed the validity of the BPI-01 through comparisons with the ABC. Although this measure has been used among people with a comorbid diagnosis of ASD and ID, there is no known published research to date using this measure among children or adults with ASD alone.

The DBC is another measure on which psychometric studies have been conducted for use among children and adolescents with ID. It is a 96 item, multiple choice, informant based questionnaire designed to assess challenging behaviors and emotional problems among children and adolescents with ID (Einfeld & Tonge, 1995). The DBC is a reliable and valid measure of emotional problems and challenging behaviors in children and adolescents with ID (Einfeld & Tonge, 1995). Einfeld and Tonge (1995) conducted a factor analysis and determined that there were 6 valid subscales: (1) disruptive (2) self absorbed (3) communication disturbances (4) anxiety (5) autistic relating and (6) antisocial. The DBC also provides a total behavior problem score. Interrater reliability ranges from .67 to .91, and test retest reliability ranges from .51 to .87 (Einfeld & Tonge, 1995). They also developed norms based on ID classification. Dekker, Nunn, Einfeld, Tonge and Koot (2002) reassessed the factor structure of the DBC among children with ID, and determined through factor analysis that there were 5, not 6, valid subscales. The disruptive and antisocial subscales from Einfeld and Tonge (1995) were combined in the Dekker and colleagues (2002) final factor structure. Dekker and colleagues (2002) found that the DBC is reliable, with internal reliabilities ranging from .66 to.91. Hastings, Brown, Mount & Cormack (2001), although finding that the measure has good reliability and validity, call for further research regarding this measure's psychometric validity. They specifically suggest future research to focus on confirmatory factor analysis, deletion of redundant items, and ability to distinguish between psychological disorders. Although the DBC may seem appropriate for use

among children with ASD, psychometric properties with this population have not been well-studied (Lecavalier, Aman, Hammer, Stoica & Mathews, 2004).

The Nisonger CBRF is an informant based measure designed to measure challenging behaviors occurring in the last month among children and adolescents with ID (Aman et al., 1996). There are two forms of the Nisonger CBRF, one for teachers and one for parents. Both forms have a social competence and a challenging behavior category. Ten items compose the social competence section which is rated on a 4 point Likert scale, ranging from 0 (*not true*) to 3 (*always or completely true*). The challenging behavior section is made up of 60 items for the parent version and 62 items for the teacher version and are rated on a 4 point Likert scale, ranging from 0 (*not a problem or did not occur*) to 3 (*severe problem or did not occur*). Furthermore, factor analysis divided the challenging behavior section into 6 subscales: (1) conduct problems, (2) insecure/anxious, (3) hyperactivity, (4) SIB/stereotypies, (5) self-isolated/ritualistic, and (6) irritable for the teacher version and overly sensitive for the parent version (Aman et al., 1996). Aman and associates (1996) concluded that the Nisonger CBRF teacher and parent version is a reliable and valid measure of challenging behaviors. For the social competence and challenging behavior sections of both the teacher and parent forms, Aman and associates (1996) found good to very good internal consistency (.78 to .87), however low interrater reliabilities were found (.30 to .37). Although interrater reliabilities were low, it is common for children to behave differently with different people and environments. Aman and associates (1996) analyzed convergent validity by obtaining correlations between Nisonger CBRF and ABC and found moderate to high correlations (i.e., .49 to .85) for predicted convergent findings. In addition, the Nisonger CBRF has age and gender norms (Tasse, Aman, Hammer & Rojahn, 1996). Although there have been some psychometric studies, more are required (Aman et al., 1996; Lecavalier et al., 2004).

Lecavalier and colleagues (2004) analyzed reliability and validity of the Nisonger CBRF among children with ASD using confirmatory and exploratory factor analysis. Although goodness of fit was acceptable, the structure of the social competence section is more similar to the original structure than the challenging behavior section (Lecavalier et al., 2004). For the challenging behavior section, Lecavalier and colleagues (2004) found no evidence for the irritability or overly sensitive subscale. Items from this subscale loaded onto the conduct problem subscale. Additionally, when analyzing children with ASD using the Nisonger CBRF, there are lower internal consistency and factor loadings. Despite the fact that this measure has been analyzed for use among children with ASD, further studies examining its validity and reliability are needed for the ASD population (Lecavalier et al., 2004).

The OAS was originally designed to assess pharmacological treatment responses among people evincing challenging behaviors who live in hospital settings (Silver &Yudofsky, 1991; Yudofsky, Silver, Jackson, Endicott & Williams, 1986). It has since been employed for examining treatment response of valproate in 8 children diagnosed with ASD (Hellings et al., 2005). This scale is comprised of 4 subscales: (1) verbal aggression (2) property destruction (3) SIB and (4) physical aggression against others. The OAS allows the respondent to record observed challenging behaviors, record the duration of a challenging behavior, rate the topography of a challenging behavior and rate the intervention used for a specific challenging behavior (Silver & Yudofsky, 1991; Yudofsky, Silver, Jackson, Endicott & Williams, 1986). Even though the OAS was found to correlate highly with the Aberrant Behavior Checklist-Community irritability subscale in a study consisting of 8 children diagnosed with Autism, the authors note that this scale requires further psychometric research for use in the ASD population (Hellings et al., 2005).

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There are also some broad band measures that have included children with ASD in their general and clinical norm samples. The BASC-2 (Reynolds & Kamphaus, 2004) is one such example. The BASC-2 measures emotional concerns, challenging behaviors and adaptability of children and young adults in the general population via self report, teacher rating and parent rating scales. Norm groups, general and clinical, included children and adolescents with ASD (Reynolds & Kamphaus, 2004). Depending on the age of the person, the preschool, child, adolescent or college form is used (Reynolds & Kamphaus, 2004). Length of forms and specific items vary slightly from one age form to the other. Overall, the BASC-2 PRS consists of 4 composites: externalizing problems, internalizing problems, adaptive skills and a behavioral symptoms index. Although items composing the externalizing scale relate to physical aggression, verbal aggression, property destruction, tantrum like behavior and defiance, and some items in the atypicality scale relate to stereotypies, the BASC-2 does not solely examine challenging behaviors. The BASC-2 also assesses for anxiety, depression, and somatization.

Reynolds and Kamphaus (2004) found that all forms of the BASC-2 were reliable and valid. General and clinical norm samples, which included children with ASD, were incorporated in the reliability and validity studies (Reynolds & Kamphaus, 2004). They found that internal consistency, α, ranged from .77 to .94 for the preschool form, .73 to .95 for the child form, and .76 to .95 for the adolescent form. The authors of the BASC-2 report that the median test retest reliabilities for the preschool, child and adolescent versions are .77, .84 and .81 respectively. Median interrater reliability for the preschool, child and adolescent forms were found to be .74, .69 and .77 respectively (Reynolds & Kamphaus, 2004).

Several studies use the BASC-2 to analyze differences (Flom 2007; Valencia, 2006) or profiles of children with ASD (Knoll, 2008). Valencia (2006) used the BASC-2 to compare adaptive skills among children with high functioning autism, AS and PDD-NOS. She found that

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children with AS demonstrate lower adaptive, social and leadership skills than children with high functioning autism or PDD-NOS. Another study analyzed scores on the internalizing and externalizing scales among children with high functioning autism, AS and PDD-NOS (Flom, 2008). Flom (2007) observed that children with ASD who have better social skills are less likely to engage in behaviors that comprise the externalizing composite (e.g. aggression, conduct problems and hyperactivity). In addition, 37.7% of the participants endorsed items from the aggression scale, and 28.9% endorsed items from the conduct problem scale.

Knoll (2008) was able to differentiate between typically developing children, children with high functioning ASD, and children with low functioning ASD using the BASC-2 PRS. When compared to typically developing children, children with high functioning and low functioning ASDs obtained higher scores on the externalizing composite and lower scores on the adaptive composite. Children with high functioning ASD received the highest scores on the externalizing composite, and children with low functioning ASD received the lowest scores on the adaptive composite. Furthermore, children with high functioning ASD and typically developing children acquired higher scores on the internalizing scale compared to children with low functioning ASD. The high functioning ASD group obtained the highest scores on the anxiety scale (Knoll, 2008).

The previous assessments, although sometimes used among people with ASD, were designed to assess challenging behaviors in non ASD populations, primarily adults or children with ID, or were broad band measures of adaptability, challenging behaviors and emotional concerns. The ASD-BPA, PDDBI and ASD-PBC are measures designed to assess challenging behaviors among people with ASD.

The ASD-BPA is a 19 item respondent based measure designed to assess challenging behaviors among adults with ASD (Matson & Rivet, 2008c). Respondents endorse items as 0

(*not a problem/impairment*) or 1 (*is a problem/impairment*). This measure consists of three

subscales and a total score (Matson & Rivet, 2008c). The three subscales derived from factor

analysis are: (1) aggression or destruction, (2) self-injury and (3) disruptive behavior (Matson &

Rivet, 2008c). Internal reliability ranges from .43 to .83 for all subscales, average test retest

reliability approaches .60, and average interrater reliability is .43 (Matson & Rivet, 2008c). The

ASD-BPA was validated using Pearson correlations and linear regression analysis against the

BPI-01 (Matson & Rivet, 2007). Furthermore, it offers clinicians an efficient way to assess for

presence and severity of challenging behaviors.

Although the ASD-BPA was designed to assess challenging behaviors among people

with ASD, it was specifically designed to study challenging behaviors among adults, not

children. Despite the high cost and debilitating nature challenging behaviors have on children

with ASD, only two measures known to this author have been developed specifically to assess

for challenging behaviors among children with ASD. These measures are the PDDBI and the

child version of the ASD-BPA, the ASD-PBC.

The PDDBI is an informant based measure designed to assess treatment responses among

children with ASD (Cohen, 2003; Cohen, Schmidt-Lackner, Romanczyk & Sudhalter, 2003).

There are two forms, a parent and a teacher form. The parent form consists of 176 items whereas

the teacher form consists of 144 items (Cohen, 2003). Each form has four adaptive behavior

subscales and six maladaptive behavior subscales. The subscales that comprise the adaptive

behavior section are (1) social approach behaviors, (2) learning, memory and receptive language,

(3) phonological skills, and (4) semantic/pragmatic ability (Cohen, 2003). The six maladaptive

subscales are: (1) sensory/perceptual approach behavior which includes stereotypies, (2) specific

fears, (3) arousal problems, (4) aggressiveness including SIB and irritability, (5) social pragmatic

problems such as inappropriate touching and lack of awareness of social cues, and (6)

semantic/pragmatic problems which includes echolalia and perseveration (Cohen, 2003). Studies

demonstrate that internal reliability for all subscales range from .73 to .97, and interrater

reliability ranges from .28 to .85 (Cohen et al., 2003). The interrater reliability is lower for the

maladaptive behavior section (.28 to .67) than the adaptive behavior section (.45 to .85; Cohen et

al., 2003). Furthermore, the PDDBI demonstrated good construct validity through factor analysis

(Cohen et al., 2003). As this measure consists of more than a hundred items and assesses more

than just challenging behaviors in children with ASD, it is not an efficient means of assessing

challenging behaviors.

The ASD-PBC was designed specifically to efficiently assess for presence and severity of

challenging behaviors in children with Autism, PDD-NOS and AS. It is an 18 item informant

based measure that assesses occurrence and severity of challenging behaviors along two

dimensions, externalizing and internalizing (Matson, Gonzalez & Rivet, 2008). The ASD-PBC is

a component of a battery which also assesses ASD symptoms and symptoms of comorbid

psychopathology. Originally this measure contained 20 items. However, due to low reliability

two items were removed from the ASD-PBC (Matson, Gonzalez & Rivet, 2008). Items are rated

on a 3 point Likert scale with 0 (*not different/no impairment*), 1 (*somewhat different/mild

impairment*), and 2 (*very different/severe impairment*). The ASD-PBC's internal consistency, α,

is .90, test-retest reliability, kappa, is .64 and mean inter-rater reliability is .49 (Matson,

Gonzalez & Rivet, 2008). Although there have been studies to assess this measure's reliability,

to date there has been no studies validating it.

Purpose

Although there has been a recent surge in the awareness of ASDs, there is still a lack of research specific to this population. So far the majority of research primarily relates to core symptoms of ASD. However, more research is needed to elucidate associated behaviors, such as challenging behaviors. Such areas that require further research are designing efficient and psychometrically sound measures that assess challenging behaviors, the relationship between age and the occurrence and severity of a variety of challenging behaviors, and how children and adolescents tend to score on commonly used broad band measures compared to typically developing controls. As discussed previously, challenging behaviors occur frequently in children with ASD, and they dramatically affect learning and development. Despite the need for psychometrically sound measures that analyze challenging behaviors among children with ASD, there is a lack of measures designed specifically to assess for challenging behaviors in this population. One of the first measures designed to assess challenging behaviors in children with ASD is the ASD-PBC. Although there have been research examining its reliability (Matson, Gonzalez & Rivet, 2008), previous to this study there has been no research examining its validity. Since good psychometrics are required when establishing measures, it is important to analyze the validity of the ASD-PBC. A measure of validity is essential because it informs researchers and clinicians about whether the assessment is measuring the construct it proclaims to measure. In an effort to present clinicians with one of the first reliable and valid measures designed to assess challenging behaviors in children with ASD, Study 1assessed the validity of the ASD-PBC.

As there is some contradictory evidence in regards to whether the presence and severity of challenging behaviors differ significantly with age in people with ASD, Study 2 examined the relationship of age to challenging behaviors. Challenging behaviors were assessed using the

ASD-PBC. To further understand how children and adolescents with ASD compare to typically developing controls on BASC-2 scores, children and adolescents with ASD were compared to typically developing controls in Study 3. This replicated research by Knoll (2008), and helped demonstrate whether children and adolescents with ASD tend to score a certain way on the BASC-2.

Study 1 Methods

<u>Participants</u>

A preexisting database on ASD and typically developing children and adolescents was used for this study. Out of 115 participants who were offered the opportunity to take the ASD-PBC and the BASC-2, one had missing data. Measures with missing data were excluded from this study. Furthermore, inclusion criteria into the typically developing group were that the child or adolescent had no psychological diagnosis (e.g., depression, anxiety, attention deficit hyperactivity disorder, ID, etc.). As such, 10 more participants were excluded from this study. Therefore, only data for 104 children and adolescents were used for the purposes of this study. Primary caregivers served as informants and were recruited from schools, clinics, support groups, parent advocacy groups and community organizations from Louisiana, Georgia, Texas, Mississippi, California, Michigan, New York, and Connecticut.

Out of the 104 participants, 49 children and adolescents were diagnosed with ASD and 55 were typically developing. Since participants were recruited from various sites across the US which may use different methods to diagnose ASD, inclusion into the ASD group occurred if a child or adolescent met a cutoff score on the DSM-IV/ICD-10 Checklist for ASD. This checklist is based on the *DSM-IV-TR* and *ICD-10* diagnostic criteria for ASD. Keeping with the *DSM-IV-TR* and *ICD-10* diagnostic criteria, a minimum of three endorsements on this checklist was required. These minimum three endorsements included two impairments in social interaction and one impairment in either repetitive, restricted or stereotyped patterns of behavior, or communication. Excellent reliabilities (i.e., internal consistency, interrater, and test retest), ranging from $r = .89$ to $r = .96$, have been reported for the DSM-IV/ICD-10 Checklist (Matson, Gonzalez, Wilkins, & Rivet, 2008). Inclusion into the typically developing group occurred through parental report on the demographic form. The demographic form had a question

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inquiring about previous and current diagnosis, where the guardian of the child or adolescent would answer accordingly. If no current or previous Axis I or Axis II diagnoses were listed, the child or adolescent was included into the typically developing group.

Participant information is discussed separately for the ASD, typically developing, and total sample groups. Demographic information for each group for age, gender, and ethnicity are below, on Table 1. Participant information for the ASD group is discussed first. The age range of children and adolescents with ASD ($n = 49$) was 4 through 16 years of age ($M = 8.47$, $SD = 3.24$), with the majority of the sample being male (77.6%) and Caucasian (71.4%). Thirteen (33.8%) of these children and adolescents with ASD had 1 or more previous or current comorbid Axis I diagnoses. These diagnoses included Attention Deficit Hyperactivity Disorder ($n = 6$, 12.2%), Bipolar Disorder ($n = 1$, 2.0%), an anxiety disorder ($n = 2$, 4.1%), a mood disorder ($n = 2$, 4.1%), Selective Mutism ($n = 1$, 2.0%), rule out Schizophrenia ($n = 1$, 2.0%), Borderline Intellectual Functioning ($n = 1$, 2.0%), and Stereotypic Movement Disorder ($n = 1$, 2.0%). Twenty two of the children and adolescents with ASD (44.9%) were taking psychotropic medication at the time of data collection, with 12 taking two or more psychotropic medications. Among the children and adolescents in this study, 14 were prescribed psychostimulants, 9 antipsychotics, 8 antidepressants, 5 mood stabilizers, and 3 were prescribed anti-anxiety medication. Out of the children and adolescents with ASD in this study 42 (85.7%) were verbal and 7 (14.3%) were non-verbal.

As seen in Table 1, the age range of the typically developing group ($n = 55$) was 4 through 13 years of age ($M = 7.45$, $SD = 2.32$). The typically developing group was comprised of 29 females (52.7%) and 26 males (47.3%). In regards to ethnicity, the majority was Caucasian (81.8%), but there were also people of African American, Latino, and 'other' ethnic descent. None had any current or previous Axis I or Axis II diagnosis listed by their primary caregiver on

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Table 1

Demographic information for the ASD, Typically developing and Total groups

Group	n	Age Range	Age		Gender (%)		Ethnicity (%)			
			M	SD	Male	Female	C	A	L	O
ASD Group	49	4 - 16	8.47	3.24	77.6	22.4	71.4	14.3	12.2	2.0
Typical Group	55	4 - 13	7.45	2.32	47.3	52.7	81.8	9.1	5.5	3.6
Total Group	104	4 - 16	7.93	2.82	61.5	38.5	76.9	11.5	8.7	1.0

Note: n = number of participants per group, M = mean, SD = standard deviation, C = Caucasian, A = African American, L = Latino, and O = other ethnicity.

the demographic form. Furthermore, all of the typically developing children or adolescents were verbal. The age range of for the total group (*n* = 104) was 4 to 16 years of age (*M* = 7.93, *SD* = 2.82). In this study, 64 of the children and adolescents were male (61.5%) and 40 were female (38.5%). There were 80 Caucasians (76.9%), 12 African Americans (11.5%), 9 Latino (8.7%), and 1 'other ethnicity' (1.0%).

Hypotheses

Before hypotheses were derived, a comparison of item content was conducted between BASC-2 and ASD-PBC scales and subscales considered for use to demonstrate convergent validity (i.e., conduct problems, hyperactivity, aggression, and atypicality from the BASC-2, as well as the ASD-PBC internalizing and externalizing scales). This was done to help determine which scales and subscales should be compared against each other for convergent validity. When developing Table 2, items from the ASD-PBC and BASC-2 were considered a match if they met the definition of the challenging behavior, or if the item represented a more broad or specific form of an item from the other assessment. Definitions of challenging behaviors were discussed in the topography of challenging behavior section of the literature review. Although it was sometimes difficult to determine whether an item matched another item, decisions were based

upon the above rule to the best of this writer's ability. See Table 2, below, for a comparison of item content on the ASD-PBC and the BASC-2 subscales and scales analyzed for use for convergent validity in this study.

For the BASC-2 aggression subscale, denoted by BA on Table 2, approximately 45% of the items matched ASD-PBC items. Some BASC-2 aggression subscale items did not match ASD-PBC items because the item did not meet full criteria for a form of aggression. Some examples of non-matching items are 'bullies others,' 'annoys others on purpose,' and 'seeks revenge on others.' Although bullies often engage in verbal and physical aggression, as well as property destruction, it was felt that these forms of challenging behavior do not comprise the essence of the term bully. Although a bully does engage in aggressive challenging behaviors, there seems to be a malicious intent that appears to go above and beyond the definitions of these challenging behaviors. The same thought process which placed 'bullies others' in the non-matching category, placed 'seek revenge on others' in the non-matching category. In regards to 'annoying others on purpose,' this item does not typically include verbal aggression or any other form of aggression, is not a broader term for an ASD-PBC item, and is not a more specific form of an ASD-PBC item. As such, this item was placed in the non-matching category. Furthermore, non-matching BASC-2 aggression subscale items do not appear to mesh with the social skills of a child or adolescent with ASD. For example, a person with ASD most likely lacks the social awareness to bully others, annoy others on purpose, or seek revenge on others. As such, the BASC-2 aggression subscale items 'bullies others,' 'annoy others' on purpose,' and 'seek revenge on others' would not be pertinent for measuring challenging behaviors in the ASD population. The BASC-2 aggression subscale items that matched ASD-PBC items, all matched under the aggression type of challenging behaviors.

Table 2

Comparison of some ASD-PBC and BASC-2 PRS items

Content		ASD-PBC items	BASC-2 PRS items
Aggression	**Verbal**	Yelling or shouting at others$_{AE}$	Threatens to hurt others$_{BA}$
			Argues when denied own way$_{BA}$
			Calls others names$_{BA}$
			Argues with parents$_{BA}$
	Physical	Pulling others' hair$_{AI}$	Hits others$_{BA}$
		Throwing objects at others$_{AE}$	
		Aggression towards others$_{AE}$	
	Property Destruction	Kicking objects$_{AE}$	Breaks others' things$_{BA}$
		Property destruction$_{AE}$	
		Banging on objects with hand$_{AE}$	
	Tantrum Behaviors	Kicking objects$_{AE}$	Throws tantrums$_{BH}$
		Banging on objects with hand$_{AE}$	
		Yelling or shouting at others$_{AE}$	
Odd Behavior	**General**	Unusual play with objects$_{AI}$	Does strange things$_{BAt}$
		Playing with own saliva$_{AI}$	Acts strangely$_{BAt}$
		Smearing or playing with feces$_{AI}$	
		Removal of clothing at inappropriate times$_{AI}$	
	Repetitive	Repeated and unusual vocalizations$_{AI}$	Repeats thoughts over and over$_{BAt}$
		Repeated and unusual body movements$_{AI}$	Repeats one activity over and over$_{BAt}$
SIB		Poking self in eye$_{AI}$	Bangs head$_{BAt}$
		Mouthing objects causing harm$_{AI}$	
		Harming self by hitting, pinching, scratching$_{AE}$	

Table 2 Continued

Content	ASD-PBC items	BASC-2 PRS items
Some Non Matched Items	Inappropriate sexual behavior$_{AI}$ Leaving the supervision of caregiver without permission$_{AI}$	Annoys others on purpose$_{BA}$ Seek revenge on others$_{BA}$ Bullies others$_{BA}$ Interrupts others when others are speaking$_{BH}$ Disrupts others' activities$_{BH}$ Needs too much supervisoin$_{BH}$ Acts out of control$_{BH}$ Sneaks around$_{BC}$ Lies$_{BC}$ Breaks the rules$_{BC}$ Disobeys$_{BC}$ Hears sounds that are not there$_{BAt}$ Seems unaware of others$_{BAt}$

Note: ASD-PBC = Autism Spectrum Disorder – Problem Behavior for Children; BASC-2 PRS = Behavioral Assessment System for Children, Second Edition, Parent Rating Scale; SIB = Self Injurious Behavior, AE = ASD-PBC Externalizing scale, AI = ASD-PBC Internalizing scale, BA = BASC-2 Aggression subscale, BH = BASC-2 Hyperactivity subscale, BC = BASC-2 Conduct Problems subscale, BAt = BASC-2 Atypicality subscale

In regards to verbal aggression, items matched based on both meeting definitions for verbal aggression. The BASC-2 aggression subscale items 'threatens to hurt others,' 'argues when denied own way,' and 'calls others names' matched the ASD-PBC item 'yelling and shouting at others' because they are all forms of verbal aggression. In the physical aggression category, the BASC-2 items 'hits others' matched the ASD-PBC items 'pulling others' hair,'

'throwing objects at others,' and 'aggression towards others.' 'Hits others' matched the ASD-PBC items because it is a specific form of physical aggression. In regards to property destruction, there are more items on the ASD-PBC that represent this challenging behavior. Both the ASD-PBC and the BASC-2 have one broad item relating to property destruction (i.e., 'property destruction,' and 'breaking others' things,' respectively). However, the ASD-PBC also has two items that are more specific forms of property destruction behaviors (i.e., 'kicking objects 'and' banging on objects with hand').

For tantrum behaviors, the ASD-PBC consists of items describing specific actions that often occur during tantrum behaviors (i.e., 'yelling or shouting at others,' 'banging on objects with hand,' and 'kicking object'), whereas the one BASC-2 item that matched under this section is very broad (i.e., 'throws tantrums'). The definition of temper tantrum includes kicking at the floor, flailing limbs, and screaming (Ando & Yoshimura, 1979; Dominick et al., 2007; Sturmey et al., 2008). 'Kicking object' is an action that often occurs in tantrum behaviors as seen through the definition which includes kicking at the floor. Also, 'banging on objects with hand' is represented in the tantrum behavior definition through flailing limbs. Arms are a type of limb and when arms flail they are likely hitting objects (e.g., floor, wall) repeatedly. It is important to note that there is only one item from the BASC-2 hyperactivity subscale that matches under the aggression heading. This item is 'throws tantrums,' which matches under tantrum behaviors, and is broader than the ASD-PBC items as it would comprise the behaviors those items represent.

Overall, only approximately 10% of the BASC-2 hyperactivity subscale items matched ASD-PBC items. Items comprising the BASC-2 hyperactivity subscale that did not match with ASD-PBC items relate to high activity levels with some impulsive behaviors. For example, some non-matching items are 'disrupts others' activities,' 'interrupts others when they are speaking,' 'needs too much supervision,' and 'acts out of control.' Although challenging behaviors often

disrupt the activities of others, make a person seem out of control, and require people to have greater levels of supervision, these are the results of challenging behaviors rather than challenging behaviors in and of themselves. As such, those items were considered non-matching. Except for 'pulling others hair,' all BASC-2 hyperactivity and aggression subscale items matched ASD-PBC externalizing scale items. Factor analysis of the ASD-PBC found that 'pulling others hair' loaded significantly (.31) on the internalizing scale and non-significantly (.27) on the externalizing scale (Matson, Gonzalez, & Rivet, 2008).

Approximately 46% of the BASC-2 atypicality subscale items matched ASD-PBC items. All of these items matched in the odd behavior and SIB content areas. In regards to general odd behaviors, the BASC-2 items that matched odd behaviors were 'does strange things' and 'acts strangely.' The ASD-PBC items state more specific forms of odd behaviors, such as 'unusual play with objects,' 'smearing or playing with feces,' and 'removal of clothing at inappropriate times.' Under the repetitive odd behavior category, the BASC-2 and ASD-PBC items both matched the definition of stereotypies and are both broad. The BASC-2 items 'repeats thoughts over and over' and 'repeats one activity over and over' matched the ASD-PBC items 'repeated and unusual vocalizations' and 'repeated and unusual movements,' respectively.

For SIB, the ASD-PBC had more items allocated to this challenging behavior than the BASC-2. The BASC-2 atypicality subscale had one item related to SIB (i.e., 'bangs head'), whereas the ASD-PBC had three (i.e., 'poking self in eye,' 'mouthing objects causing harm,' and 'harming self by hitting, pinching, scratching'). All ASD-PBC items that matched BASC-2 atypicality items were from the ASD-PBC internalizing scale, except for 'harming self by hitting pinching, scratching.' 'Harming self by hitting pinching, scratching' comprises the ASD-PBC externalizing scale per the factor analysis (Matson, Gonzalez, & Rivet, 2008). Items comprising the BASC-2 atypicality subscale that did not match relate to symptoms of schizophrenia or other

psychotic disorders. These include 'hears sounds that are not there' and 'seems unaware of others.'

Two ASD-PBC items did not fully match BASC-2 items. These were 'inappropriate sexual behavior' and 'leaving the supervision of caregiver without permission.' It is also interesting to note that none (0%) of the items comprising the BASC-2 conduct problems subscale matched any ASD-PBC items. Examples of BASC-2 conduct problem subscale items are 'sneaks around,' 'lies,' 'disobeys,' and 'breaks the rules.' These items did not meet the definition of any of the challenging behavior categories in Table 2. Although disobeying and breaking rules are technically challenging behaviors, the connotation appears to be that of more overall deceit and manipulation than the challenging behaviors listed in Table 2. As such, these were not considered a broader type of any ASD-PBC item. Although 'sneaks around' sounds similar to 'leaving the supervision of caregiver without permission,' 'sneaks around' seems to imply more covert deviant actions. As such, these two items were placed in the non-matching category. Lying was also placed in the non-matching category because it does not match the definition of a challenging behavior content area, and does not match an item on the ASD-PBC. Although lying is relatively common among typically developing children and adolescents, it is not a commonly reported challenging behavior in the ASD population.

Based on the above content analysis, the BASC-2 hyperactivity and aggression subscales were compared against the ASD-PBC externalizing scale when assessing for convergent validity. Furthermore, the BASC-2 atypicality scale and the ASD-PBC internalizing scale were compared to assess convergent validity of the ASD-PBC. As no items on the BASC-2 conduct problems subscale matched any items comprising the ASD-PBC internalizing or externalizing scale, the conduct problems subscale of the BASC-2 was not used in this study.

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Hypotheses for this study are viewed on Table 3. It was expected that the ASD-PBC externalizing scale would show convergent validity with the BASC-2 PRS hyperactivity and aggression subscales. The ASD-PBC internalizing scale was hypothesized to demonstrate convergent validity with the BASC-2 PRS atypicality scale. The BASC-2 internalizing composite assesses for depression, anxiety, and somatization. As such, it was further hypothesized that the ASD-PBC externalizing and internalizing scales would have discriminant validity with the BASC-2 internalizing composite.

Table 3

Hypothesized results for convergent and discriminant validity

Scale	BASC-2 PRS				ASD-PBC	
	BA	BH	BAt	BIC	AES	AIS
BA	1				C	
BH		1			C	
BAt			1			C
BIC				1	D	D
AES	C	C		D	1	
AIS			C	D		1

Note: BA = BASC-2 PRS Aggression Scale, BH = BASC-2 PRS Hyperactive Scale, BIC = BASC-2 PRS Internalizing Composite, BAt = BASC-2 PRS Atypicality, AES = ASD-PBC Externalizing Scale, AIS = ASD-PBC Internalizing Scale.
C = Hypothesize high correlation to show convergent validity.
D = Hypothesize low correlation to show discriminant validity.

Procedure

All measures were completed by primary caregivers after informed consent was obtained from legal guardians of all participants. Primary caregivers completed the ASD-PBC as part of a comprehensive ASD child battery which included ASD-Diagnostic, ASD-Comorbidity, a social skills measure, and demographic information. Primary caregivers also completed the BASC-2

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PRS. Directions were printed for all assessment measures and all participants were given the opportunity to discuss questions or issues. After the measures were returned, trained graduate students made follow up calls to clarify information or to address missing information, scored the assessments, and entered the data into the ASD child database. All data used in the study was collected over a two year time period. Throughout this process, supervision was received from a licensed psychologist. Furthermore, the Louisiana State University Institutional Review Board approved this study.

Measures

ASD-PBC. The ASD-PBC is part of a comprehensive battery of measures that assess problem behaviors (ASD-PBC), co-morbid psychopathology (ASD-CC), and ASD symptoms (ASD-DC) among children with Autism, PDD-NOS and AS (Matson et al., 2008a). The ASD-PBC is an 18 item informant based measure where the informant, a caregiver, is asked to rate each item according to the recent severity. Severity ratings range from 0 (*not a problem or impairment)*, to 1 (*mild problem or impairment*), to 2 (*severe problem or impairment*). These numbers are then added together to yield a total score.

To assess the best structure and reliability of the ASD-PBC, Matson, Gonzalez and Rivet (2008) studied 218 children from clinic and school settings in Louisiana, California, Georgia, Connecticut, Michigan and New York between the ages of 2 and 16 years of age. They found that this measure is composed of two dimensions, an externalizing and internalizing scale. The items in the externalizing scale assess aggression towards self and others and property destruction. Items in the internalizing scale focus on stereotypy, inappropriate sexual behaviors, and odd behavior. Internal consistency, α, is .90, test-retest reliability is .64, and mean inter-rater reliability is .49 (Matson, Gonzalez & Rivet, 2008).

BASC-2 Parent Rating Scales for Preschool, Child and Adolescent. The BASC-2

Parent Rating Scales (BASC-2 PRS; Reynolds & Kamphaus, 2004) is part of a comprehensive

battery that assesses emotional concerns, problem behaviors, and adaptability of children and

young adults via Self Report Scale, Teacher Rating Scale, Student Observation System, Parent

Rating Scale, and Structured Developmental History. This measure is used to assess clinical

diagnosis and educational classification. The informant is asked to rate each item according to

frequency of a behavior. Frequency ratings range from N (*Never*), S (*Sometimes*), O (*Often*), and

A (*Almost Always*). As the ASD-PBC is designed for caregivers to fill out, the BASC-2 PRS is

used in the current research study.

There are 4 different forms of the BASC-2 PRS, each one reflecting a different age group

(preschool, child, adolescent, and college). The preschool form assesses children ages 2 through

5 and is made up of 134 items. The child form assesses children ages 6 through 11 years of age

and is made up of 160 items. The adolescent form assesses children ages 12 to 21 and is

composed of 150 items. As the ASD-PBC is designed to assess challenging behaviors in children

age 2 through 16, the preschool, child and adolescent form of the PRS is used in this study. All

BASC-2 forms are informant based measures designed to assess externalizing behaviors,

internalizing behaviors, atypicality, withdrawal, attention problems, and adaptive skills in the

home and community. For the child and adolescent forms, the externalizing behavior composite

is composed of hyperactivity, aggression, and conduct problems scales. The externalizing

behavior composite does not include conduct problems in the preschool form. The internalizing

composite is composed of anxiety, depression, and somatization scales. The externalizing

composite, internalizing composite, atypicality scale, withdrawal scale, and attention problems

scale come together to form the Behavior Symptom Index (BSI). Items that make up the

atypicality scale focus on lack of awareness to the environment, and hallucinations. Reynolds

and Kamphaus (2004) note that this scale is often elevated in children with challenging behaviors. The adaptive behavior composite is composed of adaptability, social skills, leadership, activities of daily living, and functional communication scales (Reynolds & Kamphaus, 2004). However, Study 1 does not use the adaptive behavior composite.

BASC-2 is a reliable and valid measure of internalizing, externalizing, and adaptive behaviors for people 2 to 24 years of age (Reynolds & Kamphaus, 2004). Children with ASD were included in the general norm and the clinical norm samples and were included in the reliability and validity studies (Reynolds & Kamphaus, 2004). Not only were children with ASD included in the general and clinical norm groups (Reynolds & Kamphaus, 2004), but there have been studies using the BASC-2 to determine profiles of ASD (Knoll, 2008) and to examine skills (Valencia, 2006), or presentation of externalizing and internalizing behaviors (Flom 2007) among children with different ASD diagnoses.

Study 1 Analysis

Power Analysis

        To determine a study's power (i.e., the ability to reject the null hypothesis when the null hypothesis is incorrect) the number of participants, whether the study should be one tailed or two tailed, alpha level, level of desired power, and effect size must all be taken into account. This study analyzed the validity of the ASD-PBC in three different groups: 1) ASD group ($n = 49$), 2) typically developing group ($n = 55$), and the total group ($n = 104$). As both positive and negative correlations can be significant, a two tailed test was utilized. A significance level of .05 was used, and the level of desired power was determined to be .80, which in the behavioral sciences is the appropriate power with a significance level of .05 (Hinkle, Wiersma, & Jurs, 2003). Although the previous elements required to calculate the power of a study could be determined, the effect size was not able to be established. The effect size used to help determine a study's power should be based on prior research analyzing the magnitude of the relationship between the groups under comparison in the current study. For this study, the two elements being compared are the ASD-PBC and the BASC-2. As there have been no previous studies examining the relationship between these two measures, no effect size can be determined. As such, the power this study has at each level of effect size (i.e., small, medium, and large) was analyzed, as was the correlation coefficient required to find significant results.

        To determine the power this study had at a variety of effect sizes, ranging from small (e.g., .10) to large (e.g., .50; Cohen, 1992), a power analysis program, GPOWER (Erdfelder, Faul & Buchner, 1996) was used to determine power. A post hoc analysis, using the correlations difference from a constant (one sample case) statistical test, was run on GPOWER. To determine the power of the correlation matrices for each group (i.e., ASD, typically developing, and total)

at various levels of effect size, a two tailed test, and an alpha level of .05 was used. View Table 4

for power of the three groups at various effect sizes.

Table 4

Calculated post hoc power for the ASD, typically developing and total group at various levels of effect size, and critical values of Spearman's rho

	ASD (n = 49)					Typically Developing (n = 55)					Total (n = 104)				
Effect Size	.1	.2	.3	.4	.5	.1	.2	.3	.4	.5	.1	.2	.3	.4	.5
Power	.10	.28	.56	.83	.96	.11	.31	.61	.87	.98	.17	.53	.87	.99	.99
Adequate Power	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	Y	Y
Critical value of r_s			.28					.27					$.20^E$		

Note: N = No, Y = Yes, r_s = Spearman's rho, ^{E} = this critical value was estimated from n =100

As seen in Table 4, for the ASD and typically developing groups, this current study only

had adequate power (i.e., power of .80) when there was a medium effect size of about .4 or

greater. For the total group, the current study only had adequate power when the effect size was

about .30 (i.e., medium effect size) or greater. These findings indicate that the total group,

compared to the ASD or typically developing groups, required slightly smaller relationships

between the ASD-PBC and BASC-2 to gain significant results.

When looking at the correlation coefficients for Spearman's rho required for significant

results for each group (Table 4 critical value of r_s), it is also apparent that the total group would

find smaller correlations statistically significant. For the ASD group, which consisted of 49

participants, a correlation coefficient greater than absolute .28 would have been considered

statistically significant (Zar, 1972). For the typically developing group which had 55

participants, a correlation coefficient greater than absolute .27 would have been considered

statistically significant. However, for the total group (*n* = 104), a correlation coefficient greater

than about absolute .20 would have been considered statistically significant. As the Zar (1972) article only provides critical values for r_s through 100 participants, this critical value was estimated using a sample size of 100. As such, the actual critical value is most likely slightly lower. Overall, this study has adequate power for detecting significant differences that are a medium effect size, and this study was able to consider low correlation coefficients, of about .28, as significant.

<u>Statistical Analysis</u>

To measure the construct validity of the ASD-PBC, convergent and discriminant validity between the ASD-PBC and the BASC-2 PRS was analyzed using a correlational matrix similar to the Multitrait-Multimethod Matrix developed by Campbell and Fiske (1959). Since this was partly an academic undertaking, convergent and discriminant validity between the ASD-PBC and the BASC-2 was conducted with an ASD, typically developing, and total sample. To assess convergent validity, the ASD-PBC externalizing scale was compared to the BASC-2 PRS hyperactivity and aggression subscales. Discriminant validity was assessed by comparing BASC-2 PRS internalizing composite to ASD-PBA externalizing and internalizing scales. Correlations using Spearman's Rho (r_s) were calculated for use in this matrix and $p < .05$ was used to determine if correlations were significant. Spearman's Rho was used as opposed to Pearson's R because, in total, this data was not normally distributed (Leech et al, 2008) as demonstrated by the Kolmorgorov-Smirnov (KS) and Shapiro-Wilk (SW) tests of normality for all scales, composites, and subscales used in this study.

For the ASD group, the KS test of normality showed D(49) = .16, .18, .14, and .13, $p <$ .05 respectively for the ASD-PBC internalizing and externalizing scales, as well as the BASC-2 aggression subscale, and internalizing composite. This indicated that these distributions were significantly different than a normal distribution. However, KS and SW tests of normality

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showed that the BASC-2 atypicality subscale was not significantly different from a normal distribution. For the atypicality subscale, the KS tests or normality was $D(49) = .07$, *ns*, and the SW tests of normality was $W(49) = .99$, *ns*. Unlike the KS test, which found the BASC-2 hyperactivity subscale to significantly differ from a normal distribution, the SW test of normality found that this same subscale significantly deviated from a normal distribution with $W(49) = .95$, $p < .05.$. Although there were some discrepancies in what sections of the measures were or were not significantly different from the normal distribution, overall, this data demonstrates that for the ASD group not all subscales, composites, or scales were normally distributed. Since not all subscales and scales met the assumption of normal distribution for Pearson's R, Spearman's rho was used.

For the typically developing group, the KS test of normality showed that $D(55) = .53$, ..44, .13, .16, and .28 , all $p < .05$, for the ASD-PBC internalizing and externalizing scale, as well as the BASC-2 hyperactivity subscale, aggression subscale, and atypicality subscales, respectively. The SW test of normality also found significant deviations from a normal distribution for these same scales, subscales, and composites. However, unlike the KS test of normality, the SW test found that the BASC-2 internalizing composite was significantly different than a normal distribution, $W(55) = .95$, $p < .05$. KS found that the BASC-2 internalizing composite was not significantly different than a normal distribution, $D(55) = .11$, *ns*. The KS test of normality found that the BASC-2 internalizing scale was not significantly different than a normal distribution, $D(55) = .11$, *ns*. Since not all subscales and scales met the assumption of normal distribution for Pearson's R, Spearman's Rho was used.

For the total group, including ASD and typically developing children, the KS normality test showed that $D(104) = .30, .32, .15, .14, .19,$ and .12, all $p < .05$, respectively for the ASD-PBC internalizing and externalizing scales, as well as the BASC-2, hyperactivity subscale,

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aggression subscale, atypicality subscale, and internalizing composite. This data represents that there was a significant deviation from a normal distribution. SW significance levels were also all significant, further supporting the notion that this data significantly differs from a normal distribution. Since no subscales or scales met the assumption of normal distribution for Pearson's R, Spearman's Rho was used when assessing for validity using the total sample.

<u>Results</u>

First the findings for the ASD only sample are presented, then the findings for the typically developing sample are discussed, and finally the findings for the total sample are discussed. For the ASD sample (see Table 5), the BASC-2 aggression subscale, hyperactivity subscale, and atypicality subscale were all significantly correlated with the ASD-PBC externalizing scale, $r_s = .61, .52,$ and $.48$, all $p < .01$, respectively. The BASC-2 atypicality subscale was also significantly correlated with the ASD-PBC internalizing scale, $r_s = .51, p < .01$.

As seen in Table 5 there was no significant relationship between the ASD-PBC externalizing and internalizing scales and the BASC-2 internalizing composite, $r_s = .10,$ and $-.22$, respectively, both *ns*. Although not included in the hypothesis for convergent or discriminant validity, there was a significant correlation between the BASC-2 hyperactivity subscale and the ASD-PBC internalizing scale, $r_s = .30, p < .05$. For the typically developing group, as seen in Table 6, the BASC-2 aggression and hyperactivity subscales significantly correlated with the ASD-PBC externalizing scale, $r_s = .48,$ and $.46$, respectively, both $p < .01$. Yet the ASD-PBC externalizing scale was also significantly correlated with the BASC-2 internalizing composite, $r_s = .35, p < .01$.

As predicted the ASD-PBC internalizing scale was not significantly correlated with the BASC-2 internalizing composite, $r_s = .16,$ *ns*. However, unlike the hypothesis, the ASD-PBC

Table 5

Correlation matrix for convergent and discriminant validity for ASD sample

Scale	BASC-2 PRS				ASD-PBC	
	BA	BH	BAt	BIC	AES	AIS
BA	1	-	-	-	-	-
BH	.70**	1	-	-	-	-
BAt	.41**	.47**	1	-	-	-
BIC	.43**	.52**	.28	1	-	-
AES	**.61****	**.52****	.48**	**.10**	1	-
AIS	.25	.30*	**.51****	**-.22**	.62**	1

Note: BA = BASC-2 PRS Aggression Scale, BH = BASC-2 PRS Hyperactive Scale, BAt = BASC-2 PRS Atypicality, BIC = BASC-2 PRS Internalizing Composite,, AES = ASD-PBC Externalizing Scale, AIS = ASD-PBC Internalizing Scale.
Bolded correlations represent correlations for which there were hypotheses
** correlation is significant at .01 level * correlation is significant at .05 level

Table 6

Correlation matrix for convergent and discriminant validity for typically developing sample

Scale	BASC-2 PRS				ASD-PBC	
	BA	BH	BAt	BIC	AES	AIS
BA	1	-	-	-	-	-
BH	.67**	1	-	-	-	-
BAt	.18	.48**	1	-	-	-
BIC	.37*	.32*	.16	1	-	-
AES	**.48****	**.46****	.14	**.35****	1	-
AIS	.35**	.28*	**.23**	**.16**	.48**	1

Note: BA = BASC-2 PRS Aggression Scale, BH = BASC-2 PRS Hyperactive Scale, BAt = BASC-2 PRS Atypicality, BIC = BASC-2 PRS Internalizing Composite , AES = ASD-PBC Externalizing Scale, AIS = ASD-PBC Internalizing Scale.
Bolded correlations represent correlations for which there were hypotheses
** correlation is significant at .01 level * correlation is significant at .05 level

internalizing scale was not significantly correlated with the BASC-2 atypicality subscale, $r_s =$ .23, *ns*. The ASD-PBC internalizing composite was significantly correlated with the BASC-2 aggression and hyperactivity subscales, $r_s = .35$, $p < .01$, and $r_s = .28$, $p < .05$, respectively.

Table 7 depicts the correlations between the ASD externalizing and internalizing subscales and the BASC-2 aggression subscale, hyperactivity subscale, atypicality subscale, and internalizing composite for the total sample. As seen in Table 7, the ASD-PBC externalizing

Table 7
Correlation matrix for convergent and discriminant validity for the total sample

Scale	BASC-2 PRS				ASD-PBC	
	BA	BH	BAt	BIC	AES	AIS
BA	1	-	-	-	-	-
BH	.64**	1	-	-	-	-
BAt	.32**	.67**	1	-	-	-
BIC	.42**	.42**	.24*	1	-	-
AES	**.58****	**.59****	.58*	**.23***	1	-
AIS	.33**	.57**	**.76****	**.07**	.70**	1

Note: BA = BASC-2 PRS Aggression Scale, BH = BASC-2 PRS Hyperactive Scale, BAt = BASC-2 PRS Atypicality, BIC = BASC-2 PRS Internalizing Composite , AES = ASD-PBC Externalizing Scale, AIS = ASD-PBC Internalizing Scale.
Bolded correlations represent correlations for which there were hypotheses
** correlation is significant at .01 level * correlation is significant at .05 level

scale was significantly correlated with the BASC-2 aggression subscale, hyperactivity subscale, and internalizing composite, $r_s = .58, .59$, and .23 respectively. All *p* values were less than .01, except for the *p* value representing the correlation between the BASC-2 internalizing composite and the ASD-PBC externalizing scale, which was $p < .05$. Furthermore, there were significant correlations between the ASD-PBC internalizing scale and the BASC-2 aggression, hyperactivity, and atypicality subscales, $r_s = .33, .57$, and .76, all $p < .01$, respectively. There was

no significant correlation between the ASD-PBC internalizing scale and the BASC-2

internalizing composite, $r_s = .07$, *ns*.

Study 1 Discussion

Results of Spearman's rho revealed that the ASD-PBC demonstrates preliminary convergent and discriminant validity for the ASD group. These results indicate that among children and adolescents with ASD, the ASD-PBC does in fact measure challenging behaviors, and is able to distinguish between other constructs. However, there was not full support for convergent and discriminant validity for the typically developing sample nor full support for discriminant validity for the total sample.

Converging composites, subscales, and scales demonstrate that both measures assess the same construct. As hypothesized for the ASD sample, the ASD-PBC externalizing scale demonstrated convergent validity with the BASC-2 hyperactivity and aggression subscales. Also, the ASD-PBC internalizing scale demonstrated convergent validity with the BASC-2 atypicality subscale. Items comprising the BASC-2 atypicality subscale relate to odd and stereotypic behaviors, many of which the ASD-PBC internalizing scale assesses for (Table 2). Correlation coefficients for convergent validity were moderately high, ranging from .51 to .61, and were all significant at $p < .01$. A p value less than .01 indicates that there was a 1%, rather than a 5% chance that the null hypothesis was falsely rejected.

Similar to the ASD group, the total group displayed convergent validity between the BASC-2 aggression and hyperactivity subscales and the ASD-PBC externalizing scale as well as the BASC-2 atypicality scale and the ASD-PBC internalizing scale. Correlation coefficients representing convergent validity were significant at $p < .01$ and were in the moderate to high range (i.e., .58 to .76). Although the typically developing group displayed convergent validity between the ASD-PBC externalizing scale and the BASC-2 aggression and hyperactivity subscales, these correlation coefficients were slightly lower than those for the ASD and total groups, at .46 and .48. Furthermore, unlike the ASD group, for the typically developing group

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the ASD-PBC internalizing scale and BASC-2 atypicality scale did not converge, with a non significant correlation coefficient of .23.

Although convergent validity indicates whether the measures are assessing the same construct, it alone is not enough to determine validity. Discriminant validity is also necessary because it indicates that the measure can distinguish between constructs (Campbell & Fiske, 1959). As previously mentioned, this study found discriminant validity for the ASD sample, but did not find full discriminant validity for the typically developing and total groups. For the ASD group, the BASC-2 internalizing composite and the ASD-PBC internalizing and externalizing scales demonstrated discriminant validity, with non significant correlation coefficients ranging from .11 to -.22 (very low levels). However, for the typically developing sample, only the ASD-PBC internalizing scale and the BASC-2 internalizing composite demonstrated discriminant validity with a very low non-significant correlation coefficient (i.e., $r_s = .16$). The ASD-PBC externalizing scale and the BASC-2 internalizing composite did not demonstrate discriminant validity, with a low positive correlation coefficient of .35, $p < .01$. This finding suggests that the ASD-PBC, as designed, is more specific for use in the ASD population than the typically developing population. Similar to the typically developing sample, the total sample did not display discriminant validity for the ASD-PBC externalizing scale and the BASC-2 internalizing composite. The relationship between these scales was .23, $p < .05$, representing a significant relationship, albeit a low one.

For the typically developing group, only correlation coefficients greater than absolute .27 were considered significant (Table 4). So, although a correlation coefficient of .23 was non significant for a sample size of 55, when the number of participants increased to 104 (i.e., total group), .23 was considered a significant correlation coefficient. While .23 is a low correlation coefficient, accounting for very little of the variance between the subscales, difference in

findings may be partly due to sample size. As noted in Table 4, a correlation coefficient greater than approximately an absolute value of .20 would be considered significant for the total group, which had 104 participants. Although the total group would find correlation coefficients from .20 through .26 as significant, the typically developing ($n = 55$) and ASD ($n = 49$) groups would not. This discrepancy in what correlation coefficients would be significant could alter some findings for convergent and discriminant validity.

Depending on sample size, a correlation coefficient may or may not be significant. Also, when there is a change in sample size, the correlation coefficients may not remain the same. When a larger sample size is used, smaller correlation coefficients are found significant. As such, it is easier to find significant correlations. For example, if for the typically developing group there was a true relationship between the ASD-PBC internalizing scale and the BASC-2 atypicality subscale, a larger sample size would have been better able to detect this. As it would have been easier to detect differences, this scale and subscale may have demonstrated convergent validity. Likewise, when using a larger sample size, if there is not a true significant relationship between measures, the correlation coefficient should be small. For example, if for the total group there was not a true significant relationship between the ASD-PBC externalizing scale and the BASC-2 internalizing composite, a larger sample should reflect that in the size of the correlation coefficient. If however, the correlation coefficient remains large, this may be because there really is a significant relationship between the variables. For example, between the ASD-PBC externalizing scale and the BASC-2 internalizing composite was .23, and the critical value was .20. However, with a sample size of 68, a correlation coefficient of .23 is considered non significant (Zar, 1972). Consequently, if a smaller sample size was used, the total group may have displayed full discriminant and convergent validity. But this may be misleading, as with the larger sample size this is not demonstrated.

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It is also important to note that in the ASD group, which had the smallest sample size of 49, a correlation coefficient of -.22 was considered non significant thereby supporting discriminant validity. However, an absolute value of -.22 is only one tenth of a point smaller than .23 and is greater than the critical value for 100 participants. Perhaps if a larger sample size was utilized for the ASD group, this correlation coefficient would have been significant. Hence, there would not be support for full discriminant validity of the ASD-PBC for use in children and adolescents with ASD. Although changes in sample size may adjust the value of a correlation coefficient, they also alter the value at which correlation coefficients are considered significant. As such, it appears that the most affected correlation coefficients would be those closest to the critical value. This discussion highlights the importance of interpreting results that are affected by sample size with caution, and also illustrates the need for replication with other samples and larger sample sizes.

Other limitations that may have affected some results include item matching between subscale and scales used from the ASD-PBC and the BASC-2, and non random sampling methods. As seen in Table 2, not all items of the BASC-2 matched with items of the ASD-PBC. Some items of the BASC-2 atypicality subscale were designed to assess for symptoms of schizophrenia and other psychotic disorders, rather than SIB, stereotypies, and other odd behaviors as listed in Table 2. Unfortunately, due to the nature of the previously made database, this study was unable to only use BASC-2 items that matched challenging behaviors observed in the ASD population. In an effort to make more accurate comparisons between the ASD-PBC and BASC-2, future studies should eliminate items that do not relate to the topography of challenging behaviors in the ASD population. Perhaps, this would produce higher correlation coefficients between the BASC-2 aggression, hyperactivity and atypicality subscales, and the ASD-PBC externalizing and internalizing scales. Higher correlation coefficients between these scales and

subscales would decrease the affect of sample size on whether a correlation coefficient was significant.

Also, this study was not a random sample and as such, this sample may not be representative of the entire ASD child and adolescent population. Data was collected across different locations based on convenience. Thus, there may be an underlying variable that is unique to the current sample that may have impacted results. For example, perhaps the children and adolescents with ASD had greater severity of ASD or had parents with common beliefs about treatment compared to the overall ASD child and adolescent population. Perhaps the parents who completed measures for the typically developing group have children with challenging behaviors, or have different beliefs compared to the overall population about parenting that may affect how they raise their kids which may thereby affect their children's behavior. As a result of using these non representative typically developing and ASD samples, scores on the ASD-PBC and BASC-2 may not be representative of the overall ASD or typically developing child and adolescent populations. This affects the generalizability of results. As such, future research could further validate the ASD-PBC for use in the ASD population through using different samples of children and adolescents with ASD.

Although this study has limitations, there are also strengths. Strengths include using a measure that has much psychometric support to assess convergent and discriminant validity for the ASD-PBC. Another strength of this study was the high probability of correctly rejecting the null hypothesis if there is at least a moderate effect size between the subscale and scales used in this study. Furthermore, despite the fact that some findings should be interpreted with caution due to limitations (i.e., ASD group non significant correlation between ASD-PBC internalizing scale and the BASC-2 internalizing composite, typically developing group non significant correlation between ASD-PBC internalizing scale and BASC-2 atypicality scale, and the total

group significant correlation between ASD-PBC externalizing scale and the BASC-2 internalizing composite), this study demonstrated the preliminary convergent and discriminant validity of the ASD-PBC for use with children and adolescents. Future studies could further support the validity of the ASD-PBC by comparing this measure to other reliable and valid measures of challenging behaviors.

Assessing the occurrence and severity of challenging behaviors is important as this information is used to select challenging behaviors for treatment. Information about the types of challenging behaviors an individual engages in is essential for conducting an accurate functional assessment, without which, treatments targeting these behaviors are not as effective (Horner et al, 2002). Hence, reliable and valid assessments are the starting point necessary for effective treatments. Using reliable and valid tests that are short in duration, like the ASD-PBC, offer the added benefit of speeding up the assessment process, which allows for cost efficiency and earlier treatment.

Study 2 Methods

<u>Participants</u>

Participants consisted of 207 children and adolescents, from 2 through 16 years of age (*M* = 8.36, *SD* = 3.56) with ASD. ASD was diagnosed the same way as in Study 1. An overview of participant demographics is found on Table 8.

Table 8
Demographic information

	n	**Age Range**	**Age**		**Gender (%)**		**Ethnicity (%)**			
			M	**SD**	**Male**	**Female**	**C**	**A**	**L**	**O**
Participants	207	2 – 16	8.36	3.56	76.3	56.0	56.0	7.7	2.9	3.4

Note: n = number of participants per group, M = mean, SD = standard deviation, C = Caucasian, A = African American, L = Latino, and O = other ethnicity.

As seen in Table 8, the majority of the sample was male (76.3%) and Caucasian (56%). In addition, 53.1% of this sample was verbal at the time of testing. Previous or current diagnosis other than ASD included Attention Deficit Hyperactivity Disorder (8.5%), ID (7.5%), an anxiety disorder (3%), a mood disorder (2%), a seizure disorder (1.5%), hypotonia (1.5%), Fragile X Syndrome (1%), Down Syndrome (1%), asthma (1%), sensory integration disorder (1%), selective mutism (.5%), Tourette's Syndrome (.5%), and borderline intellectual functioning (.5%). Few children and adolescents were prescribed psychotropic medications at the time of this study (27.1%). The majority of the children and adolescents taking psychotropic medications were prescribed psychostimulants (*n* = 35, 17.5%). Other prescribed psychotropic medications included, antipsychotics (*n* = 25, 12.5%), antidepressants (*n* =15, 7.5), mood stabilizers/AED (*n* = 7, 3.5%), and antihypertensives (*n* = 3, 1.5%). Additionally, 26 participants taking psychotropic medications (13%) were prescribed more than one psychotropic medication.

Hypotheses

It was predicted that the frequency and severity of challenging behaviors would not be significantly related to age for all items of the ASD-PBC, the externalizing and internalizing scales, as well as the total score. Murphy and associates (2005) found that the majority of percent endorsement of marked concerns with aggressive behavior, SIB, and stereotypies increased slightly after 12 years. Increases in percentages over 12 years ranged from 2.2% to 15.6%. Only for tantrum behavior did the percent endorsement decrease (i.e., by 1.1%). However, Murphy and colleagues (2005) did not comment on the significance of the change in percentages for these challenging behaviors. Although Baghdadli and colleagues (2003) found that younger age was a significant risk factor for displaying SIB among children with Autistic Disorder, when comparing a non SIB and an SIB group, there was no significant difference in age. Also when comparing, through independent t tests, whether there were significant differences between children with an ASD ($n = 33$, 6 through 11 years), and adolescents with an ASD ($n = 17$, 12 through 21 years) on composites and subscales of the BASC-2 relating to challenging behaviors, there were no significant differences. Further supporting the notion that age does not affect the frequency or severity of challenging behaviors among people with ASD are findings from Murphy and associates (2009). Murphy and associates (2009) found no significant relationship between age and the frequency or severity of SIB, stereotypies, and aggression in a sample of 157 children aged 3 to 14 years with ASD. Correlation coefficients ranged from very low to moderate (i.e., absolute $r = .001$ to .700, with a median of $r = .142$; Murphy et al., 2009).

Procedure

The same procedures for data collection were used as was used in Study 1, except that assessments comprising the ASD Child Battery were the only assessments given in some circumstances.

<u>Measures</u>

This study used the ASD-PBC which was discussed in Study 1.

Power Analysis

A power analysis program, GPOWER (Erdfelder et al., 1996) was used to determine the

power of this study. A post hoc analysis of significance level, using correlations difference from

a constant statistical test, was run on GPOWER. To determine the power of the correlational

analysis, sample size, direction of the test, significance level, and effect size were considered.

There were 207 participants in this study. As this study determined if the correlations were

significantly different than 0, a two tailed test was used. A significance level (α) of .05 was used.

To determine the magnitude of the relationship between age and challenging behaviors among

children and adolescents with ASD, previous relevant research was reviewed. Only two sources

found by this writer were helpful in computing the effect size: 1) an article by Murphy and

colleagues (2009), and 2) the BASC-2 manual by Reynolds and Kamphaus (2004). Murphy and

colleagues (2009) found the following correlation coefficients representing the relationship

between age and frequency of SIB, aggression, and stereotypies: $r = .001$, -.199, and -.017,

respectively. The relationship between age and severity of SIB, aggression, and stereotypies

were $r = .700$, .142, and .100, respectively. To help determine the magnitude of the relationship

between age and challenging behaviors among children and adolescents with an ASD, the effect

size between the scores of children and adolescents with an ASD on subscales of the BASC-2

that represent challenging behaviors (i.e., hyperactivity and aggression subscales) were

computed. The effect sizes were first calculated for Cohen's d, using the following equation:

(Mean $_{child}$ − Mean $_{adolescent}$)/SDpool (Hinkle et al., 2003). The median effect size was .24. This

value was then transformed to an r family effect size using the following equation: the square

root of $d^2/ [d^2 + (1/PQ)]$, where P = the proportion of n_1 in $n_1 + n_2$, and Q = $1 − P$ (Rosenthal,

1994). There were 33 children and 17 adolescents with ASD. As such, a Cohen's d of .24

equaled an *r* of .113. Although these are Pearson correlations, and the current study used Spearman's rho, utilizing these correlations was useful in estimating the effect size for this power analysis. The median effect size was used rather than the mean effect size so that the final effect sizes were not inflated or deflated by outliers (Leech, Barret, & Morgan, 2008). Based on the effect sizes from Murphy (2009), and the effect sizes computed from the BASC-2 manual (i.e., .700, -.199, .142, .113, .100, and -.017), the median effect size was small at .13.

Based on a two-tailed test with a significance level (α) of .05, a small effect size of 0.13, and a sample size of 207, the obtained power was .46. This is below .80, which in the behavioral sciences is the appropriate power with a significance level of .05 (Hinkle et al, 2003). This indicates that out of 100 times, this study would only be able to correctly find significant results for small differences 46 times. However, for an effect size of .20 (a small effect size), this study had a power of .83, indicating that this study had appropriate power for effect sizes of .20 and greater. Interestingly, since this study consisted of 207 participants, Spearman's rho correlation coefficients were considered significant if they were greater than about absolute .19 (Zar, 1972).

Statistical Analysis

To assess the relationship between age and challenging behaviors, ASD-PBC item endorsements, scale scores, and total score was correlated with age using Spearman's rho. KS and SW tests of normality indicated that this sample was not normally distributed for all ASD-PBC items, scales, and the total score. All significance levels were $p < .001$. Since this sample deviated significantly from a normal distribution, Spearman's rho was used (Leech et al, 2008). A significance level of $p < .05$ was used to determine significance.

<u>Results</u>

Correlational analysis revealed that only item 9 (i.e., 'throwing objects at others') was significantly correlated with age, $r_s = -.26$, $p < .01$. As seen in Table 9, all other items were not significantly correlated with age.

Table 9
Correlations between age and ASD-PBC items, scales and total score for children and adolescents with ASD

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12
Age	-.02	.05	.01	.01	-.07	-.04	.12	-.04	-.26*	-.03	.04	-.13

	Item 13	Item 14	Item 15	Item 16	Item 17	Item 18	Externalizing Scale	Internalizing Scale	Total Score
Age	-.03	.01	.06	.06	.05	.02	-.05	-.03	-.04

*correlation is significant at p > .01 level

Study 2 Discussion

Correlational analysis revealed that only item 9, 'throwing objects at others,' was significantly correlated with age. All other items, the externalizing scale, internalizing scale, and total score were not significantly related to age. These results, with the exception of item 9, support the hypothesis. Overall, these results suggest that children with ASD, as they become older, tend to exhibit about the same challenging behaviors, and at the same severity level. This is consistent with research indicating that challenging behaviors in the ASD population are chronic (Berkson, 2002; Murphy, et al., 2005), and falls in line with findings by Murphy and associates (2009). In a sample of 157 children, 3 to 14 years of age with ASD, Murphy and associates (2009) found no significant relationship between age and frequency or severity of aggression, SIB, or stereotypies.

Interestingly, only one item, 'throwing objects at others' was significantly correlated with age, where the occurrence and severity decreased with age. This is consistent with research demonstrating that some challenging behaviors, such as tantrum behaviors, decrease as typically developing children age (Berkson, 2002). However, 'throwing objects at others' does not fully encompass the topography of temper tantrums. During temper tantrums, children flail their limbs, and scream (Ando & Yoshimura, 1979; Dominick et al., 2007; Sturmey et al., 2008). Children also often throw items that are nearby; though they are not necessarily throwing the objects at other people. However, if other people are nearby, it may appear this way. If throwing objects at others was occurring as part of a temper tantrum, then perhaps caregivers would have been more likely to also endorse 'kicking objects,' 'banging on objects with hand,' and 'yelling/shouting at others.' Yet, these items were not significantly correlated with age.

The significant negative correlation found for 'throwing items at others' is not consistent with research by Murphy and colleagues (2005; 2009). Before proceeding it is important to note

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that 'throwing items at others' can be considered a form of physical aggression, destructive behavior, or occurring as part of a temper tantrum. Murphy and colleagues (2005) found that the percent endorsement of participants with marked impairment in destructive and aggressive behaviors increased slightly after 12 years, and the percent endorsement of temper tantrums decreased 1.1% after 12 years for people with ID or Autism. Murphy and associates (2009) found that physical aggression was not significantly correlated with age among children with an ASD. However, the age ranges of these studies varied slightly with the current study, where the ages ranged from 2 to 16 years of age. The age range of the study by Murphy and associates (2005) was from 2.2 to 18.1 years of age for time 1 and from 14.2 to 30.4 years of age for time 2. The Murphy and colleagues (2009) study consisted of children from 3 to 14.2 years of age. Perhaps differences in participant ages as well as differences in definitions of the challenging behaviors account for the current study's different findings. Furthermore, Murphy and colleagues (2005; 2009) did not specifically examine 'throwing objects at others.'

Although challenging behaviors are thought to be chronic in the ASD population, perhaps toddlers with ASD engage in even greater amounts of 'throwing objects at others' or engage in this challenging behavior in a more severe manner than older children and adolescents with ASD. Research has found that decreases in challenging behaviors among typically developing children (Castiglia, 1988; Stevenson & Richardson as cited in Murphy et al., 2005) and children with developmental disabilities (Sigafoos, 2000) are related to increases in communication abilities (Castiglia, 1988; Stevenson & Richardson as cited in Murphy et al., 2005). Perhaps as children with ASD gained more appropriate communication skills, the occurrence and severity of 'throwing items at others' decreased.

However, if this was the case, than other items should have decreased over time. Although all other items, scales and the total score did not show a significant correlation between

age and challenging behaviors, 7 items, both scales, and the total score demonstrated very low non significant negative correlations with age. The 7 items that displayed non significant correlations with age were 'poking self in eye,' 'removal of clothing at inappropriate times,' 'unusual play with objects,' 'playing with own saliva,' 'banging on objects,' 'leaving the supervision of caregiver without permission,' and 'aggression towards others.' There is no research to explain why these items as opposed to other items had negative correlations.

Overall, the correlation coefficients found in this study are similar to most of the correlation coefficients found in Murphy and associates (2009). For example, the correlation coefficients in this study ranged from an absolute value of .01 to .26 (all very low), whereas correlation coefficients in the Murphy and associates (2009) study ranged from an absolute value of .001 to .700 (very low to moderate). Besides from the correlation coefficient of .700 for severity of SIB, all other correlation coefficients were .142 and lower. Slightly contrasting with Murphy and associates (2009) the correlation coefficients representing the relationship between age and items reflecting SIBs were very low, at .01, -.02, and .05. Although this study did not have a large enough sample size to accurately reject the null hypothesis an adequate proportion of the time when using a very small effect size (i.e., .13), there was adequate power for effect sizes of .20 or greater. Furthermore, the estimated critical value for Spearman's rho was only six tenths of a point greater than the found median effect size. As the critical value for Spearman's rho was determined using a sample size of 100 rather than 200, the critical value of Spearrnan's rho is actually less than .19; however the exact amount is not known. There is one item that has an absolute correlation coefficient of .13 (i.e., 'leaving the supervision of caregiver in some way'). Therefore, this item may have been significant if a larger sample size was used. Although a greater sample size may have made small correlation coefficients significant, it would also signify that only a very small proportion of the variance in this specific challenging behavior was

explained by age. For example, in this study a small correlation coefficient of -.26 was significant. Although this was significant, this implies that only 7% of the variance in throwing items at others was accounted for by age. As such, the majority of the variance in throwing item at others was explained by other factors. Other limitations include non random sampling which was discussed more in-depth in the discussion section of Study 1.

Although some of the findings are not fully supported by prior research, this is one of the few studies specifically examining the relationship between age and challenging behaviors in the ASD population. As there is not much research specifically analyzing age and challenging behaviors in the ASD population, future research should replicate this study to determine whether findings are robust across various samples. Although a large sample size was used in this study, further research will allow generalization, and will better facilitate clinicians' treatment in regards to challenging behaviors. To provide greater information about the fluctuations in challenging behaviors among people with ASD across their lifespan, future studies should also use differing age ranges when examining these relationships. Knowledge about the presentation of challenging behaviors across the lifespan for the ASD population will help guide the treatment process. In addition, future studies should examine the relationship between successful functional communication training and decreases in throwing objects at others.

Study 3 Methods

<u>Participants</u>

  Participants consisted of 82 children and adolescents with typical development ($n = 43$)

and ASD ($n = 39$). Children and adolescents with ASD as well as typically developing controls

were included into this study so their average scores could be compared against each other on the

BASC-2 PRS. Since the number of participants in the comparison group ($n = 43$) is within 1.5

times the number of participants in the ASD group ($n = 39$), the number of comparison

participants is appropriate (Leech et al., 2008). Inclusion into the study included having no

missing data on all subscales, scales, and composites of the BASC-2. As inclusion criteria into

the ASD and typically developing groups were the same as in Study 1, view Study1 for more

information. Table 10 highlights demographic information for the ASD and typically developing

groups.

Table 10
Demographic information for the ASD and typically developing groups

Group	n	Age Range	Age		Gender (%)		Ethnicity (%)			
			M	SD	Male	Female	C	A	L	O
ASD Group	39	5 - 16	9.41	2.95	79.5	20.5	71.8	15.4	10.3	2.6
Typical Group	43	5 - 13	8.21	2.04	41.9	58.1	83.7	4.7	7.0	4.7

Note: n = number of participants per group, M = mean, SD = standard deviation, C = Caucasian,
A = African American, L = Latino, and O = other ethnicity.

  The age range of children and adolescents with ASD ($n = 39$) was 5 through 16 years of

age ($M = 9.41$, $SD = 2.95$). The majority of the ASD group was male (79.5%) and Caucasian

(71.8%). Eleven (28.2%) of these children and adolescents with ASD had 1 or more previous or

current comorbid diagnoses. These diagnoses included Attention Deficit Hyperactivity Disorder

($n = 5$, 12.8%), a mood disorder ($n = 2$, 5.1%), an anxiety disorder ($n = 2$, 5.1%), Selective

Mutism ($n = 1$, 2.6%), rule out Schizophrenia ($n = 1$, 2.6%), and Stereotypic Movement Disorder ($n = 1$, 2.6%), Borderline Intellectual Functioning ($n = 1$, 2.6%). Furthermore, at least 7 (17.9%) of children and adolescents have a comorbid ID diagnosis. There were 15 children and adolescents with missing data for whether they had a comorbid ID diagnosis. Twenty of the children and adolescents with ASD (51.3%) were taking psychotropic medication at the time of data collection, with 12 taking two or more psychotropic medications. Among the children and adolescents in this study, 12 were prescribed psychostimulants, 9 antipsychotics, 8 antidepressants, 4 mood stabilizers, and 1 was prescribed anti-anxiety medication. Out of the children and adolescents with ASD in this study 35 (89.7%) were verbal and 4 (10.3%) were non-verbal.

As Table 10 shows, the age range of the typically developing group was from 5 through 13 years of age ($M = 8.21$, $SD = 2.04$). The majority of the typically developing group was female (58.1%) and Caucasian (83.7%). None of the children and adolescents in the typically developing group had any previous or current comorbid diagnosis at the time of this study. Additionally, all of the participants in the typically developing group were verbal.

Hypotheses

It was predicted that the ASD group, compared to the typically developing group, would score significantly higher on the externalizing composite. A previous study by Knoll (2008) found that children with ASD were more likely to score higher on the externalizing composite than typically developing children. Since the hyperactivity, aggression, and conduct problems subscales combine to form the externalizing composite, it was also predicted that the ASD group would score significantly higher on these subscales than typically developing children.

In regards to the internalizing composite, it was predicted that children with ASD would score significantly higher than typically developing children. It was also predicted that the ASD

group would score significantly higher on the anxiety and depression subscales. Knoll (2008) found that, compared to typically developing controls, not all ASD groups scored significantly greater on the anxiety and depression subscales of the BASC-2. However, other studies found that, when compared to community samples, children and adolescents with ASD display significantly greater levels of anxiety (MacNeil, Lopes, & Minnes, 2009), and depression (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000). Although children with ASD may have increased medical problems (Gillberg & Billstedt, 2000), these appear to be diagnosable. Additionally, Knoll (2008) found that both the low and high functioning ASD groups did not score significantly differently on the somatization subscale than typically developing controls. As such, it was predicted that the ASD group would not score significantly higher on the somatization subscale. Since two of the subscales that form the internalizing composite (i.e., depression and anxiety) were predicted to be significantly higher for the ASD group, it was further hypothesized that children with ASD would have significantly greater scores on the internalizing composite than typically developing children. The atypicality scale consists of items relating to hallucinations, odd behaviors, and stereotypies. Since children and adolescents with ASD often display stereotypies (APA, 2000; Bodfish et al., 2000; Nicholas et al., 2008 Matson, Wilkins, & Macken, 2009), as well as odd behaviors, such as unusual play (Matson, Wilkins, & Macken, 2009), it was predicted that the ASD group would score significantly higher on the atypicality scale than the typically developing group.

In regards to attention problems it was hypothesized that the ASD group would display significantly greater scores than typically developing controls. Research has found that inattention is common in the ASD population (APA, 2000; Leyfer, Bacalman, Davis, Dinh, & Morgan et al, 2006). Furthermore, Knoll (2008) found that children with both low and high

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functioning autism scored significantly higher on the attention problems subscale than typically developing controls.

As Knoll (2008) found that children and adolescents with ASD had significantly greater scores than a typically developing group on the withdrawal subscale, it was hypothesized that the current study would find the same results. It was further predicted that the ASD group would have a significantly higher BSI score than the typically developing group. Knoll (2008) found these results when comparing typically developing children and adolescents to children and adolescents with ASD on the BASC-2. Moreover, this index is comprised of the externalizing composite, attention problems, atypicality, and withdrawal, which were all hypothesized to be significantly greater for the ASD group.

Knoll (2008) found that the ASD group demonstrated significantly lower scores on the adaptability composite, and all subscales that comprise this composite (i.e., functional communication, social skills, activities of daily living, and leadership), than the typically developing group. It was hypothesized that this study would show the same results.

Procedure

The same procedures used for data collection purposes in Study 1 were also employed for this study.

Measures

This study focused on comparing typically developing children and adolescents to children and adolescents with ASD on all BASC-2 subscales, composites and indexes. The BASC-2 preschool, child and adolescent versions, which were previously discussed in the measure section of Study 1, were used for this study.

Study 3 Analysis

<u>Power Analysis</u>

Overall, this sample is not normally distributed. As such multiple Mann Whitney nonparametric tests were used. As there is no agreed upon method in the literature for how to estimate the exact power obtained using nonparametric tests, a priori power analysis was conducted to estimate the sample size required to obtain an appropriate level of power. Although this does not provide the exact power this study has, it is important as it informs the reader as to whether this study had an appropriate level of power. To determine the minimum level of participants this study needed to obtain an appropriate level of power, Asymptotic Relative Efficiency (A.R.E) was used (Lehmann, 2006). A.R.E entails calculating the sample size required for a two sample *t* test and then dividing the number of required participants by the underlying distribution of the Mann Whitney test. In an effort to be conservative, the lowest possible value for the underlying distribution of the Mann Whitney test was used. This lowest A.R.E value versus the *t* test is .864 (Lehmann, 2006). Thus, the number of participants required to obtain an appropriate level of power was determined for a two sample *t* test, and then this sample size was divided by .864.

A power analysis program, GPOWER (Erdfelder et al., 1996) was used to determine the sample size required for a two sample *t* test. An a priori analysis of significance level, using the difference between two independent means (two groups) statistical test, was run on GPOWER. To determine the minimum number of participants required, appropriate level of power, direction of the test, significance level, and effect size were considered. A power level of .80 was used (Hinkle et al., 2003). As this study determined if the means were significantly greater than or less than each other, a one tailed test was used. A significance level (α) of .05 was used, power level of .80, as well as a large effect size of 1.87 (Cohen, 1992).

To determine the effect size needed to power this study, previously published data was reviewed. Only one study, Knoll (2008), contained the necessary information to compute the effect size between typically developing children and children with ASD on the BASC-2. Since Knoll (2008) compared typically developing children to children with high functioning ASD and low functioning ASD, the high functioning ASD and low functioning ASD groups were averaged before computing the effect size. The following equation was used to compute the effect size: (Mean ASD – Mean Typical)/SD_{pool} (Hinkle et al., 2003). See Table 11 for computed effect sizes.

The median effect size, rather than the mean effect size was used so that the final effect sizes were not inflated or deflated by outliers (Leech, Barret, & Morgan, 2008). The median effect size for all BASC-2 composites, subscales, scales, and indexes was 1.87, which is a large effect size. Interestingly, when the effect size of this study's sample was conducted post hoc, it was similar (see Table 11).

Based on a one-tailed test with a significance level (α) of .05, a large effect size of 1.87, an allocation ratio of 1.1 between groups, and power of .80, the necessary sample size was 5 in each group with a total sample size of 10. Next, each obtained sample size was divided by .864 to determine the estimated minimum sample size required to have appropriate power for the Mann Whitney test. Five divided by .864 equaled 5.79 and ten divided by .864 was 11.57. To determine required sample size, all numbers were rounded up. As such, this study needed to have at least 6 participants in each group, and have a total sample size of at least 12 for this study to have appropriate power. Since this study had 39 participants in the ASD group, 43 in the typically developing group, and has a total sample size of 82, this reveals that the current study had more than enough power to gain reliable results.

Table 11

Effect Sizes between typically developing children and children with ASD on the BASC-2

BASC-2	Effect Sizes from Knoll (2008)	Effect Sizes from Current Data
Hyperactivity Subscale	1.58	.64
Aggression Subscale	.23	.20
Conduct Subscale	.21	.49
Externalizing Composite	.76	.64
Atypicality	2.67	2.98
Anxiety Subscale	-.56	-.25
Depression Subscale	.68	.61
Somatization Subscale	-.04	.38
Internalizing Composite	.02	.25
Withdrawal Scale	2.16	1.84
Attention Problems Scale	2.26	1.20
Behavioral Symptom Index	2.41	1.94
Adaptability	-1.48	-1.61
Social Skills	-2.54	-2.00
Leadership	-3.27	-2.72
Activities of Daily Living	-2.67	-1.72
Functional Communication	-3.53	-2.23
Adaptive Behavior Composite	-3.43	-2.55
Median Effect Size	1.87	1.41

Statistical Analysis

To assess differences in BASC-2 scores between typically developing and ASD children and adolescents, 18 separate Mann Whitney exact tests were used, one for each subscale, composite, scale or index of the BASC-2. Mann Whitney tests were used since, overall, the data

for this study was not normally distributed (Field, 2005). Significance was calculated and

reported using the exact rather than the asymptotic method because the exact method is more

accurate (Field, 2005). A significance level of $p < .05$ was used to determine significance. The

median rather than the mean were only reported for some results as the median is more

appropriate to report for nonparametric tests (Field, 2005). Furthermore Chi Square and Mann

Whitney tests were used to determine if there were any significant differences between the

groups in regards to demographic information that may affect results. A chi squared analysis was

used for categorical information and a Mann Whitney test was used for continuous data.

Results

A chi squared analysis revealed that the ASD and typically developing groups differed

significantly in terms of gender, $\chi^2(1) = 12.04$, $p < .05$. Specifically, there were a higher

percentage of males in the ASD group (79.5%) than the typically developing group (41.9%), and

there were a higher percentage of females in the typically developing group (58.1%) than the

ASD group (41.9%). This is consistent with research showing that more males evince ASD than

females at about a 3 to 1 ratio (Nicholas et al., 2008). Thus, the gender distribution appears to

match the distribution of the general population. Chi squared analysis also demonstrated that the

ASD and typically developing groups did not differ significantly in terms of ethnicity, $\chi^2(3) =$

4.10, ns. However, the groups differed significantly on whether they were verbal or nonverbal,

$\chi^2(1) = 4.64$, $p < .05$. Specifically, there were a higher percentage of nonverbal participants in the

ASD group (10.3%) than the typically developing group (0%). Mann Whitney U tests indicated

that the typically developing ($Mdn = 8.00$, $M = 8.21$) and ASD ($Mdn = 10.00$, $M = 9.41$) groups

did not significantly differ in terms of age, $U = 650.00$, ns.

Results of Mann Whitney U tests between the ASD and typically developing groups are

found on Table 12. Results indicate that scores on the hyperactivity subscale, conduct problems

Table 12

Medians, means and standard deviations for the ASD and typically developing groups on BASC-2 composites and subscales

BASC-2	Group	Mdn	M	SD	Mann Whitney U	p level	Hypotheses	Does Hypothesis Match?
Hyperactivity	ASD	61.00	62.44	14.18	361.59	< .001	ASD Higher	Yes
	Typical	45.00	48.53	11.43				
Aggression	ASD	48.00	52.00	11.04	706.50	.11	ASD Higher	No
	Typical	46.00	49.16	9.47				
Conduct problems	ASD	51.00	51.72	10.05	561.00	<.01.	ASD Higher	Yes
	Typical	46.00	45.72	8.24				
Externalizing Composite	ASD	54.00	55.92	11.57	463.00	< .001	ASD Higher	Yes
	Typical	45.00	47.53	8.86				
Anxiety	ASD	42.00	47.49	17.38	675.00	.07	ASD Higher	No
	Typical	49.00	50.35	12.24				
Depression	ASD	54.00	56.97	15.12	471.00	< .001	ASD Higher	Yes
	Typical	45.00	47.47	11.33				
Somatization	ASD	50.00	50.90	12.93	644.50	< .05	ASD not Higher	No
	Typical	42.00	45.60	8.73				
Internalizing Composite	ASD	47.00	52.36	16.63	725.50	.15	ASD Higher	No
	Typical	45.00	47.30	11.31				
Atypicality	ASD	78.00	78.79	17.70	35.00	< .001	ASD Higher	Yes
	Typical	41.00	44.42	4.93				
Withdrawal	ASD	73.00	74.33	16.74	107.50	< .001	ASD Higher	Yes
	Typical	47.00	46.84	12.43				

Table 12 Continued

BASC-2	Group	Mdn	M	SD	Mann Whitney U	p level	Hypotheses	Does Hypothesis Match?
Attention problems	ASD	64.00	64.05	7.47	222.00	< .001	ASD Higher	Yes
	Typical	48.00	50.51	9.52				
BSI	ASD	68.00	69.15	11.52	111.00	< .001	ASD Higher	Yes
	Typical	45.00	47.47	8.34				
Adaptability	ASD	35.00	35.82	8.90	208.50	< .001	ASD Lower	Yes
	Typical	51.00	50.28	8.39				
Social Skills	ASD	29.00	29.67	9.84	143.00	< .001	ASD Lower	Yes
	Typical	48.00	49.86	10.53				
Leadership	ASD	29.00	30.31	7.47	40.00	< .001	ASD Lower	Yes
	Typical	53.00	52.16	7.79				
Activities of daily living	ASD	29.00	30.62	10.19	159.00	< .001	ASD Lower	Yes
	Typical	49.00	48.86	8.03				
Functional communication	ASD	28.00	27.87	9.91	96.50	< .001	ASD Lower	Yes
	Typical	52.00	51.23	10.31				
Adaptive skills Composite	ASD	25.00	27.05	9.30	53.50	<.001	ASD Lower	Yes
	Typical	51.00	50.67	8.09				

Note: Mdn = Median, M = Mean, SD = Standard Deviation
Mann Whitney U tests were significant at $p < .05$

subscale, externalizing composite, depression subscale, somatization subscale, atypicality

subscale, withdrawal subscale, attention problems subscale, and BSI index were all significantly

greater for the ASD group compared to the typically developing group. The ASD group did not

score significantly higher than the typically developing group on the aggression subscale, anxiety

subscale, and the internalizing composite. Furthermore, the ASD group scored significantly

lower on adaptability, social skills, leadership, activities of daily living and functional

communication subscales when compared to typically developing children and adolescents.

Additionally, the ASD group scored significantly lower than the typically developing group on the adaptive skills composite.

Study 3 Discussion

The results suggest that children and adolescents with ASD have significantly greater difficulties in adaptive skills, such as functional communication, social skills, adaptability, activities of daily living, and leadership than typically developing controls. These findings were consistent with this study's hypotheses and also with previous findings (Knoll, 2008). Significantly lower scores on subscales relating to communication and social skills attest to the fact that these are also two core symptoms of ASD (APA, 2000). In terms of adaptability, the findings are in line with research showing that many children with ASD exhibit difficulties with changes in routine and environmental changes (Schreibman, 2005). Children with ASD also tend to have lower than average daily living skills as measured by the Vineland Adaptive Behavior Scales (Perry, Flanagan, Geier, & Freeman, 2009). Communication, socialization, adaptability, and daily living skills consist of skills necessary to be a good leader. As such, deficits in leadership skills in children with adolescents with ASD are not surprising.

As hypothesized, the atypicality, withdrawal, and attention problems subscales were all significantly higher for the ASD group than for the typically developing group. These findings are consistent with Knoll (2008), who compared ASD and typically developing children on BASC-2 subscales, composites and indexes. Items comprising the atypicality subscale relate to repetitive behaviors, being out of touch with reality, and odd behaviors, all of which many children and adolescents with ASD exhibit (APA, 2000; Schreibman, 2005; Matson, Wilkins, & Macken, 2009). The significantly higher scores of the ASD group on the withdrawal subscale are consistent with the fact that people with ASD usually prefer not to interact with others and do not typically engage in friendship making behaviors (APA, 2000; Schreibman, 2005).

The significantly higher scores on the attention problems subscale of the ASD group over the typically developing group reflect research demonstrating that children and adolescents with

ASD exhibit attention problems, especially when they are not engaged in their preferred task (Leyfer et al., 2006). Leyfer and colleagues found that 55% of children with Autistic Disorder exhibited impairing ADHD symptoms. This is compared to 7.8% of 102,353 children and adolescents in the United States having a diagnosis of ADHD (Center for Disease Control and Prevention, [CDC], 2003), indicating that more children and adolescents with ASD display impairing ADHD symptoms than that of the overall population.

Additionally, the ASD group had significantly greater scores on the hyperactivity subscale, conduct problems subscale, and externalizing composite, which is consistent with the hypothesis and previous research by Knoll (2008). The hyperactivity subscale consists of items relating to attention and self control concerns, which children and adolescents with ASD often have problems with (APA, 2000; Leyfer et al., 2006). As such, the significantly greater scores on the hyperactivity subscale reflect the greater impairments of the ASD group with these skills. There is much research demonstrating that children and adolescents with ASD exhibit significantly greater amounts of challenging behaviors than typically developing controls (Gurney, McPheeters, & Davis, 2006, as cited in Mudford et al., 2008; Matson, Wilkins, & Macken, 2009; Nicholas et al., 2008). Consistent with previous research (Knoll, 2008), this study found the ASD group to score significantly greater on the conduct problems subscale. The externalizing composite is comprised of the hyperactivity, conduct problems and aggression subscales. Since the majority of subscales were significantly greater for the ASD group when compared to the typically developing group (i.e., hyperactivity and conduct problems subscales), it is consistent that the externalizing composite is significantly greater for the ASD group.

Contrary to the hypothesis and previous research, the ASD group did not display significantly greater scores on the aggression subscale. Nicholas and colleagues (2008) found that significantly more 8 year old children with ASD displayed temper tantrums and other

aggressive behaviors when compared to typically developing controls. However, some items comprising the aggression subscale of the BASC-2 require the person have the ability to communicate verbally in an effective manner, which many people with ASD lack. In this study's sample, 10.3% of the ASD group was nonverbal at the time of the study, and at least 17.9% of the ASD group had a comorbid diagnosis of ID, which may further decrease a person's potential for engaging in effective verbal communication. Some items requiring verbal communication on the BASC-2 PRS aggression subscale is 'calls other people names,' 'argues when denied own way,' and 'teases others.' The inability of many caregivers of ASD children or adolescents to endorse these items may have decreased the mean score on this subscale so that it was not significantly greater than the typically developing group.

Additionally, the current study's sample included Autistic Disorder, PDD-NOS and Asperger's Disorder, as well as low and high functioning ASD into one group. Including many types of ASD into one group may have attenuated the scores of people with certain types of ASD, thereby making all differences non significant. Perhaps only children and adolescents with high functioning ASD evince significantly greater symptoms of aggression than typically developing controls. Knoll (2008) found that children with low functioning ASD did not score significantly different than typically developing children on the aggression subscale. However, children with high functioning ASD scored significantly greater on the aggression subscale than both the typically developing and low functioning ASD groups. In contrast, Matson, Wilkins, and Macken (2009) found that children with more severe ASD exhibited greater frequency and severity of challenging behaviors, including aggressive challenging behaviors. Regardless of whether children and adolescents with more or less severe forms of ASD tend to exhibit more aggression, combining people with these different forms of ASD probably affected results.

The ASD group had significantly higher scores on the depression subscale, the somatization subscale and the BSI compared to the typically developing group. Significantly higher scores on the depression subscale for the ASD group is consistent with the hypothesis and research demonstrating that children with ASD exhibit greater amounts of depression than typically developing children (Kim et al., 2000). Inconsistent with predictions, the ASD group scored significantly higher on the somatization subscale than did the typically developing group. Although children and adolescents with ASD may be less likely to complain of sickness and pain, some items comprising the somatization subscale ask how often your child gets sick, vomits, has stomach problems, goes to the doctor, gets ear infections, has fevers, has a sore throat, and how often your child misses days of school because of sickness. Many children and adolescents with ASD also have co-occurring medical conditions of seizure disorder (APA, 2000, Morgan, Roy, & Chance, 2003), tuberous sclerosis (Wiznitzer, 2004), sleep disorders (Richdale, 1999), visual and hearing impairments, hypothyroidism, and Fragile X syndrome (Gillberg & Billstedt, 2000), which likely cause increased visits to the doctor, and missing more days of school. Since it is more difficult for many children and adolescents with ASD to communicate in a functional manner, caregivers, out of concern for their child, may make more frequent visits to the doctor when their child is behaving irregularly. Therefore greater endorsement on the somatization subscale may reflect the greater amount of medical problems and concern of caregivers in the ASD population, rather than actual symptoms of somatization.

Differing from this study's predictions, the anxiety subscale was not significantly higher for the ASD group than the typically developing group. Symptoms of anxiety co-occur highly with ASD (MacNeil et al., 2009), from 11 to 84% depending on the study (White, Oswald, Ollendick, & Scahill, 2009). However, like the aggression subscale, the anxiety subscale has items requiring effective verbalization skills. A diagnosis of ASD entails that the person has

impairments in communication (APA, 2000). Furthermore, there were more people in the ASD than typically developing group who were nonverbal and had intellectual impairments. Ten and three tenths percent of the ASD group compared to 0% of the typically developing group was nonverbal at the time of this study. Also, at least seven participants (17.9%) in the ASD group compared to 0% of the typically developing group had a comorbid diagnosis of ID. The inability of caregivers with an ASD child or adolescent to endorse items requiring effective communication skills may have decreased the ASD group's mean score on the anxiety subscale.

Also akin to the aggression subscale, the co-occurrence of ASD and anxiety may occur predominantly with children and adolescents with high functioning ASD. Knoll (2008) found that only the high functioning ASD group scored significantly higher on the anxiety subscale than the typically developing group. Also, typically developing children received significantly higher scores on the anxiety subscale than did children with low functioning ASD (Knoll, 2008). The current study combined all types of ASD into one group, which may have attenuated higher scores of children and adolescents with high functioning ASD, thereby making differences between the ASD and typically developing groups non-significant. This combined with the likely inability of caregivers of people with ASD to endorse items requiring verbalization skills may explain this study's different findings for the anxiety subscale.

Although two subscales of the internalizing composite (i.e., depression and somatization) were significantly greater for the ASD group, the internalizing composite was not significantly different for the two groups. Perhaps the differences in the score between the two groups were lowered by the non-significant finding of the anxiety subscale, causing a non-significant difference for the internalizing composite. The externalizing composite, internalizing composite, withdrawal scale, attention problems scale, and atypicality scale all combine to form the BSI, and all except for the internalizing composite were significantly greater for the ASD than the

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typically developing group. Since the ASD group scored significantly greater on all parts of the BASC-2 that make up the BSI, other than the internalizing composite, it makes sense that the ASD group scored significantly higher on the BSI. These findings are also consistent with previous research by Knoll (2008), who found that both the high and low functioning ASD groups scored significantly higher on the BSI than did typically developing controls.

Although this study was able to examine differences between children and adolescents with ASD and typically developing controls, it is important to remember that this study was only able to determine overall group differences. Therefore, a limitation of this study is that these results are not interpretable at the individual level. Also, as previously discussed more in-depth in the discussion section of Study 1, the participants were a sample of convenience and was able to choose to participate in this study. Therefore, participants composing the ASD and typically developing groups may not represent their respective general populations. Despite these limitations, these findings still provide clinicians with additional information about how children and adolescents with ASD compare to typically developing controls on a commonly used broad band measure. Comparison to other groups and information about externalizing behaviors, internalizing behaviors, and issues related to adaptability provide clinicians with greater knowledge about the ASD population. Replication with different samples would further buttress the generalizability of these results. Future studies should also examine differences in item endorsements, rather than scores on scales, on the BASC-2 between people with various forms of ASD, typically developing controls and people with various forms of psychopathology. The findings from the aggression subscale highlight the importance for broad band measures that are more specific for use among the child and adolescent ASD population.

Overall Discussion

Recently there has been much research regarding ASD. However, there were still many gaps in the literature regarding psychometrically sound assessments for challenging behaviors specific for use in children and adolescents with ASD, the relationship between age and challenging behaviors, and how people with ASD score on a commonly used broad band measures of psychopathology and adaptive skills compared to typically developing controls. By focusing these studies on specific gaps in the literature, this paper was able to provide a more specific measure to assess challenging behaviors in the ASD population (i.e., the ASD-PBC), further the understanding of how age may affect the occurrence and severity of specific challenging behaviors, and inform clinicians on how children and adolescents tend to score on the BASC-2 compared to typically developing controls. As such, these studies were able to further the knowledge of people with ASDs in a variety of ways.

In general, Study 1 supported the preliminary convergent and discriminant validity of the ASD-PBC for children and adolescents with ASD by comparing scales to specific subscales and composites of the BASC-2. Thus, this study provides clinicians with an efficient and easy to administer measure that was designed specifically to assess challenging behaviors in children and adolescents with ASD. Study 2 found that age was only significantly related to 'throwing objects at others,' where it was more likely to see this challenging behavior occur or be more severe in younger children. No other items, scales, or total score on the ASD-PBC were significantly related to age. These findings suggest that, except for 'throwing objects at others', aggressive behaviors, SIBs, stereotypic behaviors, leaving the supervision of caregivers, and inappropriate sexual behaviors do not change in occurrence or severity for children 2 through 16 years of age with an ASD. Knowledge about age trends of challenging behavior for people with ASD can help guide the treatment process and has important implications for prognosis. Study 3

compared children and adolescents with ASD to typically developing controls on all subscales and composites of the BASC-2. In doing so, this study found that children and adolescents scored significantly lower on all subscales comprising the adaptive skills composite as well as this composite itself. Compared to the typically developing group, the ASD group did not score significantly greater on the aggression subscale, anxiety subscale, and internalizing composite. However, ASD children and adolescents scored significantly higher than typically developing controls on the hyperactivity subscale, conduct problems subscale, externalizing composite, depression subscale, somatization subscale, atypicality, withdrawal, attention problems, and the BSI index. These findings suggest that people with ASD tend to score differently than typically developing people on this broad band measure of psychopathology and adaptive skills, in ways that may be useful to clinicians.

Despite these findings, no study is without limitations. Overall, limitations for these studies included concerns with non random sampling, sample size concerns, and the composition of groups. All studies used samples of convenience which affect the ability to generalize findings to the overall ASD child and adolescent population. Generalizability may have been affected because there may have been something unique, such as having children with more challenging behaviors or more severe ASD, that make these groups different than their overall population. Additionally, for some studies, variations in sample size may have impacted whether correlation coefficients were significant or not. With greater sample size, smaller correlation coefficients, that were not significant for groups with smaller sample sizes, were considered significant. Finally, the aggregation of a variety of types of ASD into one group, as well as the inclusion of children and adolescents with comorbid ID and ASD may have attenuated some results. Thus some results that would have otherwise been significantly different between certain subsets of ASD and typically developing controls, may not have been found to be significant. For example,

perhaps only children and adolescents with high functioning ASD present with greater levels of anxiety than the typical population. However, if both high and low functioning ASD individuals are combined together into an ASD group, this may cause there to be no significant difference between the ASD and typically developing group. As such, the significantly higher scores of the high functioning ASD group were masked.

These limitations illustrate the need for further research on all topics studied. Additional research should further validate the ASD-PBC using larger sample sizes, using different scales to validate it against, only using BASC-2 items that specifically relate to challenging behaviors as observed in the ASD population, and using different samples of children and adolescents with ASD. In regards to the relationship between age and challenging behaviors, further research using different age ranges should be conducted to provide greater understanding of how challenging behaviors are displayed across the lifespan. Also, research should focus on whether and how the topography of specific challenging behaviors change across the lifespan among those with ASD. Although this study found differences between ASD and typically developing children on BASC-2 scores, further research is warranted analyzing profiles of people with ASD on the BASC-2. To further understand scoring differences on the BASC-2, further comparisons should be made between people with ASD and a variety of psychopathologies. Moreover, the ASD group should be deconstructed so that comparisons can be made between typically developing children and adolescents, children and adolescents with comorbid ASD and ID and those without comorbid ID, and between the various ASDs themselves (i.e., Autism, Asperger's, PDD-NOS, Rett's, and Childhood Disintegrative Disorder).

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Vita

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