Are There Behavioral Differences between Children with High Functioning Autism and Children with Asperger’s Disorder?

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Abstract
Over the past few decades, there has been much debate over the different diagnoses that fall under the umbrella of autism spectrum disorders. Current views in the field of autism spectrum disorders identify three diagnoses that fall on the autism spectrum: Autistic Disorder, Pervasive Developmental Disorder, Not Otherwise Specified, and Asperger’s Disorder. The aim of this study was to identify if and how children with Autistic Disorder, High Functioning, Autistic Disorder, and Asperger’s Disorder differ from one another on the Child Behavior Checklist-Parent Report form for children ages 6-18. No significant differences were found between the three diagnostic groups. This study is the first to look at behavioral differences between these diagnostic groups using the Child Behavior Checklist. The implications of the results are discussed in terms of future research, classification, and clinical utility.

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ARE THERE BEHAVIORAL DIFFERENCES BETWEEN CHILDREN WITH HIGH
FUNCTIONING AUTISM AND CHILDREN WITH ASPERGER’S DISORDER?

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Abstract

Over the past few decades, there has been much debate over the different diagnoses that fall under the umbrella of autism spectrum disorders. Current views in the field of autism spectrum disorders identify three diagnoses that fall on the autism spectrum: Autistic Disorder, Pervasive Developmental Disorder, Not Otherwise Specified, and Asperger's Disorder. The aim of this study was to identify if and how children with Autistic Disorder, High Functioning, Autistic Disorder, and Asperger’s Disorder differ from one another on the Child Behavior Checklist-Parent Report form for children ages 6-18. No significant differences were found between the three diagnostic groups. This study is the first to look at behavioral differences between these diagnostic groups using the Child Behavior Checklist. The implications of the results are discussed in terms of future research, classification, and clinical utility.
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Chapter I

Introduction

The term “autism spectrum disorder” (ASD) is used to describe several neurodevelopmental syndromes in which there are deficits in three main areas: communication, social interaction, and repetitive behaviors and restricted interests (Waterhouse et. al., 1996; American Psychiatric Association, 2000). These syndromes include Asperger’s Disorder, Autistic Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). Rett’s Disorder and Childhood Disintegrative Disorder are no longer considered part of the autism spectrum since research has identified distinct genetic factors associated with these two syndromes that are not present for the other disorders on the spectrum (Swedo, 2008). Therefore, Rett’s Disorder and Childhood Disintegrative Disorder will not be considered in this study. The term ASD will be used when referring to Autistic Disorder including Autistic Disorder, High Functioning (more commonly referred to as High Functioning Autism [HFA]), Asperger’s Disorder, and PDD-NOS. When individual disorders are discussed, they will be identified by their specific diagnostic labels in order to differentiate them from other disorders on the autism spectrum.

The core symptoms associated with ASD’s are severe and pervasive impairments in specific developmental areas (American Psychiatric Association, 2000). These include a triad of behaviors involving impairments in social interaction skills, language and communication skills, and restricted interests and repetitive behaviors. Specifically, social interaction abilities are often delayed and/or atypical in nature, and individuals with ASD’s may become easily over-stimulated in social situations, lack awareness of
social etiquette, display extreme reactions to invasion of space and touch, and engage in inappropriate behaviors during social interactions. For example, a child with an ASD may not direct facial expressions toward others or only involve others in the form of tools or characters for the purpose of the activity, not for social involvement. Language and communication may be delayed and/or deviant, both in verbal and nonverbal aspects, and include impairments in the pragmatic aspects of spoken language. Specifically, individuals with ASD’s may have persistent echolalia, inappropriate or bizarre speech prosody, and restricted use of language and/or an unusual vocabulary. Restricted interests and/or repetitive behaviors include inflexible interests, activities, and behaviors, such as a restricted range in the types of play or activities (Le Couteur, 2003). For example, when a child plays, he or she may mimic a certain part of a cartoon episode over and over. Or, a child may recite a specific conversation from a cartoon or recite that piece of the cartoon in conversation with others. In another example, a child may only show a strong interest in Thomas the Train and will only play with/wear clothes of Thomas the Train. Or, a child may have a strong and restricted area of interest in dinosaurs. He may collect dinosaurs, know everything about them, collect books on them, and spend all his spare time engaged in this interest.

The diagnostic classification of ASD’s has evolved over the past few decades (Mash & Barkley, 2003). There are currently two classification systems used to diagnose ASD’s, the International Classification of Diseases—10th Edition (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders—4th Edition, Text Revision (APA, 2000). As the prevalence and awareness of ASD’s have increased, the diagnostic criteria for these disorders have improved. Prior research on these two systems has found
that using one or the other current classification systems increases the reliability of
diagnosing ASD’s as compared to using previous versions of these classification systems,
and this reliability increases with more experienced clinicians (Klin, Lange, Cicchetti, &
Volkmar, 2000; Volkmar, F. R., Klin, A., Siegel, B., Szatmari, P., Lord, C., Campbell,
research on ASD’s has aided in more precise diagnostic criteria and improved
classification.

Prior to publishing the DSM-IV-TR, one study compared classification systems in
the DSM-III, DSM –III-R, and ICD -10 in order to consider whether other diagnoses
within the autism spectrum should be included, and whether or not the DSM-IV-TR
should list more specific diagnostic criteria consistent with the ICD-10 (Volkmar et al.,
1994). The results indicated the DSM-III had the broadest diagnostic criteria and elicited
more false positive diagnoses, while the ICD-10 included other ASD’s and the criteria
were better at discriminating between specific diagnoses on the autism spectrum
(Volkmar et al., 1994). Additionally, inter-rater reliability was highest when diagnoses
were made by experienced clinicians (25 or more cases) using later editions of the DSM
(Thompson, Zwaigenbaum, Goldberg, Bryson, Mahoney, et. al, 2004; Klin, Lang,
Cicchetti, & Volkmar, 2000).

Currently, inter-rater reliability among those in clinical practice appears to be
variable, especially when diagnosing children who are cognitively higher functioning,
(Klin et al., 1997). For example, whether using the DSM-IV or the ICD-10, research has
found poor discriminant validity for differentiating Asperger’s Disorder from Autistic
Disorder (Klin et al., 2000; Volkmar et al., 1994; Volkmar et al., 1992). Therefore, in an
attempt to improve diagnostic reliability further, significant changes have been proposed for the DSM-V, due to become effective in 2013. These changes, although still in the proposal phase, include having a single diagnosis of Autism Spectrum Disorder, with specifiers indicating varying degrees of severity (APA, 2010). With this change, the diagnoses of Asperger’s Disorder, Childhood Disintegrative Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) would be subsumed under the single diagnosis of ASD. At the time of this research, the DSM-IV-TR is the current diagnostic classification system, and therefore this paper refers to this system.

**DSM-IV-TR Diagnostic Classification System**

The following criteria were taken from the DSM-IV-TR (APA, 2000). For Autistic Disorder, children must have a total of six or more specific impairments, in the domains of social interaction (at least two from this domain), communication (at least one in this domain), and restricted and repetitive interests (at least one in this domain).

Qualitative impairment in social interaction includes: (a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction, (b) failure to develop peer relationships appropriate to developmental level, (c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest), and (d) lack of social or emotional reciprocity (APA, 2000, pg. 75).
Qualitative impairment in the communication domain includes: (a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime), (b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others, (c) stereotyped and repetitive use of language or idiosyncratic language, and (d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level (APA, 2000, pg. 75).

Restricted repetitive and stereotyped patterns of behavior includes: (a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus, (b) apparently inflexible adherence to specific, nonfunctional routines or rituals, (c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements), and (d) persistent preoccupation with parts of objects (APA, 2000). Furthermore, the delays or abnormal functioning must have occurred in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play. These disturbances cannot be better accounted for by Rett’s Disorder or Childhood Disintegrative Disorder.

For Asperger’s Disorder, the aforementioned core domains apply to this disorder as well; with the exception that impairment in the communication domain is not a diagnostic feature (although more subtle social communication impairments may be present (APA, 2000). There is no Clinically Significant general delay in language (e.g., single words used by age 2, communicative phrases used by age 3). There also is no
clinically significant delay in cognitive development or in the development of age-appropriate adaptive behavior (other than social interaction). Lastly, the criteria are not met for another specific Pervasive Developmental Disorder or for Schizophrenia.

A diagnosis of PDD-NOS is given when there is a severe and pervasive impairment in the development of reciprocal social interaction or verbal and nonverbal communication skills or when stereotyped behavior, interests, and activities are present but the criteria are not met for a specific ASD (APA, 2000). This could be due to late age of onset, atypical symptomatology, or more subtle symptomatology.

**Assessment Measures used in the Diagnosis of ASD’s**

Because individuals may be inaccurately diagnosed with ASD’s using assessment instruments only, researchers emphasize the importance of obtaining collateral information in order to make accurate diagnoses (Gorman, 2004). In addition, accurate diagnosis of ASD’s requires a dual approach, encompassing both routine developmental history and structured evaluation of specific autistic behaviors (Johnson & Myers, 2007).

**The Autism Diagnostic Observation Scale-Generic.** The Autism Diagnostic Observation Scale—Generic (ADOS-G) is considered the “gold standard” of assessment instruments for diagnosing ASD’s (Lord, Rutter, DiLavore, & Risi, 2003). The ADOS-G is a semi-structured assessment instrument used to evaluate both verbal and non-verbal individuals from two years of age to adult with respect to social interactions and communication, in addition to language delays. There are four modules, each taking 30 to 45 minutes to administer. Which module is administered depends on the individual’s expressive language ability as well as chronological age. Administration requires the evaluator to interact, press for specific behaviors, and observe the process. Notes are
taken during the observation period by a co–examiner and a set of scales is used to score the observation immediately after the session. Administration and scoring were standardized for each module, with scores ranging from 0 to 3 (with 0 indicating no evidence of abnormality and 3 indicating definite evidence of abnormality). While overall, administration of the ADOS-G is an important component of the diagnostic process (Gillberg, 2007), there is some subjectivity in scoring observations using this instrument. However, sufficient training reduces subjective errors in administration and scoring. Therefore, before using the ADOS-G independently, evaluators are urged to practice until they obtain findings demonstrating inter-rater consistency with an experienced clinician; alternately, a video produced by the publishers may be used to check inter-rater consistency. In addition, whenever possible clinicians and researchers are strongly encouraged to obtain training at an ADOS-G workshop (Lord, Rutter, DiLavore, & Risi, 2003).

The ADOS-G demonstrates good psychometric properties overall (Lord, Rutter, DiLavore, & Risi, 2003). Inter-rater reliability in classification of autism versus non-spectrum comparisons, analyzed separately for each module, is more than acceptable among trained professionals (Lord, Rutter, DiLavore, & Risi, 2002). Specifically, the percentage of inter-rater agreement in diagnostic classification was 100% for Modules 1 and 3, 91% for Module 2, and 90% for Module 4. Furthermore, the percentage of exact agreement for Module 1 was 91.5%, 89% for Module 2, 88.2% for Module 3, and 80% for Module 4. Inter-rater reliability also was assessed using intraclass correlations of the domain scores. The Social Interaction domain demonstrated correlations ranging from .88 to .90, Communication domain correlations ranged from .74 to .90, Communication-
Social Interaction domain correlations ranged from .84 to .98, and Stereotyped Behaviors and Restricted Interests domain correlations ranged from .75 to .90. Test-retest intraclass correlations also were assessed, and although lower, were found to be acceptable. Specifically, the Social Interaction domain test-retest correlation was .78, the Communication domain’s test-retest correlation was .73, the Communication-Social Interaction domain test-retest correlation was .82, and the Stereotyped Behaviors and Restricted Interests domain test-retest correlation was .59 (Lord, Rutter, DiLavore, & Risi, 2003).

Test developers explored validity of the ADOS-G using correlation matrices, exploratory factor analyses, and analyses of variances (ANOVAs) (Lord, Rutter, DiLavore, & Risi, 2003). Correlation matrices were generated for all items in each module and diagnostic group. Items with a higher than .70 correlation coefficient with two or more groups were considered for elimination, with the exception of “Integration of Gaze and Other Behaviors during Social Overtures” which was retained because of its research utility; however, it was not included in the algorithm because of redundancy. Exploratory factor analyses were conducted for each module, and one major factor surfaced in each module. Specifically, the majority of the items in the Social Interaction and Communication domains loaded highly on the first factor, accounting for 72% of the variance in Module 1 scores. Similarly, factor 2 accounted for 78% of the variance in scores for Module 2, factor 3 accounted for 52% of the variance in scores for Module 3, and factor 4 accounted for 53% of the variance in scores for Module 4. The ADOS-G module selected is determined by verbal equivalency, not age, and therefore fixed effects ANOVAs were used to compare verbally equivalent participants in the autism and non-
spectrum groups for each module. No specific items in any modules were significant for all three diagnostic groups. Specificity and sensitivity also were assessed for the individual modules. Although they differed slightly, they remained acceptable. When differentiating “Autism” and “ASD” from “non-spectrum disorders,” Module 1 demonstrated 97% sensitivity and 94% specificity, Module 2 demonstrated 95% sensitivity and 87% specificity, Module 3 demonstrated 90% sensitivity and 94% specificity, and Module 4 demonstrated 90% sensitivity and 93% specificity. Finally, normative data were collected using DSM IV-TR and ICD-10 criteria for PDD and Autistic Disorder, using an age-matched control group (Lord, Rutter, DiLavore, & Risi, 2003).

**Child Behavior Checklist-Parent Report Form.** Much research has emphasized the importance of supplementing information obtained by using the ADOS-G with collateral information (Lord, 2006), such as that provided using the Child Behavior Checklist (CBCL). The CBCL Parent Report Form used in this study is a broadband standardized measure used to identify the presence of behavioral and emotional problems and to assess social abilities of children ages 6 to 18 in order to aid in evaluation, diagnosis, and treatment planning (Achenbach & Rescorla, 2001). When used to assess child behaviors, it is completed by the parent(s) or via administrator interview of the parents. The three areas of functioning assessed by the CBCL are social, extracurricular, and school. Furthermore, the CBCL measures behaviors that organize into eight syndromes: Aggressive Behavior, Anxious/Depressed, Attention Problems, Rule Breaking Behavior, Social Problems, Somatic Complaints, Thought Problems, and Withdrawn/Depressed. Six additional DSM-oriented scales are Affective Problems,
Anxiety Problems, Somatic Problems, Attention Deficit/Hyperactivity Problems, Oppositional Defiant Problems, and Conduct Problems. Lastly, the CBCL includes scales of Internalizing Problems, Externalizing Problems, and Total Problems. The present study will use the most recent version of the Parent Report that was revised in 2001 (CBCL/6-18). This form is based upon two previous versions—the original version developed in 1983, and a revised version that was updated in 1991. Supplemental scales of Sluggish Cognitive Tempo, Obsessive-Compulsive Problems, and Post-traumatic Stress were added to latest version in 2007 (Achenbach & Rescorla, 2001). However, this study will not be incorporating scores from these scales into the data. Other CBCL forms include the Parent Report form for children ages 1-½ to 5, a Teacher Report form for children ages 6 to 18, a Youth Self Report form for children 11 to 18 years of age, a Adult Behavior Checklist Self Report form for adults ages 18 to 59, and Adult Caregiver Report form for adults ages 60 to 90 (Achenbach & Rescorla, 2001).

**Description of the scales.** As noted previously, the eight syndrome scales are Aggressive Behavior; Anxious/Depressed; Attention Problems; Rule Breaking Behavior; Social Problems; Somatic Complaints, Thought Problems, and Withdrawn/Depressed (Achenbach & Rescorla, 2001). These individual scales were developed via factor analysis.

The six DSM-oriented scales are Affective Problems; Anxiety Problems; Somatic Problems; Attention Deficit/Hyperactivity Problems; Oppositional Defiant Problems; and Conduct Problems (Achenbach & Rescorla, 2001). These scales were developed to reflect the diagnostic constructs represented in the DSM-IV-TR. Significant correlations have been shown between the CBCL and DSM-IV-TR diagnoses (Kasius et al., 1997).
Thus, Clinically Significant CBCL DSM-oriented scores were associated with being referred for psychiatric or psychological services in the standardization sample (Achenbauch & Rescorla, 2001).

The scales of Internalizing Problems, Externalizing Problems, and Total Problems are broader in nature (Achenbauch & Rescorla, 2001). The Total Problems scale was based on factor analysis of Total Problems scores in the Borderline range (T-score ≥ 60+), estimating the probability of the scores representing problems severe enough for clinical concern. The Externalizing and Internalizing Problems scales were derived from items that tapped into a child’s internalizing and externalizing problems. Externalizing Problems consisted of Rule-Breaking Behavior and Aggressive Behavior items. Internalizing Problems consisted of behaviors that were Anxious/Depressed, Depressed/Withdrawn, Somatic Complaints, Social Problems, Thought Problems, and Attention Problems (Sattler & Hoge, 2006).

**Administration.** Administration of the CBCL is a fairly straightforward process (Achenbach & Rescorla, 2001). In questionnaire format, the form is given to the parent or caregiver to fill out; it may also be completed via clinician interview. The parents are told to consider their child’s behavior within the last six months. There are 140 questions in a Likert-type format, and responses are scored on a three-point scale with “not true” indicated by a 1, “sometimes true” indicated by a 2, and “often true” indicated by a 3. The estimated time to complete the measure is 15 to 20 minutes.

**Scoring.** Following administration, the items are manually input into a computer-scoring module (Achenbach & Rescorla, 2001). The scores are reported as raw scores, T-
scores, percentiles, and in a graphed format. Under each scale is a list of individual items from which the score was derived.

**Algorithm development.** The CBCL algorithm was derived from reported behaviors, with threshold scores used to discriminate between referred and nonreferred groups (Achenbach & Rescorla, 2001). Classification accuracy was based on cutpoint algorithms, taking into account deviancy on the Total Problems scale. The cutpoint used was the Borderline range and above (T-score ≥ 60). This algorithm resulted in 87% classification accuracy for discriminating the referred from the nonreferred group. The algorithm produced 4% false negatives, incorrectly identifying referred children as nonreferred. In addition, it produced 9% false positives, incorrectly identifying nonreferred children as deviant.

**Psychometric properties.** Reliability of the CBCL was examined with respect to inter-rater reliability, internal consistency, and test-retest correlations (Achenbach & Rescorla, 2001). Inter-rater correlations were based on three interviewers each interviewing 241 parents, for a total number of 723 interviews. Parents were matched for age, gender, ethnicity, and SES across interviewers, and decisions were compared with those of other interviewers. Inter-rater reliability was .93 for the 20 competence items and .96 for the 118 specific problem items (both p<.001). Total Problems correlated at .80, Internalizing Problems at .72, and Externalizing Problems at .85. Correlations ranged between .65 and .85 for the remaining scales. Internal consistency was examined using Chronbach’s alpha. Internal consistency coefficients were .97 for Total Problems, .90 for Internalizing Problems, .94 for Externalizing Problems, and between .78 and .94 for the other scales. Test-retest reliability over 1-week intervals using Pearson correlations was
.94 for Total Problems, .91 for Internalizing, .92 for Externalizing, and between .82 and .92 for the remaining scales.

Validity of the most recent CBCL version is based on studies conducted using both previous and current versions of the scales given that the 1989 standardization sample did not score differently than the 2001 sample, so data from the two normative groups were combined (Sattler & Hoge, 2006; Rosemary & Steuart, 2007). Content validity is the degree to which an instrument’s content assesses what the instrument purports to assess (Murphy & Davidshofer, 2005). In the previous CBCL version, there were four items with questionable discriminability between referred and non-referred groups. The most recent version replaced those items with ones with significantly higher discriminability ($p<.01$; Achenbach & Rescorla, 2001). The remaining items had good discriminability and were retained. Criterion-related validity refers to the degree of association scores have with an external criterion of interest (Murphy & Davidshofer, 2005). CBCL data was then compared with appropriate external criteria, consisting of demographic data and diagnoses. Multiple regression analyses were computed for the problem scales, and referral effects were found to outweigh demographic effects for all problem scales ($p<.01$; Achenbach & Rescorla, 2001). Concurrent validity is the degree of correlation between other accepted instruments measuring similar characteristics (Murphy & Davidshofer, 2005). Correlations have been conducted with scores from other instruments, such as the Conners scales and the Behavior Assessment System for Children (BASC) scales (Achenbach & Rescorla, 2001). The CBCL correlated highly with the Conners scales, correlation coefficients ranging from .71 to .85. Correlation coefficients with BASC scales ranged from .38 to .89. Construct validity is the
instrument’s ability to tap into the theoretical idea or construct that it is attempting to measure, which often is done by assessing the relationship between scores and specific behaviors associated with the construct (Murphy & Davidshofer, 2005). Many studies provide evidence that the CBCL does indeed tap into the identified constructs, as evidenced by significant associations with other tests, prediction and evaluation of outcomes, and consistency with other theoretical frameworks (Berube & Achenbach, 2001). As noted above, the Syndrome scales were developed using factor analysis, and the DSM-oriented scales have been found to be associated with scores on the DSM-IV Checklist and DSM-IV clinical diagnoses in patient medical records.

**Development of Cutpoints.** Each scale has cutpoints for distinguishing between a normal and a clinical range (Achenbach & Rescorla, 2001). Using regression analysis, cutpoints were found to discriminate between referred and non-referred children \( (p < .01) \). A Borderline Clinical range was developed to improve the basis on making clinical decisions about children and services, indicating a number of behaviors that are concerning but not clearly indicative of the need for professional help. The Borderline Clinical range was designated as having a T-score between 60 and 65. The Clinically Significant range was set at a T-score of 65 and above.

**Limitations of the CBCL.** The CBCL has gone through many revisions and is now a standard to which other instruments are compared (Achenbach & Rescorla, 2001). The normative sample from which the scales were derived was predominantly White (82%), and researchers have found that the scales’ representation of behavioral problems may be less appropriate for some ethnic groups and regions in the United States (Doll, 1994). The current Parent Report version’s norms are the same as the previous version;
however, new multicultural norms have been added and can be applied when computer scoring. There have been no formal reviews conducted as of the latest edition of the Mental Measurements Yearbook (MMY). However, because the norms are the same, many of the critiques (Flanagan & Watson, 2007) of the earlier version remain appropriate. Specifically, with regard to individual items on the CBCL, users may overlook the need to ask further questions of parents when certain responses are given that can be misinterpreted, and reviewers indicate this should be more explicitly emphasized in the manual. Reviewers noted adequate levels of reliability but emphasized a rather high level of false negatives, since 17% of children found to be “normal” were actually from the clinically referred group (Doll, 1994). When looking at elevated scales, higher scale elevation often is interpreted as indicating “more severe” disorders, but this is not true of the CBCL, since higher elevations only indicate that the child has more in common with the referred standardization group. This appears to be a frequent area of confusion for users of the measure. The scales do a better job at discriminating between incompetent behaviors than competent ones; therefore, the scales are better at measuring clinical significance and less accurate at measuring varying degrees of problems or competencies (Doll, 1994, Furlong & Wood, 1994). Also, establishing concurrent validity has been a challenge, because the CBCL is the standard to which other scales are compared to and so it is difficult to find comparative measures for analysis (Furlong & Wood, 1994).

**Clinical utility with ASD.** It is essential to effectively discriminate between problems associated with ASD’s and problems that do not warrant extensive clinical evaluation for autism, since parental concerns may arise about many kinds of childhood...
behaviors (Achenbach, 2008). Currently, there has been no research done using the CBCL version for 6 to 18-year-olds explicitly looking at behavioral differences between HFA and Asperger’s Disorder. However, one study used the CBCL Parent Report Form for 1½ to 5 year olds to look at the association between clinical diagnostic conclusions about ASD’s and scores on this version of the CBCL (Sikora et al., 2008). In this study, the researchers used the Gilliam Autism Rating Scale (GARS) for comparison with the CBCL to evaluate 147 children 36 to 71 months old. The ADOS-G was used to aid in the diagnosis of children having autism, ASD, or non-autistic spectrum disorders. In this study, CBCL scores were found to be more strongly associated with ADOS-G scores than with GARS scores. The CBCL Anxious/Depressed, Withdrawn, and Aggressive Behavior syndromes, as well as the DSM-oriented Pervasive Developmental Problems (PDP) scale all were found to be significantly associated with ADOS-G categories. Furthermore, the CBCL showed more sensitivity and specificity than the GARS in this study. In all, the usefulness of the CBCL in screening for ASD’s as well as other behavioral problems via parent report was supported for this age group.

A study in Brazil using the Brazilian version of the CBCL found the instrument to be useful in identifying children ages 4 to 18 years with ASD’s (Duerte et al., 2003). In the Brazilian version the items are the same as in the English-language CBCL, and because ASD symptoms are similar across cultures it appears to be appropriately applied cross-culturally. The Autistic/Bizarre factor was found to differentiate between children with ASD’s and other psychiatric disorders, involving the following items: Confused (item 13), Repeats acts (item 66), Strange behavior (item 84), Strange ideas (item 85),
and Withdrawn (item 11). The study also found that the Thought Problems scale effectively classified autistic children among their classmates.

Another study done in Germany involving 77 participants indicated that the CBCL/4-18 can be useful in identifying behaviors associated with ASD’s, with scores on the scales measuring Attention Problems, Social Problems and Thought Problems being associated with ASD’s (Bolte, Dickhut, & Poustka, 1999). However no comparison groups were used.

There is a dearth of research looking at the utility of the CBCL for diagnostic purposes with ASD’s in the US (Huerte et al., 2003). More research on the CBCL and ASD’s is done internationally, possibly because there are a limited number of instruments used to diagnose ASD’s, and the CBCL is applied broadly because of its multicultural appropriateness.

**Epidemiological Studies**

Although the reasons are still being debated, the number of children with a new diagnosis on the autism spectrum has increased ten-fold over the past half century (Johnson & Myers, 2007). In 1966, Chamberlin (2004) reported an increase in new ASD diagnoses of 10% to 17% above the previous base rate per year, compared to the previous estimated incidence rate of 4 to 5 per 10,000 people. In 2009, the Center for Disease Control estimated autism prevalence rates (based on 2006 data) of 9 per 1000 children, or approximately 1 in 110 (Center for Disease Control, 2009). However, the precise number of individuals with ASD’s currently living in the US is unavailable. The Institute of Medicine (2004) estimated conservatively that the prevalence of Autistic Disorder in the US is 1 in 1,000, and ≥2 in 1,000 for other ASD’s (Fombonne, 2002; Gilberg and Wing,
These increases result in a significantly increased demand for efficient diagnosis and treatment.

There are strong consistencies in symptomatology, cognitive ability, gender, and socioeconomic factors associated with ASD’s worldwide (Mash & Barkley, 2003). In the US, the Centers for Disease Control (CDC) collected data from 11 sites around the country and found that an average of 41% of individuals with ASD’s had cognitive impairment (defined as IQ ≤70). In this study, a higher proportion of females demonstrated cognitive impairment, consistent with previous research (CDC, 2009; Lord et al., 1982). Across the US, ASD’s are consistently more common in males than females (CDC, 2009). Given the possible differences in behaviors between genders, gender in ASD’s is discussed in more detail below.

ASD prevalence also varies by race and ethnicity in the US. The average prevalence for non-Hispanic White children (9.9 per 110) is significantly greater than for non-Hispanic Black children (7.2 per 110) and Hispanic children (5.9 per 110). These differences may reflect changes in identification patterns, because no etiologic hypotheses have been proposed that explain ethnic differences in ASD rates. However, continued research might provide more clarity on whether or not ethnic disparities reflect differences in diagnostic issues versus environmental risk factors and/or genetic susceptibility. One possible explanation for diagnostic disparities is linked to barriers to healthcare access for some minorities, for example lack of information in Spanish (Iland, 2007). Furthermore, ethnicity also has been linked to age of diagnosis. This is concerning because early diagnosis and treatment are associated with better outcomes (Filipek et al., 2000). Furthermore, research has found that early diagnosis and treatment are associated
with greater developmental and intellectual gains compared to children diagnosed and beginning treatment at later ages (Dawson, 2008; Rogers & Vismara, 2008). The average age of diagnosis for Caucasian children is 6 years of age, while it is 8 years of age for Latino/Hispanic children and 7 years of age for African American children (Mandell, Listerud, Levy, And Pinto-Martin, 2002). Although socioeconomic status has been associated with reduced access to healthcare, the number of children diagnosed with autism has not been found to vary with socioeconomic status (Fombonne, 1999). However, a lack of resources due to low socioeconomic status may influence the prevalence in specific geographic areas (Palmer, Blanchard, Jean, and Mandall, 2005). In the Palmer et al. study, school district revenue was associated with higher proportions of children identified with ASD’s and also with increased rates of identification when measured longitudinally. Thus it appears that economically disadvantaged communities may not have adequate resources to identify these children.

**Gender Differences.** According to the Centers for Disease Control and Prevention (February 9, 2007), the ratio of boys to girls diagnosed with autism is 4.3:1. Currently, it is unknown why this discrepancy exists. One theory suggests that genetic factors play a role. This theory posits that recessive genetic factors associated with ASD’s are located on the X chromosome (Skuse, 2000) and hence are more likely to be expressed in males. Another theory postulates that behavioral differences between genders in the expression of autism make ASD’s easier to detect in boys, since the diagnostic standards for autism were developed using all-male samples (Kanner, 1943). Consideration of the behavioral differences that exist between males and females with ASD’s has only recently begun to receive attention in the literature, and there is
disagreement about whether or not gender differences exist, with multiple studies supporting both sides of this argument (Attwood & Grandin, 2007; Banach, Thompson, Szatmari, Goldber, Tuff, Zwaigenbaum, & Mahoney; Brown & Dunn 1996; McClure 2000). For example, Attwood (1999) observed that many girls with Asperger’s Disorder have the same abilities profile as boys do but exhibit a subtler or less severe expression of these characteristics. In general, research on children suggests that females exhibit a higher degree of appropriate social behavior at baseline when compared to males. In addition, females with ASD’s are better at facial recognition, affect recognition, and decoding non-verbal communication than males (McClure, 2000). From preschool on, females with ASD’s also display more frequent and empathic responses to distressful situations when compared to males (Brown & Dunn, 1996; Eisenberg & Fabes, 1995). Other studies indicate that females with ASD’s show superior skill in perspective taking than do males (Bosacki, 2000; Dunn & Cutting, 1999). Therefore, females with ASD’s may have different symptom compositions that influence the ability of clinicians to identify them (Grant, 2006).

On the other hand, gender differences in scores obtained on the Autism Diagnostic Interview, Revised (ADI-R), the Autism Diagnostic Observation Schedule-Generic (ADOS-G), and the Child Behavior Checklist (CBCL) have shown no statistically significant differences in scores between males and females in relation to the core behaviors associated with HFA (Holtman, Bolte & Poustka, 2007). However, an exploratory factor analysis of the ADI-R did reveal some item differences. Specifically, 4 to 5-year-old males were found to score higher than females for the ADI-R categories of “inappropriate facial expression” and “showing and directing attention.” Females also
were found to have had higher rates of prenatal, perinatal, and postnatal complications and to have reached developmental milestones before males. Also, an analysis using the CBCL showed that females demonstrated differences compared to males in terms of coexisting psychopathology; specifically, females had more thought/cognitive and attention problems.

The inter-agency Autism Coordinating Committee (ACC), a federal advisory committee formed by the Combating Autism Act of 2006, stated that it remains unclear whether or not the course of ASD’s is the same for females as for their male counterparts (ACC, 2008). Therefore, whether or not current interventions are appropriate for both genders also remains unclear. The committee’s 2008 draft for public comment stated that it is critical to determine if the gender ratio is accurate and whether or not these gender differences are related to protective factors, diagnostic procedures, and/or trajectory of the disorder. The ACC also recommended further research utilizing female subjects in order to better understand clinical, biological, and protective features associated with gender and ASD’s.

As noted previously, there is some evidence that females with Autistic Disorder and PDD-NOS tend to have lower Full Scale IQs than do males (Volkmar, Szatmari, & Sparrow, 1993). However, a possible bias may exist in the research based on the level of functioning of individuals evaluated for ASD’s (Volkmar, Szatmari, & Sparrow, 1993). This is due to the overlap of symptoms of Intellectual Disability (ID, formally Mental Retardation) with those of ASD’s, which may complicate which behaviors are attributed to each diagnosis. When IQ is controlled for, males exhibited more autistic characteristics
than did females (Volkmar et al., 1993), suggesting that more consideration should be paid when assessing “autistic” behaviors in girls with ID’s.

Nevertheless, past findings indicate that more females with diagnoses of ASD’s were found to have IQ scores in the lower ranges, particularly below an IQ of 35 (Volkmar et al., 1993). Females with an ASD with IQ scores of > 70 were more likely to have a diagnosis of PDD-NOS because they did not meet full criteria for Autistic Disorder (Volkmar et al., 1993; Lord et. al, 1982; Tsai & Beisler, 1983). When IQ was controlled for, few gender differences have been found, illustrating that males tend to display more severe behaviors associated with Autistic Disorder than do females, which may leading to less frequent diagnosis of ASD’s in girls (Lord et. al, 1982; Volkmar et al., 1993). Further, when controlling for IQ and adaptive behavior using the Vineland Adaptive Functioning scale raw scores, there was no statistical significance among genders for those with FSIQs < 70 (Nichols, Moravci, & Tetenbaum, 2008). It is possible that the behaviors associated with boys are more “classic” ASD behaviors and females’ behaviors are more subtle and less obvious. Therefore, girls being diagnosed most resemble boys with ASD’s and they are the only girls enrolled in research studies, skewing the actual female frequency. It is also important to note that girls, on average, receive a later diagnosis than boys (Grant & Kriz, 2009). Reasons for late diagnosis may include having different profiles than boys, running into social trouble at a later age, having fewer disruptive behaviors than boys, and it being more socially acceptable for girls to be withdrawn since it may be interpreted more favorably as being shy or submissive (Nichols, Moravci, & Tetenbaum, 2008).
Etiology

Results from family and twin studies clearly indicate that genetic factors are associated with ASD’s (Rutter, 2000). In family studies, the frequency of Autistic Disorder among siblings has been estimated to be as high as 4.5% (Jorde et al., 1991) and up to 30 times higher than in the general population. Furthermore, when encompassing all ASD’s, the frequency among siblings is estimated to be even greater, reaching 6% (Szatmari, 1999). In other studies, the concordance rate for siblings with ASD’s has been found to be between 2% and 8% (Ashley-Koch et al., 1999). Twin studies have found monozygotic concordance rates as high as 60% for Autistic Disorder and as high as 71% for all ASD’s combined (Bailey, et al., 1995). This suggests there is a strong genetic component in ASD’s.

Reasons for the increase in incidence of ASD’s are unclear and continue to be debated among experts (Mash & Barkly, 2003). The contributing factors and possibilities include: an actual rise in the incidence of the disorder, improved awareness and education, better diagnostic tools, advances in statistical methodology, acceptance that ASD’s can coexist with other conditions, increased evaluation and treatment services offered to individuals with ASD’s, and increased diagnosis of individuals with mild symptoms and higher levels of functioning. Especially, the ability to accurately diagnose ASD’s has improved, and it has been postulated that this has led to a dramatic increase in the number of ASD diagnoses. For instance, one study (Tomanik et al., 2007) utilizing a sample of 129 children (101 boys and 28 girls) between the ages of 7 to 18 years of age found that, by including information on adaptive functioning as measured by the Vineland Adaptive Behavior scale (VABS) with the ADOS-G and ADI-R data, one could
improve autism classification rates from 75% to 84%. Thus combining assessment of adaptive functioning with use of the ADOS-G can improve the rates of accurate diagnoses, possibly leading to an increase in incidence.

Neurological Aspects of Autism Spectrum Disorders. Many individuals with ASD’s demonstrate particular patterns in neuropsychological functioning, brain structure, and neurochemistry (Mash & Barkley, 2003). Although a diagnosis on the autism spectrum cannot be made solely based on cognitive and neuropsychological functioning, it is important to understand these patterns as they translate into observable behavior. This section will discuss each topic as it relates to ASD’s.

Neuropsychological Functioning. With regard to cognitive functioning, many individuals with ASD’s show similarities in cognitive deficits as measured by various cognitive tests. For example, Performance IQ (PIQ) is significantly higher than Verbal IQ (VIQ) for many ASD individuals, but this significant discrepancy is primarily displayed in individuals with a FSIQ >70 (Ghaziuddin and Mountain-Kimchi, 2004). People with HFA tend to have adequate rote memory and perceptual processes (Siegel, Minshew, & Goldstein, 1996). However, notable deficits have been found in memory, language, executive functioning, motor functioning, reading, mathematics, and perspective taking.

Brain structure, functioning, and neurochemistry. In a study using MRI procedures, individuals with ASD’s showed inconsistencies in brain structure (Filipek, Richelme, Kennedy et al., 1992) and brain imaging is not used to aid in the diagnosis of autism (Filipek, Accardo, Baranek et al., 1999). However, there is some evidence of individuals with ASD’s have larger head circumferences and greater brain volume at
birth, which then normalizes in early to mid-childhood (Piven, Arnt, Bailey, & Andreasen, 1996; Filipek, 1999).

It also has been proposed that the amygdala is one of the neural regions displaying abnormality in ASD’s (Baron-Cohen et al., 2000). In this study, the ASD group did not activate the amygdala during a task of making mentalistic inferences about the eyes during an fMRI, while people without ASD’s displayed amygdala activity. Altogether, research has provided insufficient evidence to support or rule out whether or not structural or functional regional abnormalities in the brains of people with ASD’s exist. A lack of replication of studies, inter-site differences in fMRI procedures, and inconsistency in participant age and IQ are factors that could underlie these inconsistent findings (Lotspeich et al. 2004).

There also is inconsistency in findings from studies with respect to neurotransmitters patterns in ASD’s. For example, there is no evidence to support the once-believed hypothesis that people with ASD’s have elevated levels of dopamine (Cohen & Volkmar, 1997). Similarly, studies investigating the role of serotonin, norepinephrine, and opioids in ASD’s have been conducted, but the results have been inconsistent (Koenig, Tsatsanis, & Volkmar, 2001).

More recently, individuals with ASD’s have been found to have impairment in the mirror neuron system (Ramachandran & Oberman, 2007). This system provides parietal to frontal lobe input and is activated when normal individuals observe an action carried out by another individual. Specifically, neurons in the motor cortex in the frontal lobe become active although motor activity is not being carried out but only observed. Mu wave activity, as measured with electroencephalogram (EEG), is thought to represent this
mirror neuron activity (Rizzolatti & Craighero, 2004). When children with ASD’s and typically developing children point to something, their EEG mu wave activity becomes suppressed. When typically developing children observed another person point, their mu waves also become suppressed. However, when children with ASD’s observed another person pointing, there was no change in their mu waves, (Ramachandran & Oberman, 2007). This difference may underlie blunted imitation abilities, limiting the ability for persons with ASD’s to learn from their environment and leading to difficulty understanding the intentions of others.

**Differentiating between HFA and Asperger’s Disorder**

In the current DSM-IV diagnostic system, although HFA is not a separate diagnostic category within ASD’s, it is a specifier for Autistic Disorder (APA, 2000). In addition, whether or not there is a difference between the diagnoses of Asperger’s Disorder and HFA is a controversial issue within the field of ASD (Howlin, 2003). Although differences among diagnoses have been identified, these are few and raises the question of whether or not Asperger’s Disorder is truly distinct from Autistic Disorder (Macintosh & Dissanayake, 2004). In all, it is clear that more research is needed to determine if these disorders are in fact distinct from one another (Mash & Barkley, 2003).

The most important factor discriminating Asperger’s Disorder from Autistic Disorder is that individuals with Asperger’s Disorder have no cognitive deficits and they must have a history of normal language development. Individuals who do not meet a diagnosis of Asperger’s Disorder (due to language delays or other factors) or who fit the profile for Autistic Disorder yet have no significant current cognitive or language deficits typically receive a diagnosis of HFA. The cognitive criterion for differentiating HFA from Autistic
Disorder usually is measured by Full Scale IQ scores and typically is defined as a FSIQ above 80 (Mayes & Calhoun, 2004; Verte et al., 2006; Walker et al., 2004).

While there is a dearth of research looking at the neurological differences between HFA and Asperger’s Disorder, some differences have been identified and will be discussed next. Specifically, studies regarding cognitive differences and differences in brain structure will be reviewed. No studies specifically looking at neurochemical differences between the two groups were found. Finally, a review of behavioral differences will be discussed.

**Cognitive differences.** There is debate in the field as to whether or not HFA and Asperger’s Disorder can be differentiated from one another based upon cognitive findings (Kasari & Rtheram-Fuller, 2005; Ghaziuddin & Mountain-Kimchi, 2004). When investigating the VIQ/PIQ split often found in cognitive ability test profiles among children with ASD’s, children with HFA had higher PIQ than children with Asperger’s Disorder (Ghaziuddin & Mountain-Kimchi, 2004). In addition, children with Asperger’s Disorder displayed higher VIQ than children with HFA, a finding that was replicated in another study (Lotspeich et al., 2004). Also, the Asperger’s Disorder group showed a significant VIQ/PIQ split, with VIQ being higher than PIQ, while the HFA did not show a significant split (Ghaziuddin & Mountain-Kimchi, 2004). However, the sample size was small, and a few of the participants in each group showed mixed patterns, suggesting the PIQ/VIQ split is of limited utility in differentiating between the two diagnoses in clinical practice. In an attempt to gain a better understanding of the PIQ/VIQ split and to see if it could reliably differentiate between HFA and Asperger’s Disorder, Kasari and Rtheram-Fuller (2005) conducted a review and concluded that specific cognitive ability
profiles cannot reliably differentiate between the two groups since not all studies found significant differences between groups (e.g., Mottron, 2004; Mayes & Calhoun, 2004).

**Differences in brain structure and functioning.** When investigating neuroanatomical differences between Autistic Disorder and Asperger’s Disorder, it has been found that the volume of cerebral grey matter increases with severity of symptoms for those with Autistic Disorder (Lotspeich et al., 2004). In addition, decreasing cerebral gray matter volume has been associated with increasing age across the three ASD groups (Lotspeich et al., 2004). While not significant, there also was a positive correlation between cerebral white matter volume and PIQ for individuals with Asperger’s Disorder. Additionally, these researchers found a negative correlation in which individuals with HFA had lower PIQ scores and higher grey matter volume, and in the Asperger’s Disorder group there was a typical pattern of higher PIQ scores associated with higher levels of grey matter. The findings suggest that there is a smaller association between Asperger’s Disorder and cerebral grey matter volume than there is for other diagnoses on the autism spectrum. Further investigations are needed to confirm these findings, as the sample size was small.

**Behavioral differences.** There has been a fair amount of research done attempting to differentiate HFA from Asperger’s Disorder, however there is little data displaying an actual statistical difference between the two diagnoses (Mottron, 2004; Mayes & Calhoun, 2004). There is no single assessment that differentiates between the two conditions. For instance, the ADOS-G does not differentiate Asperger’s Disorder from those with Autism or PDD-NOS (Grant, 2006). This is important because the ADOS-G is used to aid in the diagnosis of ASD’s, thus there is a need to examine other sources with
In an attempt to learn more about the differences between HFA and Asperger’s Disorder, many researchers are looking at various types of assessments to understand more about the differences between these two groups. Theorized differences between individuals with HFA and Asperger’s Disorder include individuals with HFA having more impairment in imitation, visual responsiveness, auditory responsiveness, and nonverbal communication than do those with Asperger’s Disorder (Kurita, 1997). Furthermore, children with HFA may have more impairment in social interactions, language, and communication than children with Asperger’s Disorder (Ghaziuddin & Mountain-Kimchi, 2004).

With respect to clinical measurement, children with Asperger’s Disorder demonstrate more functional language ability than do children with PDD-NOS or Autistic Disorder (as measured by item 19 on the ADI-R), and there is no history of language delay (Walker, et al., 2004). However, when investigating differences in symptoms using the ADI-R, no differences were found between those with HFA and Asperger’s Disorder with respect to repetitive and stereotyped behavior, social impairment, or communication. Due to an insufficient number of significant findings differentiating HFA from Asperger’s Disorder in this and other studies, the authors concluded that the available assessment instruments do not reliably differentiate HFA from Asperger’s Disorder.
The Children’s Communication Checklist assesses pragmatic language difficulties, which has previously been found to be useful for assessing language difficulties in ASD’s (Bishop, 1998). With regard to differences in pragmatic language, children with HFA have been found to show more impairment in fluency of speech output and complexity of syntax than do children with Asperger’s Disorder (Verte, Geurts, Rosseel, Oosterlaan, & Sergeant, 2006). Children with HFA also showed more impairment in coherence of pragmatic language than did children with Asperger’s Disorder. Nevertheless, the researchers determined that the Children’s Communication Checklist is not a reliable tool for differentiating between ASD’s.

With respect to conversational abilities, research has shown that individuals with HFA, PDD-NOS, and Asperger’s Disorder generally show a low level of aberrant conversational behavior (Paul, Orvloski, Marcinko, & Volkmar, 2008). All children with ASD’s were conversationally out of sync, often displaying inappropriate topic shifts during conversation, with few reciprocal exchanges, and were unresponsive to partners’ nonverbal social cues. They also displayed impairments in speech prosody (e.g., unusual intonation). Individuals with HFA and PDD-NOS also demonstrated more difficulty with eye gaze management (e.g., inappropriate use of eye gaze at another person’s face as a communication aid) when compared to children with Asperger’s Disorder (Paul, Orvloski, Marcinko, & Volkmar, 2008). In contrast, individuals with Asperger’s Disorder were found to exhibit a greater tendency to use overly formal speech than were individuals with HFA and PDD-NOS group (Paul, Orvloski, Marcinko, & Volkmar, 2008).
Delineating differences among various ASD groups is imperative for several reasons (Plauche-Johnson & Meyers, 2007; Macintosh & Dissanayake, 2004). Identifying subtle differences between groups may provide valuable information for diagnostic and screening processes, result in more accurate diagnoses, more specific treatment for the clinical subgroups, earlier intervention, etiologic investigation and prognosis, and counseling for recurrence risk in families. In addition, when children receive early diagnosis and early treatment, they often show greater developmental and intellectual gains compared to children who are diagnosed and initiate treatment later (Dawson, 2008; Rogers & Vismara, 2008). Specifically, individuals with ASD’s and FSIQ scores greater than 70 may have deficits in adaptive functioning that may not otherwise be expected based on their IQ (Volkmar, Carter, Sparrow, & Cicchetti, 1993). Therefore, it is important to gain a better understanding these deficits in order to address them in treatment, in order to help them adapt more successfully to their environments.

In summary, the complexities of diagnosis and classification of Asperger’s Disorder and HFA point to the need to further investigate the possibility of distinct subgroups across the spectrum (Kasari & Rotheram-Fuller, 2005). Although some researchers state that differentiating between these groups may not be necessary for interventions (Verte et al., 2006), this view does not consider language development, since both the ability to use language and age during specific phases of language development will influence one’s ability to participate fully in treatment. Currently, Asperger’s Disorder and HFA are diagnosed using a variety of information including a developmental interview with caregiver, medical history, results from assessments, and direct observation. Due to the difficulty of diagnosis, multidisciplinary evaluations are
recommended (Filipek, 1999). Many assessment measures aid in the diagnostic process. For example, the CBCL is often used to gain a better picture of the child’s problematic behaviors from the perspective of the caregiver. Currently, there is no research looking at the differences of CBCL scores among children with HFA and Asperger’s Disorder.

Aims of the current study

The aim of the present study was to investigate differences in score profiles on the Child Behavior Checklist (CBCL) between groups of individuals with ASD’s. In previous research, many studies fail to distinguish between high-functioning and low-functioning children with ASD, confounding the presence of behaviors associated with an intellectual disability with those specific to ASD (Verte et al., 2006). This study specifically looked at differences between higher functioning children on the autism spectrum in order to identify behavioral differences that could be used to help guide interventions, improve accuracy of diagnosis, and gain a better understanding of differences between the groups. In addition to examining behavioral differences between HFA and Asperger’s Disorder, a clinically-referred comparison group made up of individuals with Autistic Disorder but without the qualifier High Functioning, was used. Therefore, the aim of the study was to attempt to see if children with HFA and Asperger’s Disorder differed from one another and also from the comparison group on scales measured by the CBCL.

Hypotheses. This study proposed 10 hypotheses:

1) Participants with diagnoses of Asperger's Disorder, HFA, and Autistic Disorder would show significant differences in clinical elevations on the Internalizing
Problems scale of the CBCL. Additionally, HFA and Asperger Disorder groups would have elevated profiles relative to the Autistic Disorder group.

2) Participants with diagnoses of Asperger’s Disorder would show elevated profiles on the Externalizing scale on the CBCL relative to HFA and Autistic Disorder groups.

3) Participants with diagnoses of Asperger’s Disorder would show elevated scores on the syndrome scale of Attention Problems relative to HFA and Autistic Disorder groups.

4) Participants with diagnoses of Autistic Disorder would show elevated scores on the syndrome scale of Thought Problems relative to HFA and Autistic Disorder groups.

5) Participants with diagnoses of Autistic Disorder and HFA both would show elevated scores on the syndrome scale of Somatic Complaints relative to the Asperger’s Disorder group.

6) Participants with diagnoses of Autistic Disorder and HFA would show elevated scores on the syndrome scale of Withdrawn/Depressed relative to the Asperger’s Disorder group.

7) Participants with diagnoses of Autistic Disorder and HFA both would show elevated scores on the DSM scale of Affective Problems relative to the Asperger’s Disorder group, and in addition the Autistic Disorder group would display elevated scores relative to the HFA group.
8) Participants with diagnoses of Asperger’s Disorder would show elevated scores on the DSM scale of Anxiety Problems relative to Autistic Disorder and HFA groups.

9) Participants with diagnoses of Autistic Disorder and HFA would show elevated scores on the DSM scale of Somatic Problems relative to the Asperger’s Disorder group.

10) Participants with diagnoses of Asperger’s Disorder would show elevated scores on the DSM scale of Attention Deficit/Hyperactivity Problems relative to Autistic Disorder and HFA groups.
Chapter II
Method

Participants

Participants in this study were recruited as part of an ongoing research protocol associated with multidisciplinary clinical evaluations at the Autism Program in Oregon Health and Science University’s Child Development and Rehabilitation Center (OHSU-CDRC). Data used in this study was collected between January 2004 and October 2009. Participants were between 6 and 18 years of age. There were 42 participants with a diagnosis of HFA, 25 with Asperger’s Disorder, and 36 with Autistic Disorder as the comparison group, for a total of 103 participants. During the evaluation process, a diagnosis of Asperger’s Disorder was given when there was no history of language delay and DSM-IV-TR criteria were not met for another ASD. A diagnosis of HFA was given when the child met full criteria for Autistic Disorder and demonstrated an FSIQ greater than or equal to 80, and a diagnosis of Autistic Disorder was given when the child met full criteria for Autistic Disorder and demonstrated a FSIQ of 79 or less.

Measure

Data from the CBCL Parent Report Form for children ages 6 to 18 were analyzed in this study. In addition, demographic information and diagnoses was obtained from the child’s clinical file.

Procedure

Oregon Health and Science University Institutional Review Board (IRB) approval was secured for ongoing data collection prior to inception of the database, and joint IRB
approval from OHSU and Pacific University was obtained prior to data analysis for this study.

The procedure for data collection as a part of normal clinical operations and subsequent inclusion in the database was as follows. Upon arrival at the Autism Program for evaluation, parents/guardians who voluntarily chose to have data for their children included in ongoing research studies signed informed consent forms for this purpose. After following usual clinical procedures for evaluation and treatment, information in the participants’ files subsequently underwent de-identification and assignment of coded numbers. A master list was created in Excel that included each participant’s name and the corresponding identification number. To ensure anonymity, the identification number was then transferred to a database in SPSS. Participants meeting criteria for the current study were taken from the database for analysis. A quality assurance (QA) analysis was conducted on the data. This process involved comparing information in the patient medical charts (diagnosis and CBCL scores) to the SPSS data set. Only data pertinent to this study underwent QA.

Analyses of variance were conducted to investigate whether there were significant differences between groups with Asperger’s Disorder, HFA, and the comparison group relative to 10 outcome variables, specifically, scores on the CBCL across Internalizing Problems, Externalizing Problems, four DSM scales, and four derived syndrome scales. In all, two ANOVAs and two multivariate analyses of variance (MANOVAs) were conducted in order to meet the assumption of independent observations. T-scores were used for all analyses. Specifically, analyses were as follows:
1. Two separate ANOVAs were conducted to investigate differences between Asperger’s Disorder, HFA, and Autistic Disorder groups for the Internalizing Problems and Externalizing Problems scores.

2. A MANOVA was conducted to investigate differences between Asperger’s Disorder, HFA, and Autistic Disorder groups for scores on syndrome scales for which significant differences were hypothesized.

3. A MANOVA was conducted to investigate differences between Asperger’s Disorder, HFA, and Autistic Disorder groups for scores on the DSM scales for which significant differences were hypothesized.

The following assumptions of MANOVAs were considered. First, the assumption of independent observations was addressed. Data from distinct groups were used, and separate analyses were conducted so that observations did not depend on previous observations in the statistical analysis (e.g., due to item overlap in composite scores).

Second, equal group sizes were not obtained, however Levene’s Test indicated that the assumption of homogeneity of variance was met. Third, adequate sample size was expected based on an a priori power analyses using a small effect size. Specifically, the power analysis indicated sufficient power if using a total sample size of 114 children, looking for a small effect size on all 17 of the possible scales measured by the CBCL (Erdfelder, Faul, & Buchner, 1996). For this study, 103 data sets were obtained. A power analysis indicated sufficient power when using this sample size, looking for a small effect size on 10 of the scales. Fourth, dependent variables were either linearly related as demonstrated by significant correlations or correlations were not significant. There is no support in the literature for non-linear relationships among the variables.
Chapter III

Results

Description of the Sample

As described previously, archival data were used for the following analyses.

Table 1 presents the sample characteristics of each group. Children in the HFA group ranged in age from 6 years to 18 years. There were 35 boys and 7 girls in this group. Children in the Asperger’s Disorder group ranged in age from 6 years to 18 years. There were 16 boys and 9 girls in this group. Children in the Autistic Disorder group ranged in age from 6 years to 18 years. There were 29 boys and 7 girls in this group. Means and standard deviations for HFA, AS, AD groups can be found in Table 1. The ratio of boys to girls was similar to accepted prevalence rates between the three groups with the exception of the Asperger’s Disorder group, which displayed a smaller ratio than the other groups and differed also from published prevalence rates.

Table 1

Demographic Frequencies and Proportions for the Sample

<table>
<thead>
<tr>
<th>Group (N)</th>
<th>Gender (N)</th>
<th>Proportion</th>
<th>Mean Age in Years (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Functioning Autism</td>
<td>Female (7)</td>
<td>16.6</td>
<td>9.81 (3.97)</td>
</tr>
<tr>
<td></td>
<td>Male (35)</td>
<td>83.4</td>
<td>11.59 (4.07)</td>
</tr>
<tr>
<td></td>
<td>Total (42)</td>
<td>100.0</td>
<td>11.3 (4.06)</td>
</tr>
<tr>
<td>Asperger’s Disorder</td>
<td>Female (9)</td>
<td>36.0</td>
<td>12.16 (3.12)</td>
</tr>
<tr>
<td></td>
<td>Male (16)</td>
<td>64.0</td>
<td>9.91 (2.63)</td>
</tr>
<tr>
<td></td>
<td>Total (25)</td>
<td>100.0</td>
<td>10.71 (2.97)</td>
</tr>
<tr>
<td>Autistic Disorder</td>
<td>Female (7)</td>
<td>19.4</td>
<td>9.19 (2.27)</td>
</tr>
<tr>
<td></td>
<td>Male (29)</td>
<td>80.6</td>
<td>10.46 (3.24)</td>
</tr>
<tr>
<td></td>
<td>Total (36)</td>
<td>100.0</td>
<td>10.21 (3.09)</td>
</tr>
<tr>
<td>Total</td>
<td>Female (23)</td>
<td>22.3</td>
<td>10.54 (3.32)</td>
</tr>
<tr>
<td></td>
<td>Male (80)</td>
<td>77.7</td>
<td>10.84 (3.56)</td>
</tr>
<tr>
<td></td>
<td>Total (103)</td>
<td>100.0</td>
<td>10.76 (3.49)</td>
</tr>
</tbody>
</table>
**Preliminary Analyses**

**Age.** Differences in age among groups were explored using an ANOVA. Levene’s test for equality of variances indicated no significant differences in age variance between groups. Independent samples t-tests also were conducted on the mean ages for the HFA group, Asperger’s Disorder group, and Autistic Disorder group. When comparing the Asperger’s Disorder group to the HFA group, Levene’s test for equality of variances indicated a probability of .007, indicating that the age variances for Asperger’s Disorder and HFA groups were significantly different. However, when equal variances were not assumed, there was no significant difference in mean age between the Asperger’s Disorder group ($M = 10.72, SD = 2.97$) and HFA [$M = 11.3, SD = 4.06; t=-6.7$] groups. When comparing the Autistic Disorder group to the Asperger’s Disorder group, Levene’s test for equality of variances indicated a probability of .494, indicating that the difference in age variance between groups was not significant ($t= -.632$). When comparing the Autistic Disorder group to the HFA group, Levene’s test for equality of variances indicated a probability of .015, indicating that the age variances of Autistic Disorder and HFA were significantly different. However, when equal variances were not assumed, there was no significant difference in mean age between Autistic Disorder ($M = 10.22, SD = 3.09$) and HFA [$M = 11.3, SD = 4.06; t= -1.34$] groups. In conclusion, none of the t-tests found significant differences in age between groups. Therefore, age was not analyzed as a covariate in this study.
Hypotheses

The results of analyses are presented below for each hypothesis. A Bonferroni correction was applied to correct for multiple analyses across all 10 variables, with an adjusted alpha level of .005.

Hypotheses 1 and 2. The first two hypotheses focused on identifying differences observed in broadband measures of internalizing and externalizing symptoms among HFA, Asperger’s Disorder, and Autistic Disorder groups. The first hypothesis predicted that the HFA and Autistic Disorder groups would show an elevated profile on the Internalizing scale relative to the Asperger’s Disorder group. The second hypothesis predicted that the Asperger’s Disorder group would show an elevated profile on the Externalizing scale on the CBCL relative to the other two groups. Two one-way between-groups ANOVAs were performed to investigate differences in behavioral functioning among three levels of the independent variables (e.g., diagnostic category). One dependent variable was used in each analysis, namely the two composite scores of Internalizing Problems and Externalizing Problems.

Preliminary analyses were conducted to check for normality, linearity, univariate and multivariate outliers, and homogeneity of variance. Univariate and multivariate outliers were considered using a Mahalanobis distance analysis. Outliers were projected because of the nature of the broadband assessment and because the children referred for evaluation displayed a wide range of behavioral patterns. Each outlier was reviewed and no data entry errors or problems were noted, and outliers were included in the data set for analysis. Levene’s Test of Equality of Variances indicated that there were no violations of the assumption of equality of variances.
With regard to the first hypothesis, there were no statistically significant differences between Asperger’s Disorder, HFA, and Autistic Disorder groups on the Internalizing Problems scale: \( F(2,100) = .569; \eta^2 = .011, p = .568 \). The hypothesis that the HFA and Autistic Disorder groups would show an elevated profile on the Internalizing Problems scale relative to the Asperger’s Disorder group was rejected (see Table 2). With regard to the second hypothesis, there was no statistically significant difference between Asperger’s Disorder, HFA, and Autistic Disorder groups on the Externalizing scale: \( F(2,100) = .710; \eta^2 = .014, p = .494 \). The hypothesis that the Asperger’s Disorder group would show an elevated profile on the Externalizing Problems scale on the CBCL relative to the other two groups was rejected (See Table 2). In sum, there were no statistically significant differences between groups on any of the variables. See table 2 for means and standard deviations.

Table 2

Estimated marginal means for each diagnostic group on CBCL composite scores

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Diagnostic Group</th>
<th>Mean Scores(SD)</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internalizing Problems</td>
<td>Asperger’s Disorder</td>
<td>64.56(18.21)</td>
<td>1.63</td>
<td>Lower Bound: 61.32; Upper Bound: 67.80</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>64.71(8.17)</td>
<td>1.26</td>
<td>Lower Bound: 62.21; Upper Bound: 67.21</td>
</tr>
<tr>
<td></td>
<td>Autistic Disorder</td>
<td>62.86(8.14)</td>
<td>1.36</td>
<td>Lower Bound: 60.16; Upper Bound: 65.56</td>
</tr>
<tr>
<td>Externalizing Problems</td>
<td>Asperger’s Disorder</td>
<td>59.72(8.44)</td>
<td>1.87</td>
<td>Lower Bound: 56.02; Upper Bound: 63.42</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>57.60(8.72)</td>
<td>1.44</td>
<td>Lower Bound: 54.74; Upper Bound: 60.45</td>
</tr>
<tr>
<td></td>
<td>Autistic Disorder</td>
<td>59.89(10.52)</td>
<td>1.56</td>
<td>Lower Bound: 56.80; Upper Bound: 62.97</td>
</tr>
</tbody>
</table>
In order to ascertain whether or not gender differences accounted for these findings, separate ANOVAs for the two composite scores were conducted incorporating gender as a fixed factor. In these analyses, gender differences were not found to be statistically significant with respect to Internalizing Problems: $F(5,97)= .773; \eta^2= .008; p = .571$; Externalizing Problems: $F(5,97)= 1.438; \eta^2= .016; p = .218$.

**Hypotheses 3 through 6.** Hypotheses three through six focused on identifying differences in behavioral functioning as measured by syndrome scales of the CBCL. A one-way between groups MANOVA was performed to investigate differences in behavioral functioning among children diagnosed with ASD’s. Four dependent variables were used for the analysis, which were scores on four of eight scaled scores: Withdrawn/Depressed, Somatic Complaints, Thought Problems, and Attention Problems. The levels of the independent variable were the three diagnostic groups.

Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Univariate and multivariate outliers were observed for the three groups. Outliers were projected because of the nature of broadband assessment and because the children referred for evaluation displayed a wide range of behavioral patterns. Each outlier was reviewed and there were no apparent data entry errors or problems with the data, and outliers were used in the data set for analysis. Box’s Test of Equality of Covariance Matrices indicated that there were no violations of assumptions about covariance. Levene’s Test of Equality of Variances also indicated no violation of the assumption of equality of variances among the three groups. Therefore, results for the
entire sample were deemed reliable and Wilks’ Lambda was the multivariate test statistic used to identify significant differences.

In testing the third through the sixth hypotheses, there were no statistically significant differences found between any of the diagnostic groups on any of the syndrome scale scores at a .05 level: $F(16, 184)= 1.085, p=.706; \text{Wilks’ Lambda}= .835; \eta^2 = .086$. See table 3 for means and standard deviations.

With respect to the third hypothesis, the Asperger’s Disorder group did not show an elevation relative to Autistic Disorder or HFA groups on the dependent variable of the Attention Problems, therefore it was rejected. With regard to the fourth hypothesis, no significant differences between groups were found, and therefore this hypothesis was rejected. Of note, none of the diagnostic groups displayed scores in the Clinically Significant range, however, all were in the Borderline range. With regard to the fifth hypothesis, it was predicted that the Autistic Disorder and HFA groups both would show an elevated score on the Syndrome scale of Somatic Complaints relative to the Asperger’s Disorder group. None of the diagnostic groups displayed a Clinical or Borderline mean elevation, and there were no significant differences between groups, hence this hypothesis was rejected. With regard to the sixth hypothesis, it was predicted that the comparison and HFA groups would show elevated scores on the Syndrome scale of Withdrawn/Depressed relative to the Asperger’s Disorder group. All of the diagnostic groups displayed mean elevations that were in the Clinically Significant range; however there were no significant differences between groups and so this hypothesis was rejected.

A follow-up MANOVA was conducted for the syndrome scales incorporating gender as a fixed factor. Gender differences were not found to be statistically significant
with respect to any of the scales: Anxious/Depressed: $F(5,96) = 1.848; \eta^2 = .022; p = .11$;
Withdrawn Depressed: $F(5,96) = .253; \eta^2 = .006; p = .937$; Somatic Complaints: $F(5,96) = 1.425; \eta^2 = .003; p = .222$; Social Problems: $F(5,96) = .448; \eta^2 = .012; p = .814$; Thought Problems: $F(5,96) = 1.102; \eta^2 = .015; p = .365$; Attention Problems: $F(5,96) = .527; \eta^2 = .044; p = .756$; Rule-Breaking Behavior: $F(5,96) = .674; \eta^2 = .019; p = .644$; or Aggressive Behavior: $F(5,96) = 1.188; \eta^2 = .037; p = .321$.

Table 3

Estimated Marginal Means for each Diagnostic Group on CBCL Syndrome Scale Scores

<table>
<thead>
<tr>
<th>CBCL for Ages 6-18:</th>
<th>Diagnosis (ASD)</th>
<th>Mean(SD)</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withheld/Depressed</td>
<td>Autistic Disorder</td>
<td>65.361(8.29)</td>
<td>1.555</td>
<td>62.275 - 68.447</td>
</tr>
<tr>
<td>Asperger's Disorder</td>
<td>66.68(9.36)</td>
<td>1.866</td>
<td>62.977 - 70.383</td>
<td></td>
</tr>
<tr>
<td>High Functioning Autism</td>
<td>67.146(10.14)</td>
<td>1.457</td>
<td>64.255 - 70.038</td>
<td></td>
</tr>
<tr>
<td>Somatic Complaints</td>
<td>Autistic Disorder</td>
<td>59.556(6.92)</td>
<td>1.277</td>
<td>57.022 - 62.089</td>
</tr>
<tr>
<td>Asperger's Disorder</td>
<td>59.08(7.7)</td>
<td>1.532</td>
<td>56.040 - 62.120</td>
<td></td>
</tr>
<tr>
<td>High Functioning Autism</td>
<td>58.78(8.24)</td>
<td>1.196</td>
<td>56.407 - 61.154</td>
<td></td>
</tr>
<tr>
<td>Thought Problems</td>
<td>Autistic Disorder</td>
<td>71.5(8.31)</td>
<td>1.384</td>
<td>68.754 - 74.246</td>
</tr>
<tr>
<td>Asperger's Disorder</td>
<td>69.48(8.32)</td>
<td>1.661</td>
<td>66.185 - 72.775</td>
<td></td>
</tr>
<tr>
<td>High Functioning Autism</td>
<td>67.634(8.29)</td>
<td>1.297</td>
<td>65.061 - 70.207</td>
<td></td>
</tr>
<tr>
<td>Attention Problems</td>
<td>Autistic Disorder</td>
<td>70.333(10.76)</td>
<td>1.672</td>
<td>67.016 - 73.650</td>
</tr>
<tr>
<td>Asperger's Disorder</td>
<td>67.08(9.56)</td>
<td>2.006</td>
<td>63.100 - 71.060</td>
<td></td>
</tr>
<tr>
<td>High Functioning Autism</td>
<td>68.585(9.67)</td>
<td>1.566</td>
<td>65.477 - 71.694</td>
<td></td>
</tr>
</tbody>
</table>

Hypotheses 7 through 10. Hypotheses seven through ten focused on identifying
differences in behavioral functioning as measured by the DSM scales of the CBCL. A
one-way between groups MANOVA was performed to investigate the differences in
behavioral functioning among children diagnosed with ASD’s. Four dependent variables were used for the analysis, which were four of the six scaled scores: Affective Problems, Anxiety Problems, Somatic Complaints, and Attention Deficit/Hyperactivity Problems. The independent variables were the three diagnostic groups.

Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Univariate and multivariate outliers were observed for the three groups. Outliers were projected because of the nature of the broadband assessment, and the children referred for evaluation had a wide range of behavioral challenges. Each outlier was reviewed and there were no apparent data entry errors or problems with the data. Therefore outliers were used in the analysis. Box’s Test of Equality of Covariance Matrices was greater than .001 for all three groups, indicating no violation of the assumption of equality of covariance. Levene’s Test of Equality of Variances also indicated no violation of the assumption of equality of variances. Therefore, results for the entire sample were deemed reliable and Wilks’ Lambda was the multivariate test statistic used to identify significant differences.

In testing the seventh through the tenth hypotheses, there were no statistically significant differences found between any of the diagnostic groups on the DSM scale scores: $F(12, 184)= 515, p=.289; \text{Wilks’ Lambda}= .936; \eta^2 = .033$. See table 4 for means and standard deviations.

With respect to the seventh hypothesis, neither the Autistic Disorder group nor the HFA group showed elevated scores on the DSM scale of Affective Problems relative to the Asperger’s Disorder group. The Autistic Disorder group also did not display elevated
scores relative to the HFA group, and therefore this hypothesis was rejected. With regard to the eighth hypothesis, it was predicted that the Asperger’s Disorder group would show an elevated score on the DSM scale of Anxiety Problems relative to the Autistic Disorder and HFA groups. This hypothesis was rejected, all of the groups displayed Borderline elevations (See Table 4). With regard to the ninth hypothesis, it was predicted that the Autistic Disorder group and HFA group would show an elevated score on the DSM scale of Somatic Problems relative to the Asperger’s Disorder group. This hypothesis was rejected, none of the groups displayed Borderline or Clinically Significant elevations (See Table 4). With regard to testing the tenth hypothesis, it was predicted that the Asperger’s Disorder group would show an elevated score on the DSM scale of Attention Deficit/Hyperactivity Problems relative to the Autistic Disorder and HFA groups. This hypothesis was rejected, all of the groups displayed Borderline elevations. See table 4 for means and standard deviations.

A follow-up MANOVA was conducted for the DSM scales incorporating gender as a fixed factor. Gender differences were not found to be statistically significant with respect to any of the scales: Affective Problems: $F(5,94)= .453; \eta^2 = .040; p = .810$ Anxiety Problems: $F(5,94)= .970; \eta^2 = .002; p = .440$; Somatic Problems: $F(5,94)= .341; \eta^2 = .003; p = .887$; Attention Deficit/Hyperactivity Problems: $F(5,94)= 1.263; \eta^2 = .032; p = .287$; Oppositional Defiant Problems: $F(5,94)= .868; \eta^2 = .014; p = .506$; Conduct Problems: $F(5,94)= 1.342; \eta^2 = .039; p = .254$.

Interestingly, gender differences were observed. Specifically, for the HFA group, females mean age of diagnosis was 9.81 years and males mean age of diagnosis was 11.59 years, for a difference of 1.78 years. For the Asperger’s Disorder group, females
Table 4

*Estimated marginal means for each diagnostic group on CBCL DSM scale scores*

<table>
<thead>
<tr>
<th>CBCL for Ages 6-18: Dependent Variable</th>
<th>Diagnosis</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective Problems</td>
<td>Autistic Disorder</td>
<td>63.81(7.76)</td>
<td>1.393</td>
<td>61.040 - 66.571</td>
</tr>
<tr>
<td></td>
<td>Asperger's Disorder</td>
<td>63.42(7.89)</td>
<td>1.706</td>
<td>60.030 - 66.804</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>63.58(9.12)</td>
<td>1.322</td>
<td>60.952 - 66.198</td>
</tr>
<tr>
<td>Anxiety Problems</td>
<td>Autistic Disorder</td>
<td>62.72(8.46)</td>
<td>1.445</td>
<td>59.854 - 65.590</td>
</tr>
<tr>
<td></td>
<td>Asperger's Disorder</td>
<td>63.83(9.25)</td>
<td>1.770</td>
<td>60.321 - 67.346</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>63.60(8.5)</td>
<td>1.371</td>
<td>60.879 - 66.321</td>
</tr>
<tr>
<td>Somatic Problems</td>
<td>Autistic Disorder</td>
<td>56.56(7.27)</td>
<td>1.326</td>
<td>53.923 - 59.188</td>
</tr>
<tr>
<td></td>
<td>Asperger's Disorder</td>
<td>57.25(7.5)</td>
<td>1.624</td>
<td>54.026 - 60.474</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>56.60(8.77)</td>
<td>1.258</td>
<td>54.103 - 59.097</td>
</tr>
<tr>
<td>Attention Deficit/Hyperactivity Problems</td>
<td>Autistic Disorder</td>
<td>64.81(6.62)</td>
<td>1.264</td>
<td>62.296 - 67.315</td>
</tr>
<tr>
<td></td>
<td>Asperger's Disorder</td>
<td>63.71(8.37)</td>
<td>1.548</td>
<td>60.635 - 66.782</td>
</tr>
<tr>
<td></td>
<td>High Functioning Autism</td>
<td>62.65(7.9)</td>
<td>1.199</td>
<td>60.270 - 65.03</td>
</tr>
</tbody>
</table>

The mean age of diagnosis was 12.16 years and males mean age of diagnosis was 9.91 years, for a difference of 2.25 years. For the Autistic Disorder group, females mean age of diagnosis was 9.19 years and males mean age of diagnosis was 10.46 years, which is a difference of 1.27 years.
Chapter IV
Discussion

Whether or not it is appropriate to differentiate HFA from Asperger’s Disorder remains a debate among researchers and clinical professionals (Howlin, 2003). The purpose of this study was to investigate differences between these groups using the CBCL/6-18. In general, results indicated a few differences and many similarities. This research does not provide evidence that children with Asperger’s Disorder, HFA, and Autistic Disorder differ significantly in behavior based on parent report using the CBCL/6-18. These findings, as well as their limitations, will be discussed further in this section with regard to their impact on the clinical utility of conceptualizing behavioral differences between children with ASD’s based on diagnostic category. Although this research did not find evidence supporting differentiating between ASD diagnoses on the basis of behaviors measured by the CBCL, it is important to understand that using a parent report measure such as this is only one small part of clinical assessment of ASDs. Therefore, no conclusions can be drawn about whether or not there are other differences between ASD’s that may be measured by instruments more central to diagnosing the disorders.

Internalizing and Externalizing Problems Scores

It was predicted that the HFA and Autistic Disorder groups would show an elevated profile on the Internalizing Problems scale relative to the Asperger’s Disorder group. It was also predicted that Asperger’s Disorder group would show an elevated profile on the Externalizing scale relative to the other two groups. No statistically significant differences were found on these composite scores between any of the diagnostic groups. This supports previous findings indicating that it is difficult to reliably
identify differences between children with HFA and Asperger’s Disorder using behavioral criteria (Mottron, 2004; Mayes & Calhoun, 2004; Walker et. al, 2004) and that children with HFA and Asperger’s Disorder have similar internalizing behavioral challenges.

In reviewing the estimated marginal means of each measure, some moderate differences were found. Specifically, the Asperger’s Disorder group and the Autistic Disorder group scored two points higher than the HFA group on the Externalizing Problems score, although none of the groups were in the Borderline or Clinically Significant range and the magnitude of the differences was minimal. The Asperger’s Disorder group and the HFA groups scored two points higher than the Autistic Disorder group on the Internalizing Problems score. However, all of the groups were in the Borderline range and, again, the magnitude of the differences was minimal. These findings suggest that children with ASD’s may have more internalizing problems than externalizing problems as measured by the CBCL/6-18. This research also supports arguments that nosological categories among ASD’s are not qualitatively distinct, but rather reflect a continuum of severity (Kamp-Becker, Smidt, J., Ghahreman, M., Heinzel-Gutenbrunner, M., Becker, K., et al., 2010).

**Syndrome Scales**

It was predicted that differences would be observed on four of the syndrome scales between children with Asperger’s Disorder, Autistic Disorder, and HFA. Specifically, it was predicted that the Asperger’s Disorder group would show elevated scores on the Attention Problems scale relative to the other two groups. It was predicted that that the Autistic Disorder group would show elevated scores on the Thought
Problems scale relative to the other two groups. It was predicted that the Autistic Disorder and HFA groups both would show elevated scores on the Somatic Complaints scale relative to the Asperger’s Disorder group. It was predicted that the Autistic Disorder and HFA groups would show elevated scores on the Withdrawn/Depressed scale relative to the Asperger’s Disorder group. With respect to these hypotheses, no statistically significant differences were found between groups for any of the syndrome scale scores. This supports previous research showing a lack of ability to reliably differentiate between children with HFA and Asperger’s Disorder based on parent report of observable and measureable behavior (Mottron, 2004; Mayes & Calhoun, 2004; Walker et. al, 2004).

In reviewing the estimated marginal means of each domain on the syndrome scales, no significant differences were found. On the Withdrawn/Depressed scale, all of the groups were in the Clinically Significant range, with minimal differences between scores. These findings are consistent with previous research indicating children with ASD’s have comorbid affective problems (Mattila et al., 2010). Furthermore, the results indicate that parents of children with ASD’s who are seeking clinical care perceive their children to be withdrawn and depressed. On the Somatic Complaints scale, none of the groups were in the Borderline or Clinically Significant range, with minimal differences between scores. These results indicate that parents of children with ASD’s do not perceive their children to have significant somatic complaints. On the Attention Problems scale, all of the groups were in the Clinically Significant range. These results indicate that parents of children with ASD’s perceive their children to have clinically significant attention problems, in addition to having symptoms in the diagnostic domains of socialization, communication, and stereotyped interests.
DSM Scales

It was predicted that differences would be observed in terms of behavioral functioning between children with Asperger’s Disorder, Autistic Disorder, and HFA on four of the DSM scales of the CBCL/6-18. Specifically, it was predicted that the Autistic Disorder and HFA groups both would show elevated scores on the Affective Problems scale relative to the Asperger’s Disorder group, and in addition the Autistic Disorder group would display elevated scores relative to the HFA group. It was predicted that the Asperger’s Disorder group would show elevated scores on the Anxiety Problems scale relative to the other groups. It was predicted that the Autistic Disorder and HFA groups would show elevated scores on the Somatic Problems scale relative to the Asperger’s Disorder group. It was predicted that the Asperger’s Disorder group would show elevated scores on the Attention Deficit/Hyperactivity Problems scale relative to the other groups.

On the Affective Problems scale, all of the groups were in the Borderline range, with minimal differences between scores. On the Anxiety Problems scale, all of the groups were in the Borderline range, with minimal differences between scores. On the Somatic Problems scale, none of the groups were in the Borderline or Clinically Significant range, with minimal differences between scores. On the Attention Deficit/Hyperactivity Problems scale, all of the groups were in the Borderline range, with minimal differences between scores. Overall, any differences that were found between the groups were minimal and are unlikely to be clinically useful for determining differences between ASD diagnoses, consistent with previous research showing a lack of
ability to reliably differentiate between children with HFA and Asperger’s Disorder using these symptoms domains (Mottron, 2004; Mayes & Calhoun, 2004; Walker et. al, 2004). However, despite not being able to differentiate between diagnoses on the autism spectrum based on behaviors reported by parents on the CBCL, these findings do have clinical utility. Specifically, the DSM scales help determine problematic, sub-problematic, or non-problematic behaviors in ASD populations as a whole and may help in determining secondary diagnoses on an individual level. The results from this study also indicate that according to parental report on the CBCL/6-18, all ASD groups have sub-problematic levels (i.e., scores in the Borderline range) of affective problems, anxiety, and attention/hyperactivity.

**Gender Differences.** Although no statistically significant differences were found with respect to gender differences and ASD diagnoses, some clinical differences were observed and warrant discussion. With regard to this sample, the ratio of boys to girls was similar to accepted prevalence rates with the exception of the Asperger’s Disorder group, indicating a boy to girl ratio of 1.78 to 1, which is lower than previously identified prevalence rates. Generally, differences in diagnostic categories and rates across sites have been hypothesized to explain conflicting findings (Kamp-Becker et al., 2010). In this study, groups were not differentiated by age of diagnosis or gender, due to the small sample size of female participants. However, observed differences should be discussed because previous research indicates females tend to get diagnosed with ASD’s later than do males. Within this sample, the average age of diagnosis of HFA in females was 9.81 years and 11.59 years for males, which is a difference of 1.78 years. Given the small difference between groups, this is in contrast to speculations in the literature that females
tend to receive diagnoses of ASD’s at later ages than do males, particularly when looking at HFA and Asperger’s Disorder. Previous findings indicated that when IQ was controlled for, few gender differences have been found, suggesting that males tend to display more severe behaviors associated with Autistic Disorder than do females (Lord et. al, 1982). This study’s findings are incongruent with previous findings suggesting that high functioning girls get diagnosed later than higher functioning boys. The reason for this discrepancy is unknown, however, with regard to this sample, it appears as if girls with HFA are being detected sooner than boys with HFA. For the Autistic Disorder group, females mean age of diagnosis was 9.19 years and males mean age for diagnosis was 10.46 years, which is a difference of 1.27 years. Previous findings suggest that females with Autistic Disorder tend to have lower Full Scale IQs than do males (Volkmar, Szatmari, & Sparrow, 1993). However, a possible bias may exist in existing research based on the level of functioning of individuals evaluated for ASD’s (Volkmar, Szatmari, & Sparrow, 1993) due to the overlap of symptoms of ID, which may complicate which behaviors are attributed to ID versus ASD’s. This may explain why girls in this sample who have Autistic Disorder were identified earlier than the boys. However, it is important to highlight that, based on this study, not all sites diagnose girls later than boys. Within this sample, it appears as if girls were detected sooner than boys. More investigation is warranted to find out why—whether better screening, more education, and/or more awareness are factors in this study sample. For the Asperger’s Disorder group, females mean age of diagnosis was 12.16 years and males mean age of diagnosis was 9.91 years, which is a difference of 2.25 years. Attwood (1999) observed that many girls with Asperger’s Disorder have the same abilities profile as do boys do but
exhibit a subtler or less severe expression of these characteristics. This may be the reason for later diagnosis of females with Asperger’s Disorder in this sample.

**Summary and Implications**

This study did not support the theory that children with HFA and Asperger’s Disorder are different in terms of behavioral characteristics. Although some marginal mean differences were found, no consistent pattern was identified to suggest any reliable trend in diagnostic traits. In addition, the mean differences between diagnostic groups were minimal for each scale.

Looking at these finding in light of the current literature, there are some consistencies. A recent study using autism-specific measures, adaptive behavior measures and neuropsychological measures found no discrete phenotypes (Kamp-Becker et al., 2010). Also, previous research using the ADOS-G was not found to differentiate those with Asperger’s Disorder from those with Autistic Disorder or PDD-NOS (Grant, 2006). However, the Grant study indicated that the ADOS-G may be able to discriminate Asperger’s Disorder from PDD-NOS using total scores in the social interaction domain. Others have found subtle differences between the two groups (Ghahziuddin, 2010). Specifically, Kurita (1997) reported differences between HFA and Asperger’s Disorder, with individuals with HFA displaying more impairment in imitation, visual responsiveness, auditory responsiveness, and nonverbal communication than do individuals with Asperger’s Disorder. Another study found that children with HFA have more impairment in social interactions, language, and communication than do children with Asperger’s Disorder (Ghaziuddin & Mountain-Kimchi, 2004). Given that the present study did not specifically measure any of the aforementioned characteristics, the
results presented in this paper are consistent with some previous literature finding no differences between children with HFA and Asperger’s Disorder, as measured by clinical instruments used in the diagnosis of ASD’s. **It is important to understand that using a parent report measure such as the CBCL is only a small piece contributing to our understanding of potential differences between ASD diagnoses. These results should be interpreted with caution. Again, no conclusions can be drawn about whether or not other differences exist that may be measured by instruments more central to diagnosing the ASD’s.**

This study did find that children with ASD’s do have substantial behavior problems, consistent with a large body of literature (e.g., Mittila et al., 2010; APA, 2004). Specifically, all groups scored in the Borderline range on the Internalizing Problems scale as well as on the subscales of Affective Problems and Anxiety Problems. All of the groups were in the Clinically Significant range for the Withdrawn/Depressed, Attention/Deficit Hyperactivity, Thought Problems, and Attention Problems scales. These findings are not surprising, given that comorbid affective disorders, thought disorders, and behavioral disorders are frequently found in children with ASD’s (Mittila et al., 2010; APA, 2004). However, based on research discussed earlier, this does not necessarily mean that children diagnosed with ASD’s will have problems associated with symptoms measured by the syndrome scales.

The lack of significant findings is consistent with previous research indicating that there were no qualitative differences between diagnostic groups on the autism spectrum (Kamp-Becker et al., 2010; American Psychiatric Association, 2010). While some differences have been found between groups, these have been inconsistent,
suggesting that the differences may be associated with severity, language ability, and/or IQ rather than independent characteristics (American Psychiatric Association, 2010).

This study found that children with HFA and Asperger’s Disorder had similar profiles of behavioral functioning, based on parent report and the two groups do not display a uniquely different behavioral phenotype when assessed using behavior report measures. It is possible, due to broadband characteristic of the CBCL/6-18, that this study could not pick up on subtle behavioral differences that may be present between the two diagnostic categories. For example, it is possible that many of the differences that have been identified are largely due to communication subtleties measured more specifically using language assessment instruments, rather than the CBCL/6-18 (Ghahziuddin, 2010).

Methodological Limitations.

Several methodological limitations were present for this study. While the numbers of participants in each diagnostic group were acceptable given the prevalence of ASD’s within the general population, the overall sample size, as well as the sample size of the Asperger’s Disorder group, were small for the purposes of statistical analysis. Additional limitations of this study include the non-random sample of convenience utilizing archival data, limited sensitivity and specificity for the broadband assessment used, and not analyzing the effects of age of diagnosis and gender. These will be discussed in more detail, below.

As noted above, a limitation of this study was the small sample size of the Asperger’s Disorder group in comparison to the other group sample sizes. In addition, there were few females in this group. A larger Asperger’s group may have increased confidence in these results as well as the generalizability of the study. Thus, although no
violations of the assumption of equality of variances were present, a larger Asperger’s Disorder sample may have had more power to detect differences between groups.

Another limitation was the non-random convenience sample utilizing archival data. The use of a non-random sampling method may have presented a sampling bias, thus compromising generalizability of the results. Furthermore, because of the convenience of the archival data, it was not possible to control for socioeconomic status, ethnicity, prior treatment that may have affected behavior, and potential medical and developmental problems that may have confounded the results of this study. Furthermore, the comparison group used in this study also consisted of individuals with a diagnosis on the ASD spectrum. Therefore, the pattern of marginal means found in this study can only be applied to children with ASD’s. It is unknown whether or not this pattern is unique to children with ASD’s or also applies to children in other clinical groups. Controlling for the aforementioned factors would make the relationship between the independent variables and the dependent variables more pure, allowing the researchers to have more confidence in the findings.

The third limitation of this study is with regard to low specificity and sensitivity of the CBCL/6-18, parent/caregiver report, which is a broadband measure that is not intended to discriminate between ASD’s. In previous studies, the range of inter-rater reliability ranged between .65 and .85 for the syndrome and DSM scales, suggesting that scores on the CBCL can be influenced by the subjectivity of parents answering the items (Achenbach & Rescorla, 2001). In addition, using a broadband measure not specific to ASD’s may have blurred differences that potentially exist between ASD groups, since the
assessment is geared toward identifying broad behavior patterns, potentially missing more subtle differences.

The fourth limitation of the study was not analyzing the effects of age. A child’s behavior and psychological characteristics change over time (e.g., moral reasoning, physical development, information processing, vocabulary), which all have an impact on a child’s behavior at different developmental stages (Murphy & Davidshofer, 2005; Sattler & Hoge, 2006). In order to get a satisfactory sample size, the study included children with a broad age range, 6 to 18 years. If the study had used age as a covariate, the sample sizes would have been too small to have enough power. Therefore, age was not analyzed as a factor.

Regardless of methodological limitations, the present study contributes to the growing body of literature with respect to differences and similarities in diagnoses on the autism spectrum. The study also provides evidence that, if differences in various behaviors do exist, identifying the more subtle behaviors may be difficult when using a broadband measure such as the CBCL/6-18. Finally, the results indicate that children with ASD’s have many comorbid psychological symptoms contributing to their problems in functioning, such as problems associated with anxiety, depression, and attention deficits and hyperactivity, as measured by the CBCL/6-18.

**Directions for Future Research**

Previous research looking at behavioral differences between HFA and Asperger’s Disorder has been inconsistent. If replication of the present study supports the current findings, it would provide additional support that the CBCL/6-18 does not identify differences among children with ASD’s and therefore should not be used to identify
diagnostic differences. However, if a replication study using a larger sample size and analyzing age and gender as covariates might identify differences in behavior with respect to a child’s age and gender. Furthermore, when identifying subtle behavioral differences between HFA and Asperger’s Disorder, using other assessment tools assessing language, neuropsychological, and other behavioral observation measures should be incorporated. Additionally, it may be more relevant to rely on tools that do not rely solely on parental report but also integrate objective behavioral measures in conjunction with the ADOS-G.

Looking at objectives differences between ASD’s is important because of the proposed changes in the DSM-V. There continues to be a debate in the field as to whether or not Asperger’s Disorder and HFA are distinctly different. If etiological differences between HFA and Asperger’s Disorder exist, it is important to find ways to differentiate the two diagnoses. The dimensional change proposed for the DSM-V may limit future research investigating these differences, with possibly profound implications. For example, if Asperger’s Disorder and HFA had different etiology, combining the diagnoses could impede future research and decrease the chance of identifying a cause for one or the other. Regardless, future research should be aimed at either identifying differences among children with HFA and Asperger’s Disorder or identifying differences or subtypes among children who are high functioning with an ASD diagnosis. This should be done via objective behavioral observation measures in addition to parent report.
Conclusion

This study found no statistically significant behavioral differences between children with HFA, Asperger’s Disorder, and Autistic Disorder, as measured by the CBCL/6-18. However, behavioral differences among children with ASD’s should be further investigated in order to confidently generalize these findings. The ability to accurately identify behavioral differences among children with HFA and Asperger’s Disorder would allow future researcher to search more efficiently for etiologies of the different classifications. Identifying subtle and specific differences also would help guide specific treatment interventions.
References


