

CONCORDANCE IN RATINGS OF COMORBID SYMPTOMATOLOGY IN YOUTH
ASSESSED FOR AUTISM SPECTRUM DISORDER: CHILD CHARACTERISTICS IN
RELATION TO INFORMANT DISCREPANCIES

by

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ABSTRACT

Many youth with autism spectrum disorder (ASD) experience comorbid emotional and behavioral difficulties that have a significant impact on their functioning (Kanne, Abbacchi, & Constantino, 2009). Parents and teachers are valuable informants in piecing together a better picture of these difficulties in the assessment process. However, parents and teachers often exhibit significant divergence on reports of the same behaviors on the same child. Research into parent-teacher discrepancies have aided in identifying how these discrepancies occur and how to extract useful information regarding contextual variation in behavior from these discrepant reports (e.g. De Los Reyes, 2011). However, research in this area is rather limited in terms of comorbid psychiatric symptomatology in youth with ASD and does not explain how discrepancies in this area may be related to core symptoms of ASD. This study examined whether the relation between behavioral and emotional symptoms and ASD symptoms, IQ, and adaptive skills was different for parent and teacher reports in 141 youth referred for ASD assessment. Overall, while results replicated findings that significant discrepancies exist between parent and teacher reports of comorbid behavioral and emotional symptoms, parent and teacher reports were not differentially related to ASD symptoms, IQ scores, or adaptive skills. Results of this study highlight that parent-teacher discrepancy of comorbid symptoms may not vary across different levels of functioning in youth with ASD, and that the measure used in this study to assess comorbid behavioral and emotional symptoms may functioning similarly across different youth with ASD

LIST OF ABBREVIATIONS AND SYMBOLS

α	Cronbach's alpha
ABAS	Adaptive Behavior Assessment System
ADHD	Attention-Deficit/Hyperactivity Disorder
ADOS	Autism Diagnostic Observation Schedule
ASD	Autism Spectrum Disorder
β	Beta: Fixed Effect in MLM
BASC	Behavioral Assessment System for Children
DAS	Differential Abilities Scale
=	Equal To
F	Fisher's F ratio
<	Less Than
M	Mean: The sum of a set of values divided by the number of values in the set
MLM	Multilevel Modeling
p	p-value: the probability that the null hypothesis is true
r	Pearson product-moment correlation coefficient
σ	Sigma: Within Cluster Variance in MLM
SD	Standard Deviation: Value of variation from the mean
τ	Tau: Between Cluster Variance in MLM
WISC	Wechsler Intelligence Scale for Children
Z	Fisher's Z

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CHAPTER 1

INTRODUCTION

Children with autism spectrum disorder (ASD) are characterized by deficits in social communication and restrictive and repetitive behaviors and interests, which are present early in development and impact the child's daily ability to adapt to the demands of life (APA, 2013). Children with ASD exhibit significantly more comorbid psychiatric symptoms than their typically developing peers (Hurtig et al., 2009) and these symptoms occur in children of all ages with ASD (Lainhart, 1999). These children also exhibit various comorbid behavioral (externalizing) and emotional (internalizing) symptoms according to parents' and teachers' reports (de Bruin et al., 2007; Duarte et al., 2003; Gadow, Devincent, Pomeroy, & Azizian, 2004; 2005; Pearson et al., 2006). Emotional symptoms, such as anxiety and depression are highly common in youth with ASD (Howlin, 2000; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Lainhart, 1999; Simonoff, Pickles, Charman, Chandler, & Baird, 2008; Tantam, 2000), with 41–42% and 6–10% reaching criteria for an anxiety disorder or depressive disorder, respectively (Gjevik et al., 2011; Mattila et al., 2010). Similar prevalence rates and symptomatology are present across behavioral disorders; common behavioral diagnoses comorbid with ASD include attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD; Gadow, DeVincent, & Pomeroy, 2006; Lecavalier, 2006; Lecavalier, Gadow, Devincent, & Edwards, 2009; Leyfer et al., 2006; Simonoff et al., 2008). Up to 80% of individuals with ASD may receive a comorbid diagnosis across their lifetime (de Bruin et al., 2007; Leyfer et al., 2006), with elevated symptoms of

comorbid psychopathologies often also present in those who do not meet diagnostic cutoffs for any specific disorder. Many individuals with ASD receive multiple comorbid diagnoses across their lifetime (Siminoff et al., 2008). This is in stark contrast to their typically developing peers, where prevalence estimates of psychiatric difficulties typically range from 8% to 18% (e.g., Roberts, Attkisson, & Rosenblatt, 1998).

Effects of Comorbid Symptoms

Comorbid symptomatology presents serious complications later in life for youth with ASD (Chiang & Gau, 2016). Specifically, these comorbid symptoms have important clinical implications for treatment response and child outcomes (Gadow et al., 2005) and directly impact diagnostic decisions and treatment planning (Kanne, Abbacchi, & Constantino, 2009). Early comorbid psychopathologies may also impair social adjustment later in life, suggesting the need for early identification and intervention for the conditions (Chiang & Gau, 2016). Further, the presence of comorbid psychiatric symptoms may even exacerbate ASD symptom expression, as more severe comorbid psychiatric symptoms moderates the relations between ASD traits and repetitive behaviors (García-Villamizar & Rojahn, 2015).

Assessing Comorbidity in ASD

Typically, when working with adults, comorbid psychopathology is rated based on structured and semi-structured interviews, such as the Structured Clinical Interview for DSM (SCID; APA, 2015). However, these interviews often are neither appropriate nor effective diagnostic tools for children, particularly children with ASD who may lack self-awareness of their level of functioning (Lerner et al., 2012; Verhoeven et al., 2012). Parent interviews are often problematic in this population as well. Most youth with ASD present with multiple comorbid psychiatric conditions, and parent interviews often fail to capture both conditions

(Leyfer et al., 2006). Thus, clinicians often turn to parent and teacher questionnaire reports of the child's behavior and functioning. Several well-validated measures exist to examine these symptoms in youth with ASD. One such measure is the Behavioral Assessment Scales for Children - 2 (BASC-2; Sparrow et al., 2005). Widely used in all domains of child psychology, including ASD, the BASC-2 is a common, comprehensive parent-, teacher-, and/or self-reported questionnaire that measures a child or adolescent's overall behavioral and emotional functioning (Goldin et al., 2014; Mahan & Matson, 2011; Vickerstaff et al., 2007). Parent and teacher reports on the BASC-2 often highly impact diagnostic decisions made by clinicians, which in turn impacts treatment and service provision for the youth (Shernoff et al., 2014). A wealth of literature has emerged that suggests that parents and teachers may yield different reports on measures of child psychopathology (De Los Reyes 2011, De Los Reyes & Kazdin, 2004; 2005), and this is true specifically in ASD as well (Stratis & Lecavalier, 2015). However, this reporter discrepancy has not been well examined with the BASC-2. Given the past literature on informant agreement and the BASC-2's widespread use, this appears to be a critical gap in the literature.

Informant Discrepancies in Childhood Psychopathology

Recent findings suggest that the degree of agreement or disagreement between informants represents more than error, but rather presents important information about the functioning being examined across contexts (De Los Reyes et al. 2013; Kraemer et al. 2003). Thus, the use of multiple informants is critical to ensure an accurate and comprehensive picture of the individual being assessed is obtained, and is considered a vital part of conducting a proper assessment of an individual (Kraemer et al., 2003). This feature is common and necessary across ratings of various domains of child psychopathology and functioning (De Los Reyes et al.,

2015), as certain behaviors or symptoms may be present only in certain environmental contexts. Thus, the ability of any single informant to accurately report on these behaviors or symptoms across contexts is limited (Achenbach et al. 1987; De Los Reyes, 2011).

Predictors of Informant Discrepancies

Variation between informants' reports stems from several well-established factors. These differences are often related to variations in the informant's context in which they view the behavior, their beliefs about the child, and characteristics of the child, and how each informant interacts with or observes the child (De Los Reyes, 2011). Further, parenting stress might influence parents' ratings of their child's functioning and, during times of high stress, may lead to elevated parental reports of symptomatology compared to teachers (van der Oord, Prins, Oosterlaan, & Emmelkamp, 2006). However, most of the literature in this area to date focuses on assessing a core deficit of a particular form of primary child psychopathology, not about comorbid, secondary psychopathology.

Informant Discrepancies in ASD

Parents and teachers of children with autism spectrum disorder (ASD) are both commonly asked to report on comorbid symptomatology in addition to reporting on the child's ASD-specific functioning. These reports are often correlated, but do not perfectly overlap (Lane, Paynter, & Sharman, 2013). Research has suggested that parents are often the best informants for identifying emotional problems, while teachers might be better at identifying behavioral problems (Smith, 2007). The limited past literature in ASD indicates that ratings of emotional symptoms often are more divergent than ratings of behavioral symptoms (Kolko & Kazdin, 2006; Stratis & Lecavalier, 2015). Parents of youth with ASD are more likely to rate behavioral and emotional problems as in the clinically significant range, whereas teachers often rate these

same youth in the at-risk range (Barnhill, et al., 2000; Foley-Nicpon, Doobay, Assouline, 2010). Barnhill et al. (200) suggest that teachers may have high expectancies of emotional and behavioral difficulties among these youth, and may be more accepting of these symptoms, compared to parents who may be more surprised by these symptoms. Further, they suggest that parents have a diversity of opportunities to view the youth's behavior (e.g., at home, in the community) compared to teachers who often only interact with students in a school setting. However, whereas assessment of discrepancies across various measures of comorbid psychiatric symptoms (e.g., *Child Behavior Checklist*, Achenbach, 1991) in ASD has occurred, investigation of multi-rater convergence on the BASC-2 is near absent in this population. One study by Lane, Paynter, & Sharman (2013) yielded inconclusive findings about informant discrepancies on the BASC-2. Specifically, correlations between parents and teachers were modest at best for externalizing behaviors and exhibited low agreement in general, suggesting some level of discrepancy may be present (Lane et al., 2013). However, the generalizability of their findings is limited because the sample was relatively small and only included pre-school children. A second study by Foley-Nicpon et al. (2010) suggests that parents may report more externalizing behaviors and internalizing symptoms compared to teachers. However, Foley-Nicpon et al.'s (2000) study lacked adequate statistical methodology to determine if these differences were significantly different. Further, little work has considered how discrepancy ratings of comorbid symptoms are influenced by core deficit symptomatology and other factors related to the child being assessed. Thus, reinvestigation into parent-teacher correspondence on the BASC-2 in this population remains warranted.

Core ASD Symptomatology as Predictors of Informant Discrepancies in ASD

More salient behaviors are related to greater agreement between parents and teachers

given that these behaviors tend to occur at a higher frequency across multiple settings and are more likely to be viewed by both informants (Kolko & Kazdin, 2006). It is well established that discrepancies tend to be larger when rating internalizing problems versus externalizing problems (Achenbach et al., 1987). This is often due to behavioral issues being more easily viewable by informants. Alternatively, emotional problems are more internal issues that possess less visibility, are typically more difficult to identify, and may create greater variation between informants in identifying these problems (Hinshaw, Han, Erhardt, & Huber, 1992). Youth with ASD who have more severe ASD symptoms are more likely to experience comorbid behavioral and emotional symptoms (Jang & Matson, 2015). Thus, more severe symptoms present in multiple contexts are more likely to occur in youth with more severe ASD. As such, parent and teacher reports on these youths' severe emotional and behavioral symptoms may be less discrepant compared to reports on youth who have less severe ASD, and in turn, less salient comorbid symptomologies.

However, it may also be that when core symptoms are high, parent and teacher focus on secondary symptoms becomes diminished. Core symptoms of ASD (e.g., social communication deficits) tend to be the most concerning issues for parents, above comorbid symptomologies (McGoron et al., 2014) and above generalized functioning deficits (Rankin, Weber, Kang, & Lerner, 2016). Thus, parents, and potentially teachers, may be more aware of, and more focused on identifying, symptoms of ASD (Warnes, Sheridan, Geske, & Warnes, 2005). When ASD deficits are severe, each informant may not be as reliable in rating secondary, comorbid concerns because the salience of ASD deficits might reduce the recognition of other problem areas. This may be particularly problematic if the informant struggles to distinguish these secondary deficits (or excesses) from those deficits primarily associated with ASD. Whereas such struggles in

distinguishing symptoms are plausible, the literature suggests that secondary behavioral problems likely mask core ASD symptoms, and not the other way around (Park, Kim, Koh, Song, & Leventhal, 2014).

Cognitive Functioning and Adaptive Skills as Predictors of Informant Discrepancies in ASD

Beyond contextual and informant characteristics, child characteristics have been explored in relation to informant discrepancies in typically developing populations (e.g., Achenbach et al., 1987; De Los Reyes & Kazdin, 2005). However, inconsistent findings related to child demographic predictors in the general literature (for a review see De Los Reyes & Kazdin, 2005) may be curtailing investigations of this nature of youth with ASD. A meta-analysis in ASD, while on more limited sets of studies, does provide evidence that the children's intellectual functioning may influence the agreement between parents and teachers (Stratis & Lecavalier, 2015). Parents and teachers of children with ASD and lower IQ scores exhibit more correspondence than when children have higher IQ scores, as emotional and behavioral problems may be more salient and less variable in youth with borderline or below average IQ (Stratis & Lecavalier, 2015). Moreover, youth with ASD and lower IQ scores tend to exhibit significantly more emotional and behavioral problems than their peers with average IQ scores (Gadow, Perlman, Ramdhany, & de Ruiter, 2016). Thus, youth with ASD with lower cognitive functioning may have more salient comorbid symptoms, which are present across contexts and more readily apparent to parents and teachers alike. Likewise, although untested, the same relation may exist with adaptive functioning given that youth with ASD who have fewer adaptive skills often have greater emotional and behavioral problems than youth with ASD who have better adaptive skills (Lecavalier, 2006).

Effects of Informant Discrepancy

Informant discrepancies are predictive of treatment and long-term outcomes for children and of parental involvement in therapy (Ferdinand, van der Ende, Verhuls, 2007; Ferdinand et al., 2006; Lerner, Calhoun, Mikami, & De Los Reyes, 2012). Furthermore, informant discrepancies may be *more* predictive of child outcomes than either informant's report alone (Lerner et al., 2012), and parent–teacher discrepancies are associated with poor outcomes for youth in typically developing populations (Ferdinand et al., 2006). For example, the agreement between informant's views of how important developing a skill or reducing a behavior is may result in differences in how they approach treatment and diagnostic decisions (Frey, Elliott, & Kaiser, 2014). When teachers report more symptomatology than parents, parents may be less inclined to seek out intervention (Ferdinand, van der Ende, Verhuls, 2007). Further, informant discrepancies seem related to engagement of families in therapy (Hawley and Weisz 2003). For instance, disagreement between parents and teachers is associated with poor parental acceptance of the child by the parents (Kolko & Kazdin, 1993) and greater anxiety and depression in mothers (Briggs et al., 1996; Youngstrom et al., 2000). In summary, parent-teacher discrepancies may be particularly noteworthy, as their relationship is often seen to be critical for children's development, particularly when children have a developmental disability (Minke et al., 2014; Ruble & Dalrymple, 2002).

Current Study Rationale and Purpose

Whereas some estimates can be posited about parent-teacher agreement on the internalizing and externalizing problems in youth with ASD, little research has been conducted specifically focused on the BASC-2. The few studies that have examined BASC-2 discrepancies

in ASD (e.g., Lane et al., 2013) lacked the sophisticated statistical analyses required to fully detect informant discrepancies (Laird & De Los Reyes, 2013). Further, sub-scale discrepancies (i.e., do parents or teachers report higher depression, anxiety) have gone largely un-examined as well, and may elucidate information on which specific areas parents and teachers differ in their viewpoints.

Although some predictors of informant discrepancy have been well established, there may be other unique predictors when considering comorbid psychopathology among youth with ASD. Little work has examined if variation in core ASD symptoms and adaptive functioning shape how each informant views secondary psychiatric symptoms. It may be that when core symptoms are lower in severity, other associated behaviors (e.g., hyperactivity) and emotions (e.g., anxiety) become more apparent across settings, and may be better detected by informants.

This study explored whether parents and teachers report similar symptoms across sub-scales (e.g. depression, anxiety) and composite domains (e.g. internalizing and externalizing) on the BASC-2. Further, this study explored whether these discrepancies are related to core ASD deficits, intellectual functioning, and adaptive skills. A goal of this study is to help inform clinicians of areas in which parents and teachers may exhibit disagreement. Clinicians often use multiple informants' reports to make diagnostic decisions that help to determine what services any particular child may need. By identifying specific symptomatology that may differ by rater, clinicians can better understand which comorbid symptoms may vary in youth with ASD across different settings, and be better prepared for when they receive discrepant reports. Further, if core symptomatology is indeed related to discrepancies, clinicians may need to exercise more caution in interpreting informant's reports when ASD symptoms are low and highlight the need for further investigation into multi-informant multi-domain assessment.

Hypotheses

Considering findings by Foley-Nipcon et al. (2010), it was hypothesized that (1a) parents on average would report greater internalizing and externalizing symptomatology than teachers on the BASC-2. Typically, teachers work with many more children compared to parents—this may present a scenario in which parents are more sensitive in detecting symptomatology in their children as they do not have to focus on large numbers of children, regardless of whether symptoms (i.e., behaviors/emotional states that are unexpected or developmentally inappropriate) are actually atypical. Moreover, parents may be more likely to interpret some behaviors/emotional states that are developmentally normative as concerning symptomatology, whereas teachers may recognize their normative nature. Next, it was hypothesized that (1b) these discrepancies would exist in the same direction across all BASC-2 sub-scales. It was also hypothesized that (1c) greater overall discrepancy would exist between parents and teachers in reports of internalizing symptoms than in reports of externalizing symptoms. Externalizing behavioral problems may be more readily noticeable by each informant, whereas internalizing issues may be more difficult to detect. Thus, there exists the greater potential for more variance in internalizing scores between informants (Stratis & Lecavalier, 2015; Kolko & Kazdin, 2006).

It was also hypothesized that greater disagreement between parent and teacher reported comorbid emotional and behavioral problems on the BASC-2 would be related to (2a) lower ASD symptomatology, (2b) higher IQ scores, and (2c) higher levels of adaptive skills. As deficits in ASD, intellectual functioning, and adaptive skills increase, the likelihood of more severe and more salient comorbid internalizing and externalizing problems increases (Stratis & Lecavalier, 2015; Jang & Matson, 2015; Lecavalier, 2006).

CHAPTER 2

METHODS

Participants and Procedure

Previous clinic evaluation records were utilized in secondary data analysis. The sample consisted of 141 children, their caregiver(s), and their teachers. For the purposes of this study, data obtained from parent and teacher report and from behavioral observations by the clinicians conducting the evaluations were examined. All measures were obtained from consenting families who came to a specialty ASD clinic for ASD-related evaluations. Presence of ASD diagnosis was verified by the Autism Diagnostic Observation Schedule-2 (detailed in the ‘Measures’ section). Children from pre-school to early college years are represented in these data. These children come from various socio-economic backgrounds as this clinic serves an ethnically and socio-economically diverse portion of western Alabama. Presently, only three clinics specializing in ASD exist in the state of Alabama, thus a large portion of the population in this area relies on ASD services through this clinic. Sample demographics are described below in the Results section.

Measures

Demographic Information. Participating parents completed a demographic and family medical history form and were asked to provide demographic information about themselves, their youth, and the broader family (e.g., age of child, sex of child, previous diagnoses, family medical history). This form also asked participants to provide information on the child’s developmental milestones, psychiatric history (including past diagnoses), medical history, and

history of services and interventions received.

Measure of Comorbid Psychopathology: *Behavioral Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004)*. Teachers and parents completed the BASC-2 as a measure of their child's overall behavioral and emotional functioning. The BASC-2 includes four composite scores: Externalizing Problems, Internalizing Problems, the Behavioral Symptoms Index, and Adaptive Skills. The Externalizing Problems Composite is composed of the Hyperactivity, Aggression, and Conduct Problems sub-scales. The Internalizing Problems Composite is composed of the Anxiety, Depression, and Somatization sub-scales. In the current study, both Externalizing and Internalizing Problems composites were examined separately as measures of comorbid psychopathology. The Adaptive Skills and the Behavioral Symptoms composites were not examined in the current study.

The BASC-2 Parent Rating Scales (BASC-2 PRS) contains 150-160 items depending on the age (6 to 11 or 12 to 21) of the child being assessed. The BASC-2 Teacher Rating Scales (BASC-2 TRS) contains 139 item regardless of child age. Respondents rate items (e.g., "Is easily upset") on a 4-point Likert scale ranging from "never" to "almost always." Higher clinical sub-scale scores indicate more problematic functioning in that particular symptom area within the Internalizing, BSI, and Externalizing composites. T-scores from 41 to 59 are considered Average, T-scores from 60 to 69 are considered At-Risk and areas to monitor, and T-scores of 70 and above are considered Clinically Significant and likely deserve attention and further follow up. The BASC-2 exhibits strong reliability and validity across various youth (Tan, 2007), including good internal consistency, test-retest reliability, and interrater reliability (Reynolds & Kamphaus, 2004). The BASC-2 is widely used in community settings as a way to identify disorders that typically occur in childhood or adolescence (Tan, 2007), and has been validated

for use with youth with ASD (e.g., Mahan & Matson, 2011; Volker et al., 2010). Internal consistency estimates for BASC-2 sub-scales and composite scales are reported in Table 1.

Table 1. Chronbach’s Alpha across BASC-2 Subscales and Composites

<i>Informant</i>	Parent Report			Teacher Report		
<i>Version</i>	Pre-School	Child	Adolescent	Pre-School	Child	Adolescent
Scale						
Aggression	0.87	0.90	0.87	0.90	0.95	0.94
Anxiety	0.73	0.92	0.93	0.79	0.82	0.84
Attention	-0.04	0.43	0.44	0.06	-0.82	0.53
Atypicality	0.76	0.83	0.82	0.90	0.90	0.64
Conduct Problems		0.90	0.85		0.92	0.77
Depression	0.87	0.71	0.93	0.86	0.89	0.84
Hyperactivity	0.88	0.87	0.88	0.93	0.95	0.93
Somatization	0.70	0.87	0.89	0.79	0.60	0.95
Withdrawal	0.32	0.53	0.65	0.59	0.40	0.17
<i>Externalizing</i>	0.91	0.95	0.93	0.95	0.97	0.95
<i>Internalizing</i>	0.90	0.95	0.96	0.88	0.88	0.88

Measure of Autism Symptom Severity: *Autism Diagnostic Observation Schedule - Generic* (ADOS-G; Lord et al., 2000; Lord et al., 2012). The ADOS is a standardized, direct, observational assessment of behaviors during play-based interactions meant to illicit skills deficits consistent with ASD. The test is administered and scored by a trained clinician and covers the current behavior of the child being evaluated. Individuals are evaluated using one of four “modules” of the test in the first version of the measure or one of five “modules” when using the second version of the measure, with different modules designed to match the child’s level of expressive language and chronological age. Items cover the social communication and restricted behaviors or interests domains of the DSM-5, and are informed by ICD-10 and DSM–IV criteria. The ADOS is considered a gold-standard measure of autism symptom severity

(Falkmer, Anderson, Falkmer, & Horlin, 2013) and demonstrates strong psychometric properties (Hus & Lord, 2014; Falkmer et al., 2013), including strong inter-rater and test-retest reliability, strong discriminant validity (Lord et al., 2000), and acceptable internal consistency (Gotham, Risi, Pickles, & Lord, 2007). The ADOS-2, the second edition of the measure, was updated with more detailed instructions and the inclusion of a score to compare across versions and modules of the ADOS (Lord et al., 2012). Cronbach's alpha for the different modules and versions of the ADOS ranged from .80 to .86 in the current study. For the purposes of the current study, this comparison score was utilized in any analyses using the ADOS as a measure of ASD symptoms.

Measure of Adaptive Functioning: *Adaptive Behavior Assessment System (ABAS-2;* Harrison & Oakland, 2008; *ABAS-3;* Harrison & Oakland, 2015). The ABAS-2 and the ABAS-3 are measures of adaptive functioning that assesses a child's current functioning and adaptive skills in communication, community use, functional academics, school/home living, health and safety, leisure, self-care, self-direction, social, and motor skills. The ABAS-2 is a widely-used measure that is often utilized when assessing youth with ASD (e.g., Clark, Magill-Evans, & Koning, 2015) and the ABAS-3 contains updated norms for the measure (Harrison & Oakland, 2015). Both measures have three composite domains (conceptual, social, and practical) and an overall score called the Global Adaptive Composite (GAC). The three composites and the GAC have a mean of 100 and standard deviation of 15. Higher scores indicate better adaptive functioning. The measures have demonstrated moderate to high test-retest and inter-rater reliabilities, and has demonstrated strong internal consistency ($\alpha = .98$; Clark et al., 2015). Cronbach's alpha for the different ages and versions of the ABAS ranged from .93 to .99 in the current study. The GAC was utilized in the current study to measure adaptive skills.

Measure of Intellectual Functioning: Wechsler Intelligence Scale for Children-IV (WISC-IV; Wechsler, 2003). The WISC-IV is a measure of intellectual ability and cognitive processing. It has 10 core sub-tests that produce scaled scores ($M = 10$; $SD = 3$) that can be clustered into four composite indices ($M = 100$; $SD = 15$): the Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI), and the Processing Speed Index (PSI). These four indices can then be combined to form the Full Scale Intelligence Quotation (FSIQ), which is a measure of general intellectual ability. The WISC-IV has demonstrated good concurrent validity with other established measures of IQ in ASD (Mayes & Calhoun, 2008) and has good reliability and validity in overall usage (Wechsler, 2003).

Wechsler Intelligence Scale for Children – V (WISC-V; Wechsler, 2014). The WISC-V is a newer version of the WISC-IV. It has 10 core sub-tests that produce scaled scores ($M = 10$; $SD = 3$) and retains three of the four composite indices present on the WISC-IV: the Verbal Comprehension Index (VCI), the Working Memory Index (WMI), and the Processing Speed Index (PSI). The Perceptual Reasoning Index (PRI) of the WISC-IV is split into the Visual Spatial Index (VSI) and the Fluid Reasoning Index (FRI) on the WISC-V. These five indices can then be combined to form the Full-Scale Intelligence Quotation (FSIQ), which is a measure of general intellectual ability. The WISC-V has been validated for use in youth with ASD with and without language impairment and has been shown to have great convergent validity with the WISC-IV (Wechsler, 2014). Overall, the Wechsler intelligence scales are the most commonly used IQ measures in this population (Mottron, 2004).

Differential Ability Scales-Second Edition (DAS-II; Elliott et. al, 2007). The DAS-II is a measure of cognitive skills for children 2.5 - 18 years of age. The DAS-II contains two separate batteries depending upon the child's chronological age, Early Years and School Aged. The DAS-

II contains 3 composites for the Early Years (verbal, non-verbal, spatial) and 3 composites for the School Aged (verbal, non-verbal reasoning, spatial). Both batteries of the DAS-II yield an age-normed General Conceptual Ability Score (GCA) measuring overall conceptual and reasoning abilities. The DAS-II has been previously used with youth with ASD (e.g., Nowell, Schanding, Kanne, & Goin-Kochel, 2015) and has demonstrated good internal, test-retest, and interrater reliabilities (Thorndike, Hagen, & Sattler, 1986). The DAS-II also has demonstrated good convergent validity with the WISC in typically developing children (Byrd & Buckhalt, 1991) and in children with learning disabilities (Dumont, Cruse, Price, & Whelley, 1996). For the current study, the DAS-II GCA was used in analyses.

As each measure of intelligence contains a mean of 100, a standard deviation of 15, and are on the same scale, the DAS-II GCA was merged with the FSIQ on the WISC-IV and the WISC-V to create a broad IQ score. All analyses involving IQ were performed with each IQ measure individually as well as with the combined IQ score. If no differences are found between analyses ran with each IQ measure separately, interpretations will be based on the combined IQ score to increase parsimony, foster cross-measure interpretability, and to increase statistical power to detect effects. However, if differences are evinced between any of the effects of each IQ measure, then interpretations will be based on each IQ measure individually.

Data Analytic Approach

Data were modeled as a two-level repeated-measures multi-level model with informants nested within children predicting BASC-2 scores (equations for all models are presented in Figures 1 and 2). Informant (coded: 1=Teacher, 2=Parent) was entered as a predictor at level 1, to examine whether mean BASC scores were significantly different between parents and teachers.

Cognitive Functioning

Level-1:

$$\text{Externalizing} = \pi_{0i} + \pi_{1i} * \text{Informant}_{ti} + e_{ti}$$

Level-2:

$$\pi_{0i} = \beta_{00} + \beta_{01} * \text{Cognitive}_i + \beta_{02} * \text{Age}_i + \beta_{03} * \text{Sex}_i + U_{0i}$$

$$\pi_{1i} = \beta_{10} + \beta_{11} * \text{Cognitive}_i + \beta_{12} * \text{Age}_i + \beta_{13} * \text{Sex}_i + U_{1i}$$

Combined Fixed Effects:

$$\beta_{00} + \beta_{01} * \text{Cognitive}_i + \beta_{02} * \text{Age}_i + \beta_{03} * \text{Sex}_i + \beta_{10} * \text{Informant}_{ti} + \beta_{11} * (\text{Cognitive}_i * \text{Informant}_{ti}) + \beta_{12} * (\text{Age}_i * \text{Informant}_{ti}) + \beta_{13} * (\text{Sex}_i * \text{Informant}_{ti})$$

Combined Random Effects:

$$U_{0i} + U_{1i} * \text{Informant}_{ti} + e_{ti}$$

Autism Symptoms

Level-1:

$$\text{Externalizing} = \pi_{0i} + \pi_{1i} * \text{Informant}_{ti} + e_{ti}$$

Level-2:

$$\pi_{0i} = \beta_{00} + \beta_{01} * \text{ADOS}_i + \beta_{02} * \text{Age}_i + \beta_{03} * \text{Sex}_i + U_{0i}$$

$$\pi_{1i} = \beta_{10} + \beta_{11} * \text{ADOS}_i + \beta_{12} * \text{Age}_i + \beta_{13} * \text{Sex}_i + U_{1i}$$

Combined Fixed Effects:

$$\beta_{00} + \beta_{01} * \text{ADOS}_i + \beta_{02} * \text{Age}_i + \beta_{03} * \text{Sex}_i + \beta_{10} * \text{Informant}_{ti} + \beta_{11} * (\text{ADOS}_i * \text{Informant}_{ti}) + \beta_{12} * (\text{Age}_i * \text{Informant}_{ti}) + \beta_{13} * (\text{Sex}_i * \text{Informant}_{ti})$$

Combined Random Effects:

$$U_{0i} + U_{1i} * \text{Informant}_{ti} + e_{ti}$$

Figure 1. Diagram of models predicting BASC Externalizing scores.

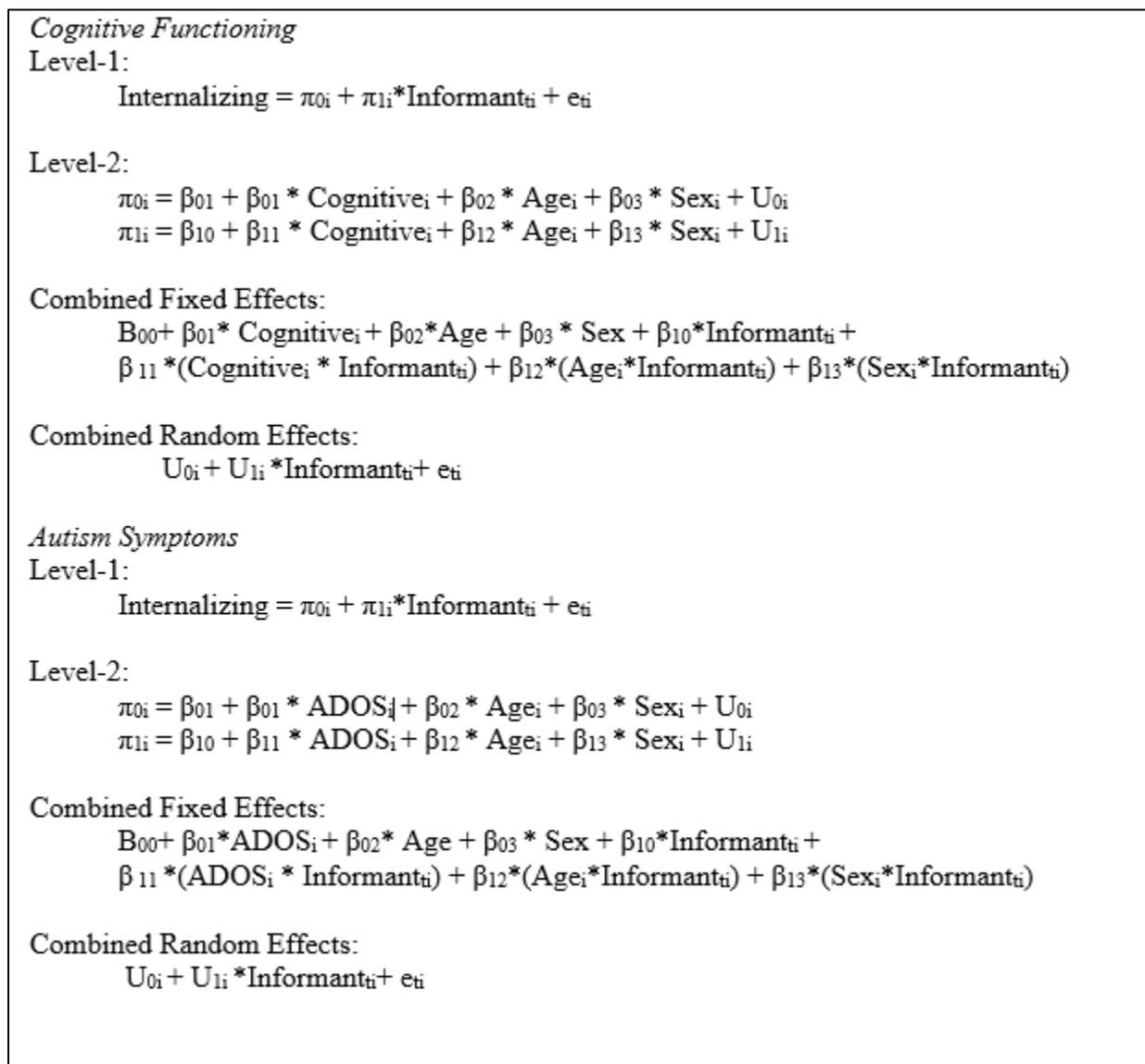


Figure 2. Diagram of models predicting BASC Internalizing scores.

For hypothesis 1a, that parents, on average, would report greater internalizing and externalizing symptomatology than teachers on the BASC-2, models tested BASC-Externalizing scores and BASC-Internalizing scores as outcome variables. For hypothesis 1b, that these discrepancies would exist in the same direction across all BASC-2 sub-scales, models tested each

of the 9 overlapping BASC sub-scales as outcome variables¹. Next, ASD symptoms and IQ scores were then entered (separately) into the model as level-2 predictors to examine if variance in BASC-2 scores not accounted for by Informant could be explained by ASD symptoms and IQ scores, as well as if the relationship between Informant and BASC-2 scores varied depending on level of ASD symptoms and IQ scores (testing hypotheses that greater disagreement between parent and teacher reported comorbid emotional and behavioral problems on the BASC-2 would be related to lower ASD symptomatology [hypothesis 2a] and higher IQ scores [hypothesis 2b]). From there, child age and sex were entered in the model as level-2 covariates to determine whether these relations vary between boys and girls, or vary at different ages.

Further, to test hypothesis 1c, that discrepancy would be greater between ratings of Internalizing symptoms compared to ratings of Externalizing symptoms, a Fisher's r to z transformation compared the correlation between parent and teacher reports of Externalizing symptoms to the correlation between parent and teacher reports of Internalizing symptoms to see if one correlation is significantly stronger than the other. First, each correlation coefficient (r) is converted to a z -score. Then, the two z -scores are compared to each other (while also taking into account covariance and sample size) and a resulting Fisher's Z is used to determine the significance of the difference between the two correlations (for a review of this methodology see Kenny, 1987, pg. 279).

To test hypothesis 2c, that greater adaptive skills will predict greater discrepancy between parent and teacher-reported BASC-2 scores, a one-way analysis of variance was conducted. Cutoff scores on the BASC-2 (normal, at-risk, or clinically significant as indicated in the BASC-2 clinical manual) were calculated for each youth's parent and teacher reports. From there, each

¹ Overlapping sub-scales include: Hyperactivity, Aggression, Conduct Problems, Anxiety, Depression, Somatization, Atypicality, and Withdrawal

youth was classified into one of four groups (Parent Higher, Teacher Higher, Both Equally High, Both Equally Low) based upon the similarity of the classifications yielded by the parent and teacher report and the severity level of these classifications. Youth considered at-risk on both reports or in the clinically significant range on both reports were included in the Both Equally High group. This procedure was completed twice, once to derive group classifications for Internalizing symptoms and once to derive group classifications for Externalizing symptoms. This 4-group structure has been previously used by De Los Reyes et al. (2010) and Rote and Smetana (2016) when examining patterns of agreement between informants. Group was entered as the independent variable, with ABAS scores entered as the dependent variable to determine whether adaptive skills are higher or lower in groups where discrepancy between parent and teacher report is present than when parent and teacher report are similar. Post-Hoc linear contrasts were then performed to determine if the two discrepancy groups differ from the two non-discrepancy groups on adaptive skills.

CHAPTER 3

RESULTS

Descriptives

Overall, the majority of the sample of children was male (77%). The average child age was 8.47 years old (range 3 to 18; $SD = 3.95$). Seventy-three youth (52%) received a diagnosis of ASD, while 52 youth received non-ASD diagnosis (14 ADHD, 10 ADHD + other disorder, 6 mood/anxiety disorder, 7 Developmental Delay, 15 other developmental disabilities), and 16 received no diagnosis at all. Sixty-two teacher-reports (72%) were completed by general education teachers, 17 were completed by special education teachers (20%), and 7 were completed by other educational professionals (8%). The average length of time in which the teacher had known the child was about 12 months ($M = 12.40$, $SD = 10.22$). Fifty-five percent of parents who completed the parent-report measures were married, although 71% of youth in the study were reported to have multiple caregivers, with 13% of youth split between parental homes. The most common type of caregiver who completed parent-report measures was mothers (83%), followed by fathers (7%), grandparents (7%), and guardians (3%). The average age for mothers was 37 years ($M = 37.29$, $SD = 9.34$) and the average age for fathers was 39 ($M = 39.70$, $SD = 8.98$).

The average FSIQ on the WISC-V was 86.38 (range 67 to 111, $SD = 18.88$) and 85.17 (range 46 to 139, $SD = 22.71$) on the WISC-IV. The average GCA on the DAS-II was 83.38 (range 38 to 108, $SD = 15.37$). The FSIQ on the WISC-IV, the FSIQ on the WISC-V, and the GCA on the DAS-II were combined to serve as a single IQ measure ($M = 84.42$, $SD = 17.35$,

range 38 to 139). The average GAC standard score for the ABAS-3 was 73.88 (SD = 16.68) and the average GAC for the ABAS-2 was 71.81 (SD = 16.91), which fell in the low and borderline ranges respectively. Average ADOS composite score in the current sample was 4.55 (SD = 2.81). The average parent reported Externalizing (M = 63.30, SD = 15.56) and Internalizing (M = 61.70, SD = 16.31) scores were in the At-Risk classification range on the BASC-2. The average teacher reported Externalizing (M = 57.86, SD = 13.90) and Internalizing (M = 56.69, SD = 13.74) scores were both in the Average range.

One-way analysis of variance determined that those who received an ASD diagnosis scored significantly higher on parent-rated Withdrawal ($F(1,120) = 4.34, p = .04$), Aggression ($F(1,120) = 4.48, p = .04$), and Atypicality ($F(1,120) = 4.54, p = .04$) on the BASC-2 compared to youth who did not receive an ASD diagnosis. Those who received ASD diagnoses also scored higher in teacher-rated Withdrawal ($F(1,92) = 4.34, p = .04$) and on the ADOS ($F(1,136) = 160.80, p < .001$), compared to children who did not receive an ASD diagnosis. Correlations between variables are presented in Table 2.

Table 2. Correlations between Variables of Interest in the Present Study

	1	2	3	4	5	6	7	8
1. Age	-	.37***	-.04	-.14	-.24*	-.26***	.17	.09
2. ASD Symptoms		-	.06	.04	-.13	-.15	.12	-.02
3. Adaptive Skills			-	.25*	-.11	-.13	.04	.09
4. IQ Scores				-	.08	.23*	.00	.19
5. T-Externalizing					-	.44***	.40***	-.04
6. P-Externalizing						-	-.03	.40***
7. T-Internalizing							-	.33***
8. P-Internalizing								-

Note. T = Teacher. P = Parents. * $p < .05$. ** $p < .01$. *** $p < .001$.

Hypothesis 1

Overall, BASC-2 Externalizing Symptoms ($\beta_{10} = 6.23, p < .001$) and Internalizing Symptoms ($\beta_{10} = 5.51, p < .01$) were significantly higher when rated by parents compared to teachers (Hypothesis 1a). At the sub-scale level, 2 scales (Attention Problems and Withdrawal)

demonstrated poor internal consistency (Table 1) across the different versions of the BASC-2, and were not analyzed in the current study. Overall, 5 (Conduct Problems, Depression, Aggression, Hyperactivity, Somatization) of the 7 sub-scales that were examined were rated significantly higher by parents than teachers (see Table 3; Hypothesis 1b).

Table 3. Sub-Scale Discrepancy on the BASC-2 Overlapping Sub-Scales

<i>Sub-Scale</i>	Anxiety	Depression	Somat	Conduct	Aggress	Hyper	Atypicality
<i>Fixed Effects</i>							
β_{00} - Intercept	52.77***	50.54***	48.41***	47.88***	52.46***	52.11***	63.98***
β_{10} - Informant	2.12	6.78***	4.51**	5.23**	3.57*	7.20***	4.23
<i>Random Effects</i>							
τ_{00}	85.99	215.13**	146.17*	88.95	205.01**	187.71**	342.79**
τ_{01}	-49.03**	-84.60***	-73.79***	-30.83	-78.05***	-73.47***	-162.77***
τ_{11}	53.46	63.65	59.17	50.11	62.58	52.28	77.36
σ^2	126.11***	113.07***	131.92***	71.94***	102.00	103.04***	275.12***
<i>Deviance (-2LL)</i>							
Intercept Only	1757.67	1794.01	1766.51	1174.06	1778.64	1765.94	1860.31
Final Model	1753.50	1780.16	1759.90	1162.16	1773.78	1749.01	1855.15
$X^2(3) = 7.815$	4.17	13.85	6.61	11.9	4.86	16.93	5.16

Note. Somat = Somatization. Aggress = Aggression. Hyper = Hyperactivity.

Italics = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Overall the correlation between parent and teacher rated Externalizing symptoms was not stronger than the correlation between parent and teacher rated Internalizing symptoms ($z = .88$, $p = .38$; Hypothesis 1c).

Hypothesis 2

Autism symptoms did not explain a significant amount of variance in either Internalizing ($\beta_{01} = 1.12, p = .30$; Table 4, Model C) or Externalizing ($\beta_{01} = -.77, p = .45$; Table 5, Model C) Symptoms when examined via MLM as a level-2 predictor. Further, the effect of Informant on either Internalizing ($\beta_{11} = -.60, p = .37$; Table 4 Model C) or Externalizing ($\beta_{11} = .01, p = .99$; Table 5 Model C) Symptoms did not vary depending on level of ASD symptoms (Hypothesis 2a). When covariates were added into the model, the effects of age ($\beta_{02} = .05, p = .58$) and sex ($\beta_{03} = -2.85, p = .69$; Table 4, Model D) did not explain significant unique variance in Internalizing symptoms, across informants. The effect of Informant on Internalizing Symptoms did not vary based on age ($\beta_{12} = .01, p = .84$) or sex ($\beta_{13} = 2.86, p = .52$; Table 4, Model D). The effects of age ($\beta_{02} = -.02, p = .76$) and sex ($\beta_{03} = -9.07, p = .17$) did not explain significant unique variance in Externalizing Symptoms, across informants (Table 5, Model D). Likewise, the effect of Informant on Externalizing Symptoms did not vary based on age ($\beta_{12} = -.04, p = .38$) or sex ($\beta_{13} = 3.35, p = .41$; Table 5, Model D). As such, a significant amount of variance between teacher- and parent-reported Internalizing ($\sigma^2 = 128.79, p < .001$) and Externalizing ($\sigma^2 = 98.85, p < .001$) Symptoms remained unexplained, suggesting additional factors likely explain parent-teacher discrepancies on the BASC-2.

Table 4. Effects of Informant, ADOS, and Covariates on BASC-2 Externalizing Scores

Multilevel Model	Model A	Model B	Model C	Model D
<i>Predictors Added</i>	Intercept	Informant	ADOS	Sex & Age
<i>Fixed Effects</i>				
β_{00} - Intercept	60.91***	51.09***	54.31***	58.10***
β_{10} - Informant		6.23***	6.47*	8.71
β_{01} - ADOS			-0.77	-0.84
β_{11} - ADOS x Informant			0.006	0.32
β_{02} - Age				-0.02
β_{03} - Sex				-9.07
β_{12} - Age x Informant				-0.04
β_{13} - Sex x Informant				3.35
<i>Random Effects</i>				
τ_{00}	73.19**	155.37*	156.52*	144.86*
τ_{01}	--	-59.50**	-60.69**	-56.79**
τ_{11}	--	56.85	57.70	53.08
σ^2	152.12***	96.19***	100.04***	98.85***
<i>Deviance Components</i>				
-2 Log Likelihood	1774.79	1760.17	1616.12	1605.69
<i>Parameters Estimated</i>	3	6	8	12
χ^2		14.62**	144.05***	10.43*

Note. *Italics* = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5. Effects of Informant, ADOS, and Covariates on BASC-2 Internalizing Scores

Model	A	B	C	D
<i>Predictors Added</i>	Intercept	Informant	ADOS	Sex & Age
<i>Fixed Effects</i>				
β_{00} - Intercept	59.41***	50.73***	46.02***	43.29***
β_{10} - Informant		5.51**	8.07*	6.66
β_{01} - ADOS			1.12	1.03
β_{11} - ADOS x Informant			-0.60	-0.74
β_{02} - Age				0.05
β_{03} - Sex				-2.85
β_{12} - Age x Informant				0.01
β_{13} - Sex x Informant				2.86
<i>Random Effects</i>				
τ_{00}	56.57*	106.82	108.26	99.42
τ_{01}	--	-54.14**	-54.38*	-51.91*
τ_{11}	--	62.06	63.49	61.03
σ^2	179.11***	124.74***	127.40***	128.79***
<i>Deviance Components</i>				
-2 Log Likelihood	1788.43	1776.18	1632.25	1627.87
<i>Parameters Estimates</i>	3	6	8	12
χ^2		12.25**	143.93***	4.38

Note. *Italics* = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

IQ scores across the WISC-IV, WISC-V and DAS-II were combined into an overall IQ score. IQ did not explain a significant amount of variance in either Internalizing ($\beta_{01} = -.21$, $p = .27$; Table 6, Model C) or Externalizing ($\beta_{01} = -.13$, $p = .47$; Table 7, Model C) Symptoms when examined via MLM as a level-2 predictor. Further, the effect of Informant on either Internalizing ($\beta_{11} = .17$, $p = .12$; Table 6, Model C) or Externalizing ($\beta_{11} = .13$, $p = .19$; Table 7, Model C) Symptoms did not vary depending on level of IQ (Hypothesis 2b). When covariates were added into the model, the effects of age ($\beta_{02} = .03$, $p = .67$) and sex ($\beta_{03} = -6.42$, $p = .39$) did not explain

significant variance in Internalizing Symptoms, across informants (Table 6, Model D). The effect of Informant on Internalizing Symptoms did not vary based on age ($\beta_{12} = .03, p = .51$) or sex ($\beta_{13} = 6.90, p = .13$; Table 6, Model D). Further, the effects of age ($\beta_{02} = -.08, p = .29$) and sex ($\beta_{03} = -8.18, p = .23$) did not explain significant variance in Externalizing Symptoms across informants (Table 7, Model D). The effect of Informant on Externalizing Symptoms did not vary based on age ($\beta_{12} = -.01, p = .82$) or sex ($\beta_{13} = 3.39, p = .43$; Table 7, Model D). A significant amount of variance remained unexplained between teacher and parent reported Internalizing ($\sigma^2 = 102.53, p < .001$) and Externalizing ($\sigma^2 = 85.68, p < .001$) Symptoms, again suggesting additional factors likely explain parent-teacher discrepancies on the BASC-2.

Table 6. Effects of Informant, IQ, and Covariates on BASC-2 Externalizing Scores

Model	A	B	C	D
<i>Predictors Added</i>	Intercept	Informant	Combined IQ	Sex & Age
<i>Fixed Effects</i>				
β_{00} - Intercept	60.91***	51.09***	60.99***	70.48***
β_{10} - Informant		6.23***	-4.48	-3.36
β_{01} - IQ			-0.13	-0.14
β_{11} - IQ x Informant			0.13	0.13
β_{02} - Age				-0.08
β_{03} - Sex				-8.18
β_{12} - Age x Informant				-0.01
β_{13} - Sex x Informant				3.38
<i>Random Effects</i>				
τ_{00}	73.19**	155.37*	148.37*	121.85
τ_{01}	--	-59.50**	-55.97**	-47.81**
τ_{11}	--	56.85	57.17	51.73
σ^2	152.12***	96.19***	85.35***	85.68***
<i>Deviance Components</i>				
-2 Log Likelihood	1774.79	1760.17	1360.12	1349.27
<i>Parameters Estimated</i>	3	6	8	12
χ^2		14.62**	400.05***	10.85***

Note. Inclusion of Diagnosis did not result in a significant change in -2 Log Likelihood (-2 log likelihood = 1348.45, $\chi^2(2) = 0.82$, $p > .05$).

Italics = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 7. Effects of Informant, IQ, and Covariates on BASC-2 Internalizing Scores

Model	A	B	C	D
<i>Predictors Added</i>	Intercept	Informant	Combined IQ	Sex and Age
<i>Fixed Effects</i>				
β_{00} - Intercept	59.41***	50.73***	69.41***	67.30***
β_{10} - Informant		5.51**	-9.16	-14.41
β_{01} - IQ			-0.21	-0.20
β_{11} - IQ x Informant			0.17	0.18
β_{02} - Age				0.03
β_{03} - Sex				-6.42
β_{12} - Age x Informant				0.03
β_{13} - Sex x Informant				6.90
<i>Random Effects</i>				
τ_{00}	56.57*	106.82	175.73*	179.05**
τ_{01}	--	-54.14**	-70.48**	-71.79**
τ_{11}	--	62.06	60.95	55.79
σ^2	179.11***	124.74***	105.07***	102.53***
<i>Deviance Components</i>				
-2 Log Likelihood	1788.43	1776.18	1374.85	1363.42
<i>Parameters Estimates</i>	3	6	8	12
χ^2		12.25**	401.33***	11.43*

Note. Inclusion of Diagnosis did not result in a significant change in -2 Log Likelihood (-2 log likelihood = 1361.37, $\chi^2(2) = 2.05$, $p > .05$).

Italics = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Separate analyses were performed using each of the IQ measures separately and results are presented in Table 8 and Table 9. When broken down by measure, effects of informant (β_{10}), IQ (β_{01}), and their cross-product (β_{11}) were all non-significant across each of the three measures of IQ when predicting Externalizing (Table 8) and Internalizing (Table 9) composites on the BASC-2.

Table 8. Comparison of Effects of Different IQ Measures on BASC-2 Externalizing Scores

Measure of IQ	Combined	DAS Only	WISC-IV Only	WISC-V Only
<i>Fixed Effects</i>				
β_{00} - Intercept	60.99***	52.62*	59.34**	74.22
β_{10} - Informant	-4.48	-5.96	-4.76	-21.72
β_{01} - IQ	-0.13	0.02	-0.22	-0.32
β_{11} - IQ x Informant	0.13	0.15	0.17	0.34
<i>Random Effects</i>				
τ_{00}	148.37*	184.07	3.72	16.55
τ_{01}	-55.97**	-73.66*	-10.95	-14.47
τ_{11}	57.17	63.43	32.25	48.00
σ^2	85.35***	98.36**	52.57**	86.87*
<i>Deviance Components</i>				
-2 Log Likelihood	1360.12	693.99	360.06	283.94

Note. *Italics* = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 9. Comparison of Effects of Different IQ Measures on BASC-2 Internalizing Scores

Measure of IQ	Combined	DAS Only	WISC-IV Only	WISC-V Only
<i>Fixed Effects</i>				
β_{00} - Intercept	69.41***	56.15*	102.02**	32.39
β_{10} - Informant	-9.16	-9.45	-22.67	20.26
β_{01} - IQ	-0.21	-0.05	-0.58	0.23
β_{11} - IQ x Informant	0.17	0.15	0.34	-0.15
<i>Random Effects</i>				
τ_{00}	175.73*	27.30	513.78*	180.12
τ_{01}	-70.48	-30.67	-160.60**	-62.85
τ_{11}	60.95	34.48	66.32	83.48
σ^2	105.07***	112.16***	82.31	112.78*
<i>Deviance Components</i>				
-2 Log Likelihood	1374.85	657.36	386.56	302.71

Note. *Italics* = $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

When considering the externalizing grouping structure used in one-way ANOVA analyses, 27 youth fell in the both low group, 14 fell in the both high group, 26 fell in the parent higher, and 8 fell in the teacher higher groups. When considering the internalizing grouping structure, 28 youth fell in the both low, 10 fell in the both high, 28 fell in the parent higher, and 9 fell in the teacher higher groups. Results of a one-way ANOVA examining group (parent higher, teacher higher, equally high, equally low) by ABAS symptoms suggest that group membership was not related to differences in ABAS scores when considering Externalizing Symptoms ($F(3,54) = 1.17, p = .33$) or Internalizing Symptoms ($F(3,54) = .26, p = .85$; Hypothesis 2c). Furthermore, planned contrasts comparing the two discrepancy groups (parent higher, teacher higher) to the two congruent groups (both high, both low) revealed that ABAS scores did not differ between youth with discrepant Externalizing risk classifications and youth with non-discrepant Externalizing risk classifications, $t(24) = .94, p = .33$, or between youth with discrepant Internalizing risk classifications and youth with non-discrepant Internalizing risk classifications, $t(54) = .37, p = .72$.

CHAPTER 4

DISCUSSION

The aim of this study was to determine whether parent and teacher reports on comorbid emotional and behavioral problems are differentially related to primary symptoms of ASD, adaptive skills, and IQ among youth assessed for ASD. Multi-level modeling suggested that discrepancy between teacher- and parent-reported behavioral and emotional functioning exists when assessing youth referred for an ASD-specific assessment. This is in line with previous literature, which suggests that discrepancy is common between parent and teacher reports of comorbid symptomatology in youth with ASD (see Stratis & Lecavalier, 2015).

Similarly, parents reported more symptoms compared to teachers on 5 of the 7 overlapping sub-scales on the BASC-2: Hyperactivity, Aggression, Conduct Problems, Depression, and Somatization. This suggests that, when assessing youth for ASD, there may be little variation in agreement between teacher and parent report across different areas on the BASC-2. Similarly, no difference between the correlation of parent and teacher externalizing symptoms and the correlation of parent and teacher internalizing symptoms was evident. These results could be due to informant characteristics (parents tending to perceive more symptoms than teachers) or situational characteristics of the child (children may display more problem behaviors and more emotional symptoms at home with their parents). Factors related to informant characteristics (i.e. traits of the informant, the situation the informant is in, or how the informant interacts with the child), such as parents having a more precise view of the child (as teachers usually have to tend to more children at any given moment than parents) are possible

reasons why parents might globally rate symptoms higher than teachers. With regard to specific subscales, research shows that some youth with ASD will not exhibit emotional or behavioral symptoms, however, most youth will display some level of elevated atypicality due to the similarities with ASD symptoms (Volker et al., 2010). Thus, across youth with ASD, these behaviors may be more pervasive and more consistent across contexts and cases of ASD, and teachers may be able to identify these symptoms more easily than comorbid symptoms in youth with ASD. The same may be true for anxiety, as anxiety disorders hold the highest rate of comorbidity with ASD, with upwards of 40% of individuals with ASD meeting criteria for an anxiety disorder (Leyfer et al., 2006; Simonoff, Pickles, Charman, Chandler, Loucas, & Baird, 2008). However, when less common comorbid symptoms are considered, parents tended to rate symptoms higher than teachers in the current study. Overall, the correlation between parent and teacher externalizing symptoms was similar to that of parent and teacher internalizing symptoms. This provides further evidence that patterns of agreement between parents and teachers on the BASC-2 may be consistent across different scales. This may be indicative of informant characteristics influencing ratings on the BASC-2 rather than contextual variation. Contextual variation of symptoms may lead to some symptoms that are stronger and more evident at home, with some symptoms more evident at school (Smith, 2007). Thus, when contextual variation is driving informant discrepancies, there typically are differences in agreement across different symptom domains. However, when a factor related to an informant (memory, interpersonal perception) is driving informant discrepancies, patterns of discrepancy may be consistent across different areas of functioning (De Los Reyes, 2011).

In further exploration of these discrepancies, the child characteristics that were examined do not appear to be driving the informant discrepancies present within the current sample.

Neither ASD symptoms nor IQ scores explained significant additional variation in BASC-2 scores not already explained by Informant. Further, the relation between informant and BASC-2 scores did not vary based on either ASD symptoms or IQ scores. In other words, significant discrepancy and unexplained variation still existed between parent and teacher BASC-2 scores even after ADOS scores were included in the model as a predictor (i.e., addition of ASD symptoms did lead to a better fitting model overall). Though this study's small sample size is noteworthy, the interaction between ASD symptoms and informant was small in both models (predicting Internalizing and predicting Externalizing), thus even with a larger sample size, it is unlikely that a clinically meaningful effect of ASD symptoms on the relationship between informants would emerge. After inclusion of IQ scores into the model, informant no longer predicted BASC scores. Although, the relation between parent and teacher BASC may not vary at different levels of IQ scores, IQ may explain variation in BASC-2 scores that is also explained by informant, thus reducing the amount of unique variance explained by each predictor. It could also be that IQ scores may indeed be a significant factor in the model, and the current study may lack the statistical power needed to detect an interaction between Informant and IQ scores due to small sample size. In terms of adaptive skills, youth who had discrepant risk classifications between parent and teacher reports on the BASC-2 did not have greater or fewer adaptive skills than youth who had congruent classifications. Moreover, no significant differences were found between any of the groups (parent higher, teacher higher, both high, both low). This suggests that parent and teacher ratings of comorbid symptoms may not be differentially impacted by the child's level of adaptive functioning. Moreover, this suggests that patterns identified when considering the effect of adaptive skills on agreement between parent and teacher ratings of comorbid symptoms using BASC-2 *t*-scores also applies to BASC-2 at risk classifications.

This pattern of results, taken together, largely suggests that the severity of primary symptoms does not differentially influence ratings of comorbid symptoms. Multiple indicators of primary functioning (ASD symptoms, IQ scores, adaptive skills) were all unrelated to differences in parent and teacher reports of comorbid emotional and behavioral problems. These results occurred whether emotional and behavioral problems were considered on a continuum (i.e., BASC-2 *t*-scores) or as at-risk classifications. Moreover, this pattern of results was identified through both sophisticated statistics such as multi-level modeling, and more traditional statistics such as correlational analyses and analysis of variance. Results hold important implications for assessment of youth with and without ASD. For clinicians, inclusion of parent and teacher measures of secondary concerns may be valid regardless of the severity of the child's primary symptom presentation. Moreover, results suggest a robustness to the application of the BASC-2 for assessing youth with and without ASD in that the measure demonstrates consistent patterns between informants, regardless of the youth's level of ASD symptoms, adaptive functioning, and intellectual functioning. The BASC-2 has been widely used in this population, and results of this study support continued use of this practice.

Future Directions

Although this study was not able to evince characteristics of the youth as a predictor of parent-teacher discrepancy, it may be worth exploring in future examinations. Future work should employ a similar approach with only youth with ASD. Moreover, future research should include a diverse population of youth with ASD, such as youth diagnosed as toddlers, which was not captured in this sample. Also, youth in other, perhaps better-served, regions of the country should also be considered to improve the generalizability of results. Further, analyses were completed only during initial diagnosis for many individuals. It may be that autism symptoms

affect parent-teacher agreement only after the parent is aware the child has autism and may displace understanding of behavioral problems as ASD symptoms. Longitudinal patterns of agreement would be needed to determine how relations between parent and teacher ratings of comorbid systems varies over time. Beyond replication of results, future work is still needed to explain why discrepancies exist between parent and teacher reported comorbid symptoms in ASD. One factor that may be worth considering is the ordering of measures during the assessment process. For clinicians, a worry might be that a respondent's answers to questions on one measure may affect their answers on a different, but similar, questionnaire. In the present study, it is unknown whether the informants completed the BASC-2 before or after completing measures of ASD symptoms. If an order effect exists, then order of questionnaire administration may be important for clinicians to consider during their assessment procedures. Unfortunately, however, this hypothesis was not testable in the current study.

Limitations

The current study possesses several limitations that may reduce the generalizability of results. First, the sample is small and statistical power in the current study is relatively low. For example, a power analysis yielded power of .52 when determining whether informant discrepancies in externalizing problems still exist once ADOS is included in the model. Second, both parent and teacher reports were not available for each participant, which led to missing data. However, this study employed statistical methodologies that utilize all available data under conditions where missing data are assumed to be missing at random. Although it is assumed in the current study that missing data occurred at random (e.g., a teacher never mailed back the BASC-2), randomness of missing data can never be fully verified. Third, while MLM is the suggested statistical approach for modeling nested data, currently there is no technique that

adequately examines discrepancy as an outcome variable in order to determine whether a factor predicts discrepancy between two variables (Laird & De Los Reyes, 2013). Fourth, data were obtained from a single clinic in an underserved region of the country. The same results may not apply to other regions of the country, particularly regions that are better served. It may be that only youth who have parents and teachers who agree about what symptoms the child has demonstrated are referred for ASD-specific assessment in underserved regions. In other regions with more resources, more youth may be referred and assessed for ASD. Thus, it is possible that non-significant results in the current study could potentially be due to some characteristic that is unique to this sample (e.g, age of diagnosis, average IQ) that is different from other samples of youth with ASD. For instance, the current sample had a later average age of diagnosis (9.6 years) and had an average IQ (85) that was lower than most samples. As such, results more aligned with the hypotheses could be found in a more general population of youth with ASD. However, the current set of results would still apply to subsections of the population similar to this study's sample, such as those in underserved regions and with youth who are "lower-functioning". Fifth, parent-report was used on the ABAS, thus, one informant is represented in both predictor (parent-reported BASC-2) and outcome variables in models predicting the ABAS. However, as mentioned before, this line of analysis was only conducted because there was no significant difference between the correlation of ABAS scores with parent-reported BASC-2 scores and the correlation of ABAS Scores with teacher-reported BASC-2. Finally, relations between each rater's reports and diagnostic outcomes could be highly useful information, however, records of diagnostic outcomes of comorbid psychiatric disorders may not be readily available in these data, and even when this information is available, these comorbid diagnoses may not be confirmed.

It is worth noting that for many of these youth, this is the first time they are being

assessed for autism symptoms. Thus, the idea that parents may be more focused on noticing and identifying symptoms of ASD may not apply, as these parents are just learning that their children may have ASD. The influence of ASD symptoms on ratings of comorbid symptoms may be more evident in parents of children who have ASD and have held a diagnosis for several years. It is also worth noting that this sample consisted of youth with and without ASD. Although differences in mean levels of most variables were not found, it is possible that youth with ASD demonstrate different relations between measures of interest than youth without ASD, and when combined, effects are not present. Beyond specific group differences between youth with ASD and youth without ASD, interpretations of two groups together yields the possibility of Simpson's paradox occurring.

Summary

Results suggest that parents rate Externalizing and Internalizing symptoms higher than teachers rate the same symptoms. This was evident across 5 of the 7 overlapping sub-scales that demonstrated good reliability on the BASC-2. This is consistent with work by Foley-Nicpon, Doobay, and Assouline (2010) and Barnhill et al. (2000) where parents rated comorbid behavioral symptoms higher than teachers rated. It may be that youth with ASD display more problematic behaviors and emotional disturbances at home than at school. However, this discrepancy does not appear to be explained by ASD symptoms, IQ of the child, or Adaptive skills. This suggests that characteristics of the child may not affect how successfully parents and teachers are able to come to a consensus about the child's functioning. Moreover, no differences were found in discrepancy between parents and teachers across diagnoses. This suggests that the literature on informant discrepancies among youth who are clinically referred may also extend to understanding informant discrepancies among youth with ASD. Specifically, the agreement

between parent and teacher reports did not vary depending on the severity of ASD symptoms or the child's IQ. Moreover, having discrepant parent- and teacher-reported BASC-2 at risk classifications was not associated with higher or lower ABAS scores than youth who had similar classifications on both parent and teacher reports. Results suggest that the BASC-2 may behave similarly across different youth referred for an ASD evaluation and should not be discontinued from its use as a key measure of comorbid behavioral and emotional symptoms in the ASD assessment process.

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