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Adaptive Behavior and Clinical Characteristics of Children Referred for an Autism Spectrum Disorder Evaluation

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ADAPTIVE BEHAVIOR AND CLINICAL CHARACTERISTICS OF CHILDREN REFERRED FOR AN AUTISM SPECTRUM DISORDER EVALUATION

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LIFESPAN DEVELOPMENTAL PSYCHOLOGY

ABSTRACT

The current study aimed to identify patterns of adaptive functioning in autistic children. Additionally, this study assessed predictors of adaptive functioning by examining whether cognitive ability predicted adaptive functioning in children with and without ASD and exploring whether expressive and receptive language predicted adaptive behavior and whether those relationships were moderated by an ASD diagnosis. Participants included 196 children who were evaluated for ASD at a tertiary care clinic. In this sample, 89 participants (45%) were diagnosed with ASD, 143 (73%) were male, and the average age was 6.63 years old (*SD*= 3.08). Profile analysis was used to evaluate the patterns of adaptive behavior. Results indicated that autistic children performed worse on measures of overall adaptive behavior compared to children without ASD, $F(1, 190)= 10.56$, $p=.001$. However, autistic and non-autistic children did not exhibit significantly different patterns of adaptive functioning. Both the ASD and non-ASD groups displayed similar patterns, scoring significantly higher on the daily living skills domain (*M*= 72.01) compared to the communication (*M*= 67.54) and socialization domains (*M*= 68.50). Multiple hierarchical regression was used to evaluate predictors of adaptive functioning. Due to the multicollinearity between receptive and expressive language, they were assessed in separate models. After controlling for motor abilities and maternal education, the results

indicated that participants with higher cognitive functioning had better adaptive functioning (p<.001). Neither receptive language nor expressive language were significant predictors of adaptive functioning (p= .92 and p= .17, respectively). The final model with receptive language explained 30% of the variance in adaptive functioning, F(6, 185)= 12.02, p<.001, and the model with expressive language explained 29.5% of the variance, F(6, 185)= 12.29, p<.001. In conclusion, the current findings show that children with autism had significantly poorer adaptive functioning compared to those without ASD. This study also found that cognitive functioning was significantly related to adaptive behavior, but contrary to expectations, language deficits in autistic individuals were not related to adaptive behavior as a whole. Future research should attempt to clarify the relationship between language abilities and adaptive functioning.

Keywords: autism spectrum disorder, ASD, adaptive behavior, language

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INTRODUCTION

Autism spectrum disorder (ASD) is a highly prevalent neurodevelopmental disorder that affects one in 44 children in the US (Maenner et al., 2021). According to the most recent edition of the *Diagnostic and Statistical Manual of Mental Disorde*rs (DSM-5) the diagnostic criteria for ASD indicate children must exhibit both impairment of social interaction and social communication and restricted and repetitive interests or behaviors in order to be diagnosed with ASD (American Psychiatric Association, 2013). The characteristics or symptoms of ASD often contribute to impaired adaptive behavior, which refers to the social or practical skills required to function independently in daily life (American Psychiatric Association, 2013). For instance, adaptive behavior includes the ability to get dressed appropriately and independently, participate in social interactions, and follow the directions and sequencing of safety rules.

Previous research consistently demonstrates individuals with ASD have lower adaptive functioning compared to those without ASD (Bal et al., 2015; Carpentieri & Morgan, 1996). While cognitive ability and language skills are typically considered the best predictors of later outcomes for autistic children (Magiati et al., 2014), adaptive behavior may be used to predict long-term outcomes more accurately among children who have average cognitive abilities (Farley et al., 2009). Additionally, early intervention targeted at improving adaptive functioning results in better long-term outcomes for autistic children (Dawson et al., 2010). Programs designed to foster the development of adaptive skills help develop independence and responsibility in autistic children (Myers & Johnson, 2007). As such, it is important to evaluate clinical characteristics related to adaptive

behavior to gain a better understanding of the presentation of adaptive behavior in autistic children and help determine which interventions and treatment would be most beneficial.

Language ability is one clinical characteristic that warrants further investigation related to adaptive skill development. Communication deficits are a hallmark characteristic of ASD (American Psychiatric Association, 2013). Many autistic children develop language at a slower rate than typically developing children (Mitchell et al., 2006), yet there has been limited research connecting language ability to adaptive functioning. Since language is necessary for communication, it likely plays a key role in children's ability to socialize and function independently in daily tasks. However, the relationship between language development and adaptive behavior has been understudied in autistic children. The research to date indicates there is a positive relationship between language and adaptive behavior (Bal et al., 2015; Di Rezze et al., 2019; Park et al., 2012), but additional studies are needed to replicate these findings. Thus, the goal of this thesis was first, to examine adaptive behavior profiles in a clinical sample of children who were evaluated for ASD, and second, to explore the relationship between language and adaptive functioning.

ASD Diagnosis

ASD is a complex neurodevelopmental disorder which shows variation in presentation among individuals. As such, diagnosis is best determined through a comprehensive evaluation from a multi-disciplinary team. In addition to completing the gold standard diagnostic measures of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) and the Autism Diagnostic Interview, Revised (ADI-R), children who have suspected ASD are best served through evaluations across multiple areas of functioning,

such as psychology, speech language pathology, and occupational therapy (Huerta & Lord, 2012).

Oftentimes, parents begin to notice signs of ASD in their children, such as a delay in the onset of their child's spoken language, around 18 months (De Giacomo & Fombonne, 1988). However, the most stable diagnosis of ASD does not occur until children are about three years of age (Brian et al., 2016). The delay in diagnosis may be due to the wide variety of symptoms associated with ASD, and the difficulty discerning ASD from other developmental disorders. The variety of symptoms to discern may include trouble participating in back-and-forth conversations, adverse reactions to certain sounds, highly fixated interests, or stereotyped behaviors, such as hand flapping. Although ASD is typically diagnosed in childhood, the symptoms affect individuals throughout their lives (Brugha et al., 2011). The long-term impact on individuals' lives highlights the importance of continued research.

ASD and Adaptive Behavior

Adaptive behavior is defined as an individual's ability to be self-sufficient in performing daily tasks (Sparrow et al., 2005). Importantly, adaptive functioning refers to individuals' typical performance of daily activities, rather than only to ability. For example, a five-year-old child who usually dresses themselves displays a high level of adaptive functioning, while a five-year-old who can get dressed on their own but typically will not, displays a lower level of adaptive functioning. Poor adaptive behavior prevents individuals from achieving functional independence, and stronger adaptive functioning is associated with more optimal outcomes later in life, such as the ability to obtain and maintain a

job (Farley et al., 2009). Deficits in adaptive behaviors tend to persist throughout the lifetime (Mathews et al., 2015), so it is critical to identify populations with poor adaptive functioning, where additional intervention is needed (Klin et al, 2007).

Adaptive behavior is age-related, meaning as children age the skills constituting adaptive behavior advance and become more complex. Young children are expected to perform basic adaptive behaviors, such as feeding themselves or saying their name, while older children are expected to be able to perform increasingly difficult tasks to function independently, such as preparing food, cleaning, or acting appropriately in social situations. Autistic children tend to demonstrate higher levels of adaptive behavior at younger ages, when the tasks expected for them are less demanding (Klin et al., 2007). Over time adaptive skills typically decline in autistic individuals and become more discrepant from cognitive abilities as age increases. Accordingly, older children with ASD tend to have relatively poor adaptive skills compared to mental abilities than younger children with ASD (Kanne et al., 2011).

Autistic children additionally exhibit greater adaptive behavior deficits when compared to typically developing individuals or individuals with other developmental disabilities. For instance, autistic children tend to develop daily living skills more slowly than typically developing children (Di Rezze et al., 2019). Bal and colleagues (2015) found that children with ASD experienced more difficulty attaining daily living skills than children with other non-ASD, developmental disorder diagnoses. All the children included in this study were suspected of having ASD, so the non-ASD group contained participants who at-risk for ASD but received the diagnosis of a different disability or psy-

chiatric disorder. Throughout childhood and adolescence, from ages 2- 21, autistic individuals showed a slower progression in the development of daily living skills, such as personal hygiene and money management, than those with nonspectrum diagnoses. Another study found that when matched for age and intelligence quotient (IQ), autistic individuals displayed poorer adaptive functioning compared to those who were typically developing (Kenworthy et al., 2010). These results support a disproportionately greater impairment in adaptive functioning in children with ASD.

A main focus of the research on adaptive behavior has been evaluating whether there is a typical adaptive behavior profile in autistic children. The Vineland Adaptive Behaviors Scales is one of the most widely used measures for evaluating adaptive behavior (Sparrow, 2011). A 2001 study by Luisell et al. assessed the most common instruments used across national service centers in the United States for individuals with ASD and found that 60.6% of practitioners reported using the Vineland Adaptive Behavior Scales when measuring adaptive behavior. Due to its widespread use, most of the research on adaptive behavior profiles focuses on the three primary domains specifically identified and defined by the Vineland Adaptive Behavior Scales: daily living skills, socialization, and communication (Sparrow et al., 2005). The socialization domain assesses individuals' functioning in social situations, the daily living skills domain measures performance of age-appropriate tasks such as feeding, dressing, cleaning and money management, and the communication domain assesses how well individuals listen, understand, and express themselves on a daily basis.

Most studies have indicated children with ASD experience a general pattern of adaptive functioning with the highest impairments in socialization and moderate delays in

communication and daily living skills (Botle & Poustka, 2002; Loveland & Kelley, 1991; Kanne et al., 2011; Stone et al., 1999; Volkmar et al., 1987). Children with ASD also tend to exhibit a relative strength in daily living skills compared to the other adaptive behavior domains (Bal et al., 2015; Botle & Poustka, 2002). However, some research did not find this expected profile of adaptive behavior. Mathews et al. (2015) examined children and adolescents with ASD across a range of intellectual abilities and found that daily living skills were most impaired while the communication domain was the least impaired. Due to the conflicting results, additional research is needed for clarification.

Research has attempted to explain variability from the typical profile in adaptive behaviors by the severity of ASD symptoms. The results, however, have been mixed. Goyla and McIntyre (2018) found that ASD symptom severity accounted for variability in children's adaptive functioning. Specifically, children who scored higher on measures of symptom severity experienced greater decreases in adaptive functioning, which was especially true for the socialization domain of adaptive behavior. Conversely, Kanne and colleague's (2011) study of 1,089 children with ASD indicated autism symptomology was not related to adaptive function. However, Kanne et al. (2011) included cognitive functioning, measured by IQ, in their study, and Goyla and McIntyre (2018) did not. Prior research has linked cognitive ability and adaptive behavior (Klin et al., 2007; Pathak et al., 2019), so these results indicate that cognitive functioning may explain the relationship between ASD symptom severity and adaptive functioning. Additionally, one longitudinal study exploring the effect of symptomology found that ASD symptom severity predicted later daily living skills (Bal et al., 2015; Green & Carter, 2014), while a different longitudinal study did not find a difference in daily living skill outcomes among

children with differing symptom severity (Di Rezze et al., 2019). These mixed results may indicate it is not autism symptomology as a whole that is related to adaptive behavior, but rather certain ASD symptoms, such as language deficits, may be associated with adaptive functioning.

Cognitive Ability and Adaptive Behavior

Some of the heterogeneity in the adaptive behavior profile of individuals with ASD has been attributed to impaired cognitive functioning (Kanne et al., 2011; Klin et al., 2007; Pathak et al., 2019). Impaired cognitive ability is a common feature in individuals with autism. Research has indicated 35.2% of children with ASD are classified as having intellectual disability (Maenner et al., 2021). It is generally accepted that lower intellectual ability is associated with decreased adaptive functioning in individuals with ASD (Kanne et al., 2011). Pathak et al. (2019) evaluated adaptive behavior profiles in 2,538 school-aged children and found that scores on the Vineland Adaptive Behaviors Scales were strongly positively correlated with IQ, indicating children with better cognitive functioning had increased adaptive behavior. Klin and colleagues (2007) were interested in the relationship between ability and disability in higher functioning children with ASD. Ability was measured through adaptive functioning, and disability was measured with ASD symptomology. While there was not a strong association between adaptive function and disability, there was a positive relationship between IQ and adaptive behavior.

Another study assessed the association between adaptive behavior and cognitive ability, defined by IQ, in individuals with ASD with an intellectual disability compared to

those with ASD without an intellectual disability (Botle & Poustka, 2002). The presence of an intellectual disability moderated the impact of cognitive functioning on adaptive behavior, where the relationship between IQ and adaptive behavior was magnified in individuals without an intellectual disability compared to those with an intellectual disability. However, in line with the previous studies, this study found that adaptive behavior was positively associated with global intellectual ability. Overall, these studies highlight the expected presentation of adaptive behavior among individuals with ASD based on cognitive ability. Specifically, individuals with lower cognitive ability have poorer adaptive functioning. These findings are also important for demonstrating that despite average or high IQ, children with ASD experience impairments that impact their daily life and adaptive functioning (Perry et al., 2009).

ASD-Related Language Impairments

Language deficits are a common attribute in autistic individuals. Research indicates autistic children are significantly more likely to experience impaired language development compared to typically developing children (Kwok et al., 2015; Mitchell et al., 2006), and language disorder is often comorbid with ASD (American Psychiatric Association, 2013). Autistic individuals tend to have difficulty understanding communication from others as well as difficulty sufficiently responding to comments and questions (Capps, Kehres, & Sigman, 1998). Beyond the increased likelihood of language deficits, there is significant heterogeneity in the presentation of language skills across autistic children (Kjelgaard & Tager-Flusberg, 2001). Some autistic children may have typical lan-

guage skills while others have language skills that are significantly below age expectations. It is estimated that around 25% to 35% of individuals with ASD are nonverbal, meaning they never acquire functional language (Rose et al., 2016; Tager-Flusberg et al., 2005).

Delays in language development are reported as the earliest and most common parental concern for children with ASD (De Giacomo & Fombonne, 1988). Although typically developing children tend to produce their first words around the average age of 12 months, one study reported autistic children produce their first words at around 38 months of age (Howlin, 2003). Accordingly, language deficits, such as delayed language, lack of requesting behavior, or the inability to answer comprehension questions, help differentiate autistic children from children who are typically developing or have other developmental disorders (Maestro et al., 2005). While children with other developmental disorders may also have reduced language skills, there are key differences in the language profile of children with ASD that influence the production and presentation of their language abilities.

The production of language may involve unusual, eccentric characteristics which help distinguish ASD from other developmental disorders (Eigsti et al., 2010). For example, some autistic children use delayed or immediate echolalia, where they repeat or imitate words and phrases they have heard from sources such as television shows or conversational partners, respectively. Echolalia is only partially communicative, and it does not benefit language development (Eigsti et al., 2010). Odd and overly formal stereotyped language is another unique characteristic some autistic children exhibit. These unusual

features of language, along with a general lack of social responsiveness in autistic children, will often lead to increased difficulty communicating with others (Seol et al., 2014).

Language impairments typically involve both receptive and expressive language skills (Kwok et al., 2015). Receptive language refers to the ability to comprehend communication from others, while expressive language refers to the ability to express themselves. Autistic children have significantly poorer receptive and expressive language compared to their peers of the same nonverbal mental age (Maljaars et at., 2012). Further, most studies have found that autistic children tend to experience greater impairments in receptive language than expressive language (Kjelgaard & Tager-Flusberg, 2001; Lord et al., 2004; Luyster et al., 2008; Seol et al., 2014). However, a meta-analysis including 74 studies indicates there is a global language impairment in autistic children with no expressive advantage (Kwok et al., 2015). This presentation of receptive and expressive language skills tends to be unique when compared to children who are typically developing or have other developmental disorders. In typically developing children, receptive language is generally more advanced than expressive language (Fenson et al., 1994), which is opposite of the pattern typically seen in autistic individuals.

When examining children with other developmental disabilities, Seol et al. (2014) found autistic toddlers showed significantly more impaired receptive language abilities than toddlers with a developmental language delay. However, there was no difference in expressive language ability. Another study comparing toddlers with ASD to toddlers with non-spectrum developmental delay revealed that those with ASD displayed a significantly different receptive-expressive language profile (Weismer et al., 2010). Again, the study found autistic children exhibited more impaired receptive language. Albert et al.

(2021) examined young children with developmental disabilities and severe expressive language delays and discovered a significant strength in their receptive language. This pattern also tends to remain true when compared to children with Down syndrome or structural language impairment, as all children except those with ASD showed greater deficits expressive language, while those with ASD had larger deficits on receptive language (Davis et al., 2016). This research clearly indicates the presentation of receptive and expressive language is distinct in autistic individuals.

Adaptive Behavior and Language

Previous research has demonstrated a relationship between general language ability and adaptive behavior. Weller and Strawser (1987) conducted one of the first studies to link adaptive functioning to language and found that some students in special education programs experienced difficulties in adaptive behavior skills due to deficits in language use and understanding. Another early study by Venter et al. (1992) assessed high-functioning, school aged autistic children over a period of eight years. This study measured language ability, ASD symptomology, intellectual functioning, adaptive functioning, and scores on standardized achievement tests. The results indicated verbal skills were the strongest predictor of social-adaptive functioning. Mayo and colleagues (2013) evaluated the relationship between early language skills, measured retrospectively through parent-report of first word acquisition, and later adaptive behavior. Earlier age of first word was related to higher adaptive behavior. In a more recent study, Di Rezze et al. (2019) used the total language score on the Preschool Language Scale, fourth edition (PLS-4) to assess language. Language ability was found to be significantly related to the performance of daily living skills. However, these studies limited their definition of adaptive behavior

to focus specifically on daily living skills, excluding other domains involved in adaptive functioning (i.e., socialization and communication).

Other studies have evaluated the relationship between language and adaptive functioning by splitting language abilities into expressive language skills and receptive language skills. The available research typically indicates poorer receptive language skills are associated with lower adaptive functioning in children with ASD (Bal et al., 2015; Park et al., 2012). Park and colleagues (2012) found that in children with ASD, receptive communication skills were associated broadly with adaptive behavior while expressive language skills were associated specifically with social skills, rather than adaptive behavior altogether. They assessed preschool children aged 3 to 5 years old who were either typically developing or diagnosed with ASD or developmental delay. Importantly, the association between language and adaptive behavior was unique to children with ASD. Similarly, a longitudinal study assessing predictors of daily living skills in individuals referred for an ASD evaluation found that receptive language, in addition to nonverbal mental age and social-communication impairment, predicted later ability to perform daily living skills (Bal et al., 2015). These studies additionally limited their definition of adaptive behavior to daily living skills, rather than exploring adaptive behavior as a whole. This study sought to elucidate the relationship between adaptive functioning and language ability, measured by expressive and receptive language, in autistic children by assessing the association across additional domains of adaptive behavior, including socialization and communication.

Current Study

The first aim of this study was to investigate adaptive behavior profiles in a clinical sample of children who were referred for an ASD evaluation. Although Mathews et al. (2015) found daily living skills were most impaired in a sample of children and adolescents with ASD, most research suggests individuals with ASD show the most impairment on the socialization domain of adaptive behavior (Botle & Poustka, 2002; Loveland & Kelley, 1991; Kanne et al., 2011; Volkmar et al., 1987). Some studies have also found children with ASD perform best in the daily living skills domain of adaptive behavior (Bal et al., 2015; Botle & Poutska, 2002). This study sought to replicate and support prior research on the patterns of adaptive functioning found in most of the studies.

The second aim was to explore how language ability is related to adaptive functioning in children with ASD compared to children diagnosed with other developmental disabilities. The literature has consistently indicated children with ASD experience deficits in adaptive functioning (Bal et al., 2015; Carpentieri & Morgan, 1996), yet there have been mixed results on what clinical characteristics are related to adaptive behavior. It is likely specific symptoms of ASD, namely language deficits, are related to adaptive behaviors. However, this association has been understudied. Previous research on the effects of expressive and receptive language on adaptive functioning in children with ASD has only focused on the daily living skills domain of adaptive behavior (Bal et al., 2015; Park et al., 2012). This study attempted to fill the gap in the literature by including additional domains of adaptive behavior to further explore how language abilities predict adaptive functioning in children with ASD beyond cognitive ability and age.

While adaptive behavior becomes more important as children age and are expected to perform daily tasks independently, intervention is most effective when started as young as possible (Bal et al., 2015). It is important to implement interventions early so children can build adaptive skills and mitigate the deficits they experience as they develop. Additionally, clinical correlates measured in children as young as 2 years old were able to predict later adaptive function (Bal et al., 2015). Thus, since adaptive behavior is critical throughout childhood as skills develop and become more useful, this study include children from diagnosis to age 18.

It has additionally been well documented that cognitive ability is associated with adaptive behavior (Kanne et al., 2011; Klin et al., 2007; Pathak et al., 2019). It is expected that this study will support prior research, and children with lower cognitive ability will exhibit poorer adaptive behavior. Overall, this study aimed to replicate previous studies on adaptive behavior profiles in children with and without ASD, as well as to support and expand upon findings related to the relationship between adaptive functioning and receptive and expressive language skills.

Hypotheses

AIM 1: The first aim of this study was to compare the adaptive behavior profiles of children with ASD to the adaptive behavior profiles of children who were diagnosed with other developmental disabilities. Based on prior research, the following patterns are expected.

Hypothesis 1a: Autistic children will perform worse on measures of overall adaptive behavior compared to children without ASD.

Hypothesis 1b: The pattern of adaptive functioning across domains will differ based on the presence of an ASD diagnosis, where autistic children will have the greatest impairment to the socialization domain of adaptive behavior and the daily living skills domain will be the least impaired.

AIM 2: The second aim of this study was to assess unique predictors of adaptive functioning by (1) examining whether cognitive ability predicts adaptive functioning in children with and without ASD, and (2) exploring whether expressive and receptive language predict adaptive behavior and if those relationships are moderated by ASD diagnosis.

Hypothesis 2a: Cognitive ability will uniquely predict adaptive functioning.

Hypothesis 2b: Both receptive and expressive language skills will not be associated with adaptive functioning in children who have a non-ASD diagnosis.

Hypothesis 2c: In autistic children, receptive language skills will uniquely predict adaptive functioning.

Hypothesis 2d: In autistic children, expressive language skills will not predict adaptive functioning.

METHOD

Participants

This study examined data from the ASD Database gathered from participants who were evaluated by licensed professionals at the University of Alabama Birmingham (UAB) Civitan-Sparks Clinics. The UAB Civitan-Sparks Clinics employs highly trained clinicians who function as an interdisciplinary team to determine the appropriate diagnoses and recommend interventions. Participants included children (M_{age} = 6.63, SD_{age} = 3.08) who were referred to the clinics for concerns and assessment of developmental delays. Individuals were diagnosed based on evaluation from a clinical psychologist, gold standard autism assessments including the Autism Diagnostics Observation Schedule (ADOS-2) and Autism Diagnostic Interview-Revised (ADI-R), and reports from other professionals such as speech-language pathologists, occupational therapists, and medical social workers. Children who received an ASD diagnosis and those who received a non-ASD diagnosis were included in this study for comparison purposes. In addition to ASD, common diagnoses include intellectual disability, language disorders, and attention deficit hyperactivity disorder (ADHD). Approximately 7.1% (14) received an intellectual disability diagnosis, 16.3% (32) received an impaired language diagnosis, and 6.6% (13) participants received an ADHD diagnosis.

Measures

Demographic Variables

Demographic information including age, sex, race, caregiver education, and family characteristics were collected during the retrospective chart review process based on reports from caregivers and health care professionals. Race was subjectively collected through clinician report.

ASD Assessments

Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). The ADOS-2 is a standardized, semi-structured play-based assessment used to measure ASD-related behavior and differentiate ASD from other developmental disorders (Lord et al., 2012). The ADOS-2 measures children on features of ASD such as use of eye contact, quality of social overtures, and stereotyped language. Scores are transformed and analyzed using the manual and diagnostic algorithm. The ADOS-2 can be used with children as young as 12 months old. There are 5 Modules of the ADOS available for use: the Toddler Module for children under 30 months of age, and Modules 1-4 which are administered based on the child's verbal ability. Each of the modules evaluates behavior in the domains of social affect (SA) and restricted and repetitive behavior (RRB) and additionally give an overall comparison score of ASD symptomology. The ADOS-2 has demonstrated good interrater reliability, ranging from .86 to .92 for the SA domain, .45 to .90 for the RRB domain, and .85 to .92 for the total score (Zander et al., 2016).

Autism Diagnostic Interview-Revised (ADI-R). The ADI-R is a semi-structured interview administered to the caregiver(s) of an individual with suspected ASD (Rutter el al., 2003). The ADI-R evaluates an individual's developmental history and current behavior. The comprehensive interview includes 93 open-ended questions used to assess functioning in three domains: language/communication, reciprocal social interactions, and restricted, repetitive, and stereotyped behaviors and interests. Individuals must have a mental age of at least two to be evaluated using the ADI-R. Responses are scored on a scale of 0-3 based on the presence and severity of the behavior. The ADI-R has demonstrated high interrater reliability of .83 (Zander et al., 2017). The ADOS and ADI-R are considered the gold-standard tools for diagnosing ASD (Falkmer et al., 2013). In this dataset, they were used to help identify and inform the ASD diagnosis.

Adaptive Functioning Assessment

Vineland Adaptive Behavior Scales (VABS). The VABS is a standardized, semi-structured interview which measures the adaptive behavior of individuals from birth to age 90 (Pepperdine & McCrimmon, 2017). When administering this assessment, highly trained clinicians conduct an interview with the caregivers of the child. Questions on the VABS are designed to measure the functional behaviors individuals typically engage in on a daily basis compared to other individuals of the same age. The VABS assesses three main domains: communication, daily living skills, and socialization. The communication domain measures receptive, expressive, and written communication, such as how often the individual uses words, appropriately responds to information from others, or uses reading and writing skills. The daily living skills domain measures independence related

to personal, domestic, and community-based skills. For example, how the individual practices personal hygiene, completes household tasks, or uses the telephone. The socialization domain assesses interpersonal relationships, play and leisure, and coping skills. Items in this domain may evaluate how the individual engages in activities with others, regulates emotions, or gives socially appropriate responses.

There are two versions of the VABS included in this dataset, the Vineland-II, and the updated Vineland-III (Sparrow et al., 2016; Sparrow et al., 2005). The content in the Vineland-II was updated to modify or remove outdated items and increase cultural sensitivity, in order to be more reflective of current society. Additionally, there were minor modifications to scoring responses. Items are scored with a zero, one, or two, depending on how often the behaviors are performed independently. On both the Vineland-II and Vineland III zero indicates "never" and two indicates "usually", however on the Vineland-II one indicates "sometimes or partially", while on the Vineland-III one only indicates "sometimes" and does not give credit for behavior that is partially independent. The VABS yields standardized scores for each of the domains and for an overall adaptive behavior composite. Internal consistency ranges from .84 to .93 for each of the domains and .93 to .97 for the adaptive behavior composite. The VABS reported generally good test-retest and interrater reliability, with correlations ranging from .76 to .92 and .71 to .81, respectively (Sparrow et al., 2005).

Language Measures

The dataset used in this study includes clinical evaluations performed or supervised by professional speech language pathologists, however, not all children received

the same language assessment due to age and varying abilities. The Preschool-Language Scale (PLS 3, 4 & 5) and the Clinical Evaluation of Language Fundamentals (CELF) are the most commonly available language assessments contained in the ASD database. Additionally, these measures have good psychometric evidence of methodological quality (Denman et al., 2017). In order to avoid limiting the sample size by only including children who received one specific language measure, children who received either the PLS or the CELF were included.

Preschool Language Scale (PLS). The PLS is an instrument used to assess language skills and language development in young children (Zimmerman et al., 2003). There are three nationally normed editions of the PLS: the third edition (PLS-3), fourth edition (PLS-4), and fifth edition (PLS-5). The PLS-3 and PLS-4 can be used on children from birth to age 6 years and 11 months, and the PLS-5 can be used until age 7 years and 11 months. This measure is primarily used to identify language delays and language disorders in young children by evaluating a range of communication behaviors, such as eye contact, pointing, joint attention, and verbal responses to pictures. The PLS is comprised of two subscales: the auditory comprehension subscale, which is used to measure receptive language skills, and the expressive communication subscale, which is used to measure expressive language skills. Test items are presented to children based on their age and progressively become more difficult. Items are passed if the examiner elicits the behavior in the child, if the behavior is seen in a spontaneous interaction with the caregiver or examiner, or for certain items the behavior may be passed if the caregiver is able to provide specific examples of the child exhibiting the behavior. Tasks that are passed are scored

with a "1", and if they are not passed, they are scored with a "0." Tasks for each of the subscales are then summed for a raw score for auditory communication and a raw score for expressive communication. The scores are converted to be normed and there are percentile ranks and age equivalents available for comparison. The PLS can only be administered by trained professionals and has demonstrated high reliability and validity. Test-retest reliability coefficients range from .82 to .97 for the subscales scores and the total language score, internal consistency coefficients range from .66 to .96, and a study on inter-rater reliability found 99% agreement between scorers (Zimmerman et al., 2009; Zimmerman & Castilleja, 2005).

Clinical Evaluation of Language Fundamentals (CELF). The CELF comprehensively assesses individuals' language and communication skills to detect the presence of a language disorder or delay (Semel et al., 2003; Semel et al., 2004; Wiig et al., 2013). The Clinical Evaluation of Language Fundamentals preschool version (CELF-P2) is designed to measure expressive and receptive language skills in children from 3 to 6 years and 11 months of age (Semel et al., 2004), while the CELF-4 and CELF-5 assess language in individuals from 5 years to 21 years of age (Semel et al., 2003; Wiig et al., 2013). The preschool version of the CELF provides standardized scores for the following categories: core language, receptive language index, expressive language index, language content index, and language structure index (Semel et al., 2004). Similarly, the CELF-4 and CELF-5 provide standardized scores for core language score, receptive language, expressive language, language structure, and language content. The CELF is administered through a series of subtests which correlate to the core language and index scores. The CELF-5 has

high inter-examiner reliability, as coefficients range from .91 to .99 (Wiig et al., 2013). Additionally, inter-item reliability ranges from .81 to .97, indicating good consistency across test items. All versions of the CELF have evidence of good content validity (Denman et al., 2017).

Cognitive Measures

Children received various cognitive assessments based on age and ability. Rather than limiting the dataset further by only including children with specific cognitive measures, children with any standardized cognitive measure were included. The cognitive tests available included the Wechsler Abbreviated Scale of Intelligence, First Edition (WASI) and Second Edition (WASI-II); the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) and Fifth Edition (WISC-V); Stanford-Binet Intelligence Scale; Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III); Leiter International Performance Scale, Third Edition (Leiter-3); Reynolds Intellectual Assessment Scales (RIAS); and Differential Ability Scales, Second Edition (DAS-II). Since each of these measures are standardized and provide a score of 100 with a standard deviation of 15, scores from the available cognitive measures for each child were combined into a composite variable for cognitive ability.

Procedures

ASD Database

Data from interdisciplinary evaluations conducted by highly trained professionals at the UAB Civitan-Sparks Clinics was retrospectively reviewed, systematically collected

and entered into the ASD database. Additionally, data available from other healthcare professionals such as occupational therapists, speech-language pathologists, and psychologists, as well as school records and demographic information gathered from an intake protocol, was collected and entered into the ASD database. Data collection was completed by graduate and undergraduate students who have achieved 95% reliability. The data was only entered into the database by graduate students who have achieved 95% reliability. This study used retrospective data analysis from the ASD database and was approved by the UAB Institutional Review Board (IRB)

Data Analysis

The data were pooled from the database, then they were screened for any data entry errors. Errors were corrected prior to conducting any statistical analyses. Only participants who received the Vineland Adaptive Behavior Scales, a standardized language measure, and a standardized cognitive measure were included (N= 196). Descriptive statistics and preliminary analyses were conducted in IBM SPSS version 28. The data were evaluated for missingness and outliers. Participants with missing data were compared to those with complete data on ASD diagnosis, sex, cognitive functioning, age, and language abilities using chi-square test and independent sample t-tests. Multivariate outliers were defined as cases exceeding a Mahalanobis distance score of 20. Univariate outliers were cases that exceeded a z-score of 3.29 on the primary variables of interest. Bivariate correlations among the main variables were examined. To guide the selection of covariates for the main models, differences between the ASD and non-ASD groups were evalu-

ated using independent-sample t-tests for age, cognitive ability, and motor ability. Additionally, a chi-square test was used to assess whether the ASD groups differed by sex, and a Mann-u Whitney test evaluated whether ASD diagnosis was associated with maternal education. Finally, the relationships between adaptive behavior and potential covariates were evaluated. An independent samples t-test was conducted to examine whether adaptive functioning differed between the male and female participants. An ANOVA was conducted to determine whether adaptive functioning differed by maternal education level, and a Pearson's correlation evaluated whether age was related to adaptive functioning.

To test the first aim, profile analysis evaluated the patterns of adaptive behavior using a group x measure design, with the three primary domains of the VABS, communication, socialization, and daily living skills, used as the dependent variables. A test of levels compared the ASD and the non-ASD groups to test whether autistic children performed worse on overall adaptive behavior than non-autistic children. A test of flatness evaluated whether there was a significant difference in the means of the adaptive behavior domains averaged across the ASD and non-ASD groups. Significant tests of levels and flatness were followed-up with post-hoc comparisons on marginal means. For the significant test of levels, pairwise comparisons between the ASD and non-ASD groups were performed with a Bonferroni correction. For the significant test of flatness, pairwise comparisons between the adaptive behavior domains were compared using an average of the ASD and non-ASD groups with a Bonferroni correction. The interaction from the profile analysis (i.e., test of parallelism) evaluated whether differences between the ASD and non-ASD groups varied by domain of adaptive functioning.

For the second aim of this study, hierarchical multiple regressions were conducted in Stata version 17 to test whether cognitive ability, expressive language, and receptive language are unique predictors of adaptive functioning. Prior to the regressions, multiple imputation was performed in Stata version 17 to address missing data. Due to concerns about multicollinearity because of the high correlation between receptive and expressive language (r= .84, p<.01), these predictors were evaluated in separate models. Diagnosis was included as a categorical variable with two levels: ASD and non-ASD. The Adaptive Behavior Composite from the Vineland Adaptive Behavior Scale served as the dependent variable. The covariates, motor composite and maternal education, were entered at Step one. At Step two, autism diagnosis, cognitive composite, and language ability were added. At Step three, the interaction between language ability and ASD diagnosis was entered. Models 2a and 3a include receptive language, while models 2b and 2c include expressive language.

RESULTS

Preliminary Analyses

Demographic characteristics of the sample are displayed in Table 1. Participants had an average age of 6.63 years old, with a standard deviation of 3.08 years and a range from 1.92 to 18.92 years of age. Among the total 196 participants, 130 (66%) had complete data and 3.66% of data points were missing. Participants with missing data did not significantly differ from those with complete data in ASD diagnosis, sex, cognitive functioning, age, or language abilities (all $p>.05$). The data were further screened for both multivariate and univariate outliers. No cases exceeded a Mahalanobis distance score of 20, indicating there were no multivariate outliers. No values on the primary variables of interest exceeded a z-score of 3.29, indicating there were no univariate outliers.

Table 1

Demographic Characteristics

	ASD Dx (n= 89)	Non-ASD Dx (n= 107)	Total (N= 196)
	n (%)	n (%)	n (%)
Sex			
Female	25 (28.10)	28 (26.17)	53 (27.04)
Male	64 (71.91)	79 (73.83)	143 (72.96)
Race			
White	42 (47.19)	67 (62.62)	109 (55.61)
Black	28 (31.46)	25 (23.36)	53 (27.4)
Hispanic	13 (14.61)	1 (0.94)	14 (7.14)
Asian	0 (0.00)	1 (0.94)	1 (0.61)
Unknown	6 (6.74)	13 (12.15)	19 (9.69)
Maternal Education			
<12 years	8 (8.99)	16 (14.95)	24 (12.25)
Graduated HS/GED	31 (34.83)	40 (37.38)	71 (36.22)

Some College	23 (25.84)	28 (26.17)	51 (26.02)
College Graduate	17 (19.10)	7 (6.54)	24 (12.24)
Graduate School	2 (2.25)	3 (2.80)	5 (2.55)
Unknown	8 (8.99)	13 (12.15)	21 (10.71)

To guide the selection of covariates for the main models, t-tests were used to test whether age, motor abilities, and cognitive abilities differed between the ASD and non-ASD groups. Results indicated no significant differences in age (p>.05). The average age of participants diagnosed with ASD was 7.05 years old (SD= 3.01), and the average age of participants who were not diagnosed with ASD was 6.28 years old (SD= 3.11). Both motor abilities and cognitive abilities were significantly lower for the ASD group compared to the non-ASD group (t(194)= 1.88, p= .031, d= .27, and t(165)= 1.79, p= .041, d= .27, respectively). Table 2 displays group means for the variables of interest in this study. A chi-squared test indicated there was no significant difference in sex between the ASD and non-ASD groups (p>.05). Finally, a Mann-Whitey test showed that mothers of autistic children had significantly higher levels of education than mothers of non-autistic children (p<.05).

Table 2

Descriptive Statistics

	ASD Dx (N= 89)	Non-ASD Dx (N= 107)	Total (N= 196)
	M (SD)	M (SD)	M (SD)
Motor Composite	60.84 (19.55)	66.66 (22.55)	64.11 (21.43)
Cognitive Composite	70.11 (18.77)	75.22 (19.03)	72.90 (19.03)
Receptive Language	61.16 (15.69)	72.57 (17.80)	67.36 (17.76)
Expressive Language	62.26 (17.13)	72.59 (17.97)	67.93 (18.29)
Total Language	61.37 (17.07)	71.21 (18.27)	66.71 (18.36)
Adaptive Behavior	67.97 (11.79)	75.22 (10.66)	70.51 (11.39)

Next, potential covariates were evaluated in relation to adaptive functioning. Table 3 shows bivariate correlations among the study variables. Adaptive functioning was significantly correlated with the motor and cognitive composites. Results of an ANOVA revealed a marginally significantly effect of maternal education on adaptive functioning, $F(4,166)= 2.36$, $p= .056$. A t-test indicated that adaptive functioning did not significantly differ by sex, $t(73)= 1.35$, $p= .182$, $d= .25$. Lastly, adaptive function and age were not found to be correlated, $r= -.08$, $p= .301$. The results suggest using the motor composite and maternal education as covariates. The assumptions of multivariate normality, linearity, homoscedasticity, homogeneity of variance-covariance matrices, and an absence of singularity were assessed and met prior to conducting the primary analyses.

Table 3

Correlations Among Variables

	1	2	3	4	5	6	7	8
1. Receptive Language	1.00							
2. Expressive Language	0.84***	1.00						
3. Vineland Communication	0.45***	0.51***	1.00					
4. Vineland Daily Living Skills	0.23**	0.26***	0.67***	1.00				
5. Vineland Socialization	0.29***	0.38***	0.75***	0.74***	1.00			
6. Adaptive Composite	0.35***	0.41***	0.87***	0.88***	0.90***	1.00		
7. Motor Composite	0.15	0.19*	0.18*	0.19*	0.14	0.16*	1.00	
8. Cognitive Composite	0.64***	0.63***	0.60***	0.39***	0.41***	0.47***	0.30***	1.00

Note: *p<.05 **p<.01 ***p<.001

Adaptive Behavior Profiles

Profile analysis was used to investigate performance across the three primary domains of the Vineland Adaptive Behavior Scale, communication, daily living skills, and socialization, in children with and without ASD. Four participants (2.04%) did not receive domain-level scores and were thus excluded from this analysis (n= 192). The interaction from the profile analysis (i.e., test of parallelism) assessed whether the differences between the ASD and non-ASD groups varied by adaptive behavior domain. The results were nonsignificant, $F(1, 190) = 1.45$, $p = .23$, suggesting that differences between ASD and non-ASD groups did not vary by domain of adaptive behavior.

Group differences were compared between the ASD and the non-ASD groups with a test of levels. As predicted, the results indicated autistic children performed significantly worse on the average of the adaptive functioning domains compared to children without ASD, $F(1, 190)= 10.56$, $p=.001$. The significant test of levels was followed up with post-hoc comparisons on marginal means of the average of all adaptive behavior domains. The means for each adaptive domain for the ASD and non-ASD groups are shown in Figure 1 and Table 4. Additionally, Table 4 displays all pairwise comparisons. Autistic children had significantly lower scores for communication, daily living skills, and socialization.

Figure 1

Mean Standard Scores of the Adaptive Behavior Domains by ASD Diagnosis

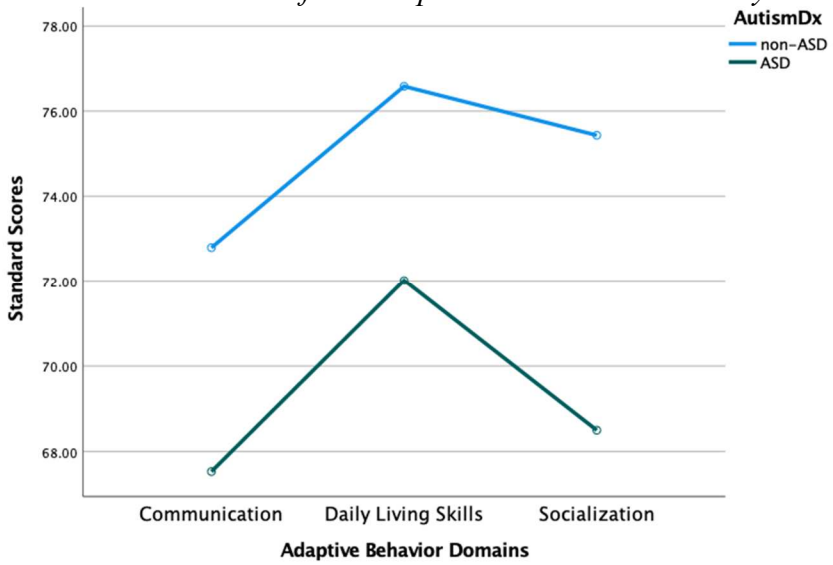

Table 4

Means and Standard Deviations of Adaptive Behavior Domains by ASD diagnosis

	Autism Dx		Non-Autism Dx		ASD vs non-ASD Pairwise Comparisons	
	M	*SD*	*M*	*SD*	Mean diff	*p*
Communication	67.54	15.52	72.79	13.07	5.25	.012
Daily living skills	72.01	14.15	76.59	12.42	4.57	.018
Socialization	68.50	12.59	75.43	11.73	6.93	<.001

Finally, a test of flatness revealed that performance significantly differed across the three subscales of the Vineland Adaptive Behavior Scales, F (1, 190) = 6.72, p= 01. To follow up this significant test, the marginal means for each of the adaptive domains were compared using Bonferroni adjusted alpha levels of .0167 per test (.05/3). Participants had significantly higher scores on the daily living skills domain (M= 74.30, SD= 13.29) compared to both the communication domain (M= 70.16, SD= 14.30, p<.001) and

the socialization domain (*M*= 71.97, *SD*= 12.16, *p*= .002). Additionally, scores on the socialization domain were significantly higher than scores on the communication domain, *p*= .031.

Predictors of Adaptive Functioning

Table 5

Hierarchical Regression Analysis for Variables Predicting Adaptive Behavior

Step	Predictor	B	*t*	Δ R^2	R^2	*p*
1				.073	.073	*p*<.001
	Motor Composite	0.09	2.27*			
	Maternal Education	2.27	2.71**			
2a				.216	.289	*p*<.001
	Cognitive Composite	0.26	5.06***			
	Autism Dx	-4.32	2.79**			
	Receptive Language	-0.01	0.10			
3a				.006	.295	*p*<.001
	Autism Dx x Receptive Language	0.12	1.20			
2b				.223	.296	*p*<.001
	Cognitive Composite	0.22	4.40***			
	Autism Dx	-3.67	2.43*			
	Expressive Language	0.07	1.41			
3b				.004	.300	*p*<.001
	Autism Dx x Expressive Language	0.07	0.87			

Note: N=196; *p<.05 **p<.01 ***p<.001

Results of the regression analysis are shown in Table 5. The hierarchical multiple regression revealed that at Step 1 both better motor abilities and higher maternal education significantly predicted better adaptive behavior. The model at Step 1 accounted for 7.3% of the variance in adaptive functioning. The addition of cognitive ability, autism diagnosis, and receptive language in Step 2a explained an additional 21.6% of the variance in adaptive functioning and significantly improved the model, as shown in Table 5. In-

cluding expressive language instead of receptive language in Step 2b explained an additional 22.3% of the variation from Step 1. After controlling for motor abilities and maternal education, the cognitive composite and autism diagnosis significantly improved the prediction of adaptive functioning. Autistic children had an adaptive behavior composite that was about 4 points lower than non-autistic children, and for each one-point increase in cognitive ability, adaptive behavior increased by approximately a quarter of a point. Neither expressive language nor receptive language were unique predictors of adaptive functioning in these models. Additionally, there were no significant interaction effects of autism diagnosis and language ability on adaptive functioning in Steps 3a and 3b.

DISCUSSION

The present study sought to examine adaptive behavior profiles and predictors of adaptive functioning in children with and without ASD. The participants were evaluated for ASD at a tertiarty care clinic. Autistic children had significantly lower motor abilities and cognitive functioning compared to non-autistic children. This was expected as poor motor skills and lower cognitive functioning are common symptoms of ASD (Fulceri et al., 2019; Maenner et al., 2021). Additionally, mothers of autistic children had higher levels of education than mothers with non-autistic children. Higher parental education has been linked to an earlier recognition of concerns with their child's development (Moh & Magiati, 2012), so this finding may have occurred because mothers who had more education were able to better identify symptoms of ASD. There was no significant association between sex and ASD-diagnosis. The male-to-female ratio in this sample was approximately 2.7:1, which reflects the typical proportion of male-to-female children meeting the criteria for an ASD diagnosis of 3:1 (Loomes et al., 2017).

Using the Vineland Adaptive Behavior Scales, the first aim was to compare the adaptive behavior profile of autistic children to the adaptive behavior profile of children diagnosed with other developmental disabilities. The results supported the prediction that autistic children would perform worse on measures of overall adaptive behavior compared to children without ASD. This finding is consistent with prior research, which indicates autistic children tend to have poorer adaptive functioning compared to both typically developing children and children with other developmental disabilities (Bal et al.,

2015; Kenworthy et al., 2010). However, it is important to note that the adaptive behavior composite score for both groups fell at least one standard deviation below average. The non-ASD group on average scored nearly two standard deviations below the mean and the ASD group scores over two standard deviations below the mean. Thus, all participants in this study had clinically significant deficits.

The results did not support the hypothesis that autistic and non-autistic children would exhibit different patterns of adaptive functioning. It was predicted that autistic children would display a unique profile of adaptive behavior, scoring highest on the daily living skills domain and lowest on the socialization domain. While children in this study did score significantly higher on the daily living skills domain (M= 72.01) compared to the communication (M= 67.54) and socialization domains (M= 68.50), both the ASD and non-ASD groups displayed similar patterns, so the presentation of patterns of adaptive functioning domains was not unique to ASD. Prior research has demonstrated that autistic children exhibit a relative strength in daily living skills (Bal et al., 2015; Botle & Poustka, 2002), but in this study, both children with ASD and non-ASD diagnoses performed significantly better on the daily living skills domain than on the other domains. The lack of a significant difference in the profiles of adaptive functioning by ASD diagnosis may be a result of the nature of the current study's sample. Participants in this study were specifically referred to the clinics for an evaluation due to suspicions of ASD. Thus, those in the non-ASD group may still have symptoms and characteristics of ASD but not to a level that warrants a clinical diagnosis of ASD and that likely contributes to the similarity in adaptive behavior profiles of both groups.

The second aim of this study was to assess cognitive ability and language as unique predictors of adaptive functioning. The hypothesis that cognitive ability would uniquely predict adaptive behavior was supported. Consistent with prior research, higher cognitive abilities predicted better adaptive functioning (Kanne et al., 2011; Klin et al., 2007; Pathak et al., 2019). This suggests that children with impaired intellectual functioning also tend to experience difficulty with the social or practical tasks used on a daily basis.

Regarding language and adaptive behavior, it was hypothesized that both expressive and receptive language skills would not be associated with adaptive functioning in children with a non-ASD diagnosis. In autistic children, it was hypothesized that receptive language skills would uniquely predict adaptive functioning, but expressive language skills would not. The results partially supported these hypotheses. Preliminary analyses indicated significant positive correlations between receptive and expressive language and adaptive behavior, however, after controlling for maternal education and motor abilities, results of the hierarchical regression showed that neither receptive nor expressive language abilities predicted adaptive functioning in ASD or non-ASD participants. While it has been previously demonstrated that poorer receptive language is associated with worse daily living skills (Bal et al., 2015), the current study's findings suggest language deficits in children experiencing symptoms of autism may not impact adaptive behavior as a whole. Additional research should be conducted to clarify the association between language and adaptive behavor.

Limitations

There are several limitations that must be addressed. First, information about participants' race and ethnicity was obtained through clinician report rather than self-report. Hence, the race variable may be biased, so it was only used to describe the sample and was not included in the statistical analyses. Additionally, the data were collected from a clinical population, which may limit the generalizability of the findings. Since children were specifically referred to the clinics because of ASD concerns, this study did not include a typically developing group reference group. As a result, the findings for the non-ASD group may not apply to typically developing children without developmental delays. Another limitation is the use of multiple assessments to create the motor, cognitive, and language variables under the assumption that the scores were comparable. This study used retrospective chart review from clinical evaluations, so the assessments that were administered differed according to clinical relevance. However, this practice is often used in ASD research because of the nature of the clinical setting (Pathak et al., 2017). Finally, this study used a correlational design and cannot determine causality in the studied relationships. It is likely that the relationships among many of these variables are bidirectional. Future studies should utilize longitudinal and intervention designs to better assess the directionality of the studied relationships.

Implications and Future Directions

The attainment of adaptive behavior is critical for future independence and success (Bal et al., 2015). Specific deficits and strengths in adaptive behavior are important to identify for guiding future interventions and determining where support is most needed. Overall, the results of this study indicate that while autistic children have poorer

adaptive behavior than children with non-ASD diagnoses, these differences did not vary across the domains of daily living skills, communication, and socialization. Additionally, both groups experience relatively greater deficits in the communication and socialization areas compared to the daily living skills domain. Thus, children with developmental delays, and particularly those with ASD diagnoses, may benefit most from interventions targeted towards the communication and socialization domains of adaptive behavior.

This was one of the first studies to examine the association between receptive and expressive language and general adaptive functioning in a clinical sample of autistic and non-autistic children. While this study indicated that there was no association between language abilities and adaptive behavior, other studies have found that receptive language is related to daily living skills (Bal et al., 2015; Park et al., 2012). Future research should clarify the relationship between language ability and adaptive functioning in relevant pediatric populations by evaluating the association between receptive and expressive language and the three primary domains of adaptive behavior, daily living skills, socialization, and communication. Only few longitudinal studies to date evaluated the impact language abilities on the attainment of daily living skills over time (Bal et al., 2015; Di Rezze et al., 2019). Additional longitudinal studies would help determine whether receptive and expressive language influence the development of adaptive skills over time in autistic children.

In summary, the current study contributed to the literature suggesting autistic children experience greater deficits to their adaptive functioning than children with other developmental disorders. Thus, adaptive behavior interventions should be a key part of autistic children's treatment plans due to the impairments they face. This study also found

that language abilities were not related to adaptive functioning after accounting for other characteristics. Identifying which clinical characteristics contribute most to adaptive behavior deficits is crucial for the development of interventions designed to mitigate adaptive functioning delays. Other symptoms, such cognitive functioning, may be more important to consider than language in relation to adaptive functioning. The current study's findings suggest language deficits in autistic individuals may not impact adaptive behavior as a whole. Future research should continue to identify factors related to adaptive functioning to help address the adaptive skill deficit autistic children and children with symtoms of autism face.

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APPENDIX

IRB NHSR DETERMINATION LETTER

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 |
irb@uab.edu

NHSR DETERMINATION

TO: Stein, Brianna

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000196 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)
IORG Registration # IRB00012550 (IRB 03)

DATE: 14-Jul-2021

RE: IRB-300007557
Adaptive Behavior and Clinical Characteristics of Children Referred for an Autism Spectrum Disorder Evaluation

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The Office of the IRB has reviewed your Application for Not Human Subjects Research Designation for the above referenced project.

The reviewer has determined this project is not subject to FDA regulations and is not Human Subjects Research. Note that any changes to the project should be resubmitted to the Office of the IRB for determination.

if you have questions or concerns, please contact the Office of the IRB at 205-934-3789.

Additional Comments:

Secondary analysis of de-identified data