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THE BIG FIVE AND ADHD: AN INVESTIGATION OF SUBTYPES AND EMOTIONAL REGULATION

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THE BIG FIVE AND ADHD: AN INVESTIGATION OF
SUBTYPES AND EMOTIONAL REGULATION

By

Gabriel Alan Casher

B.A., Hope College, 2013

A Thesis

Submitted in Partial Fulfillment of the Requirement for the

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THE BIG FIVE AND ADHD: AN INVESTIGATION OF
SUBTYPES AND EMOTIONAL REGULATION

By
Gabriel A. Casher

A Thesis Submitted in Partial
Fulfillment of the Requirements
for the Degree of
Master of Arts
in the field of Psychology

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MAJOR PROFESSOR: Dr. Michelle Kibby

Attention-Deficit/Hyperactivity Disorder (ADHD) is a commonly occurring neurodevelopmental disorder in children, affecting 3-7% of children (APA, 2000). Despite the high prevalence of ADHD, conceptualization of its subtypes, ADHD-PI and ADHD-C, remains under debate. One method of describing psychopathology is through the use of personality traits. The current study evaluated relationships between ADHD subtypes, ADHD symptoms, and the Big Five in 83 children between 8 and 12 years of age. Children with ADHD were consistently rated as having lower Agreeableness, Conscientiousness, and Openness than children without ADHD.

Additionally, children with ADHD-PI had the lowest Openness, and children with ADHD-C had the lowest Conscientiousness, although these results differed by rater. When evaluating the symptom domains of ADHD, Extraversion, Conscientiousness, and Emotional Instability were associated with H/I, whereas only Conscientiousness was associated with inattention.

Hyperactivity, specifically, was related to Extraversion, Conscientiousness, and Emotional Instability, whereas impulsivity was related to Conscientiousness and Emotional Instability only.

Last, connections between the Emotional Regulation, Emotional Instability, and H/I are discussed. Implications regarding the use of personality measures to describe psychopathology in childhood are discussed, as are the challenges of using multiple raters in clinical populations.

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CHAPTER ONE

INTRODUCTION

Attention-deficit/hyperactivity disorder is one of the most common disorders in childhood, affecting 3-7% of children (American Psychiatric Association, 2000). Furthermore, research indicates that the prevalence of ADHD is increasing. According to the U.S Centers for Disease Control and Prevention (CDC), between 2003 and 2011, the rate of having a history of ADHD diagnosis increased by 42%. Consistent with this, between 2007 and 2011, the percentage of children taking medication for ADHD increased by an average of 7% per year (Visser et al., 2014). Some researchers question whether this increase is due to an increase in actual ADHD prevalence in the population or a result of misdiagnosis by health care providers (Visser et al., 2014). For this reason, further in-depth understanding of ADHD and the specific characteristics of individuals truly having the disorder is warranted. One construct that is underutilized in the description of some traits related to ADHD is personality. Whereas literature has linked ADHD with a number of academic, cognitive, social, temperamental, neurobiological, and genetic correlates, information regarding the personality traits corresponding with ADHD in children is more scant. Furthermore, although these aforementioned correlates have been studied in relation to the subtypes of ADHD, namely ADHD-predominantly inattentive presentation (ADHD-PI), ADHD-predominantly hyperactive/impulsive presentation, and ADHD-combined presentation (ADHD-C), less is known about any potential personality differences between subtypes. Moreover, ADHD is heterogeneous, with symptom presentation varying significantly between individuals diagnosed with the same disorder (Mash & Barkley, 2003). Despite its utility in potentially fostering our understanding of ADHD, variations in personality traits have not been extensively studied or

utilized to help explain the heterogeneous nature of ADHD in children (De Pauw and Mervielde, 2011). This is important because using personality may help in understanding the etiology and symptomatology of psychological disorders (Nigg et al., 2002b).

Therefore the purpose of my study was to evaluate differences between ADHD subtypes in terms of personality characteristics. Specifically, I assessed for differences in the levels of each of the Big Five personality traits between children with ADHD-C, ADHD-PI, and controls using a pre-existing dataset. I also investigated how well the Big Five predicted the dimensions of ADHD: inattention and hyperactivity/impulsivity. Thus, by utilizing both a dimensional (number of symptoms) and categorical (DSM-5 diagnosis) approach in defining ADHD, this study provides insight into differences in the presentation of ADHD and how they relate to personality traits. A second purpose was to look at the role emotional regulation plays in the relationship between ADHD and personality. Emotional regulation has been proposed as a trait that differs significantly between ADHD subtypes and between ADHD and controls (Maedgen & Carlson, 2010; Sobanski et al., 2010). Furthermore, it is related both conceptually and empirically with traits from the Big Five (Dyce, 1997; Frick & Morris, 2004; Nigg, 2006). For this reason, I investigated the contribution of emotional regulation in explaining personality's relation to ADHD, particularly hyperactivity/impulsivity. In understanding the relationships between ADHD and personality, it was of interest to note if personality traits associated with ADHD-C, particularly emotional instability, are related more directly to ADHD symptoms or if they are actually representative of emotional regulation deficits commonly found in ADHD-C.

CHAPTER TWO

LITERATURE REVIEW

Attention-Deficit/Hyperactivity Disorder

Overview. In the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (DSM-5; American Psychiatric Association, 2013), Attention-Deficit/Hyperactivity Disorder (ADHD) is characterized by a persistent pattern of inattention and/or hyperactivity and impulsivity that interferes with adaptive functioning and is beyond what is expected for an individual's age. The diagnostic criteria for ADHD are bifurcated into two distinct categories corresponding with the dimensions of inattention and hyperactivity/impulsivity, respectively. In order for an individual to be diagnosed with ADHD, he/she must exhibit six or more symptoms from one symptom domain. Other criteria of note include the onset of symptoms prior to age twelve years, the presence of symptoms in two or more settings, and the presence of impairment in social, academic, or occupational functioning. Additionally, these symptoms must not be present exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder and are not better accounted for by another mental disorder.

The current standard for diagnosing ADHD in the U.S. is the DSM-5, but due to its recent publication, most of the ADHD literature to date has not utilized DSM-5 diagnostic criteria. Therefore, for the purpose of my study, DSM-5 diagnostic criteria was not used. Most of the literature used for this study utilized the DSM-III, DSM-III-R, or DSM-IV, so I will briefly discuss some changes that have been made over the years. In the DSM-III, Attention Deficit Disorder (ADD) was used to describe what we now call ADHD. This nomenclature reflected the notion of inattention as the central feature of ADD, whereas the presence or absence of

hyperactive symptoms differentiated between the subtypes of ADD: with hyperactivity (ADD/H) or without hyperactivity (ADD/noH) (APA, 1980). The revised version of the DSM-III – DSM-III-R – eliminated subtypes altogether, only including an ADHD diagnosis and resulting in a heterogeneous population of individuals with a diagnosis of ADHD, as some had predominately inattentive symptoms, some had predominantly hyperactive/impulsive symptoms, and some had a mixture of both. The DSM-IV defined ADHD as a persistent pattern of inattention and/or hyperactivity-impulsivity that is present both before the age seven and in at least two settings. Subtypes under DSM-IV are ADHD-predominantly inattentive type (ADHD-PI), ADHD-predominantly hyperactive-impulsive type (ADHD-H/I), and ADHD-combined type (ADHD-C; APA, 2000).

The ADHD criteria from the DSM-IV was used in this project. It is similar to the DSM-5 criteria, with a few key differences. First, DSM-IV requires the onset of symptoms to be prior to age 7 years, whereas DSM-V requires the onset to be prior to age 12 years. The consequence of this change is that, when using DSM-5 criteria, inattention symptoms have more time to develop, resulting in fewer diagnoses of ADHD-H/I (Nigg, Tannock, & Rohde, 2010). Other changes seen in DSM-V include the inclusion of symptom examples that are applicable across the lifespan, rather than being confined to childhood, and the need for the presence of multiple symptoms in multiple settings. Last, DSM-V allows for a comorbid ADHD/Autism Spectrum Disorder (ASD) diagnosis, which was not permissible in the DSM-IV.

Due to many factors, including the method of ascertainment of diagnostic information (parent-report, self-report, or teacher-report), the criteria used to diagnose ADHD (e.g., DSM-III vs. DSM-III-R), and the population of interest (e.g., clinic-referred vs. population sample), prevalence rates of ADHD vary widely across research studies. For instance, according to the

DSM-IV, the prevalence of ADHD is estimated to be 3-7% percent in school age children, whereas other studies estimate the prevalence of ADHD to be as high as 22-57% (Mash & Barkley, 2003). One possible reason for these higher rates is that some studies use only the presence of hyperactivity, rather than a clinical diagnosis of ADHD, to estimate the prevalence of ADHD (Mash & Barkley, 2003). The lower rates are more often found when complete DSM criteria are used.

Furthermore, these rates differ between males and females, with males being diagnosed at a higher rate than females. However, the level of impairment in clinic-referred children is often found to be comparable between boys and girls, with similar comorbidity (Gershon, 2002). The ratio of males-to-females diagnosed with ADHD ranges from 2:1 to 9:1, and may depend partly on the subtype of ADHD being diagnosed. It may be that ADHD-PI has less pronounced gender differences. For instance, male-to-female ratios in one school-based sample were 2.8:1 in ADHD-C, 2.3:1 in ADHD-PI, and 4.1:1 in ADHD-H/I (Gaub & Carlson, 1997). Additionally, the male-to-female ratio is consistently higher in clinic-referred samples compared to community-based samples, suggesting that males with ADHD are more likely to be brought to a treatment facility, compared to females. One explanation for this phenomenon is the higher rate of comorbid Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) in males compared to females in the general population (Szatmari, 1992).

As mentioned previously, there are two distinct domains of symptoms in ADHD, an inattention domain and a hyperactivity-impulsivity domain. These domains underlie the subtypes of ADHD: ADHD-C, ADHD-PI, and ADHD-H/I. Specifically, in order to be diagnosed with ADHD-PI or ADHD-H/I, an individual must exhibit six or more symptoms from the inattention domain or hyperactivity-impulsivity domain, respectively, and less than six

symptoms from the other domain. If six or more symptoms are met from both domains, an individual could be diagnosed with ADHD-C. Inattention symptoms focus on a primary deficit in sustained and focused attention, including symptom descriptions such as “Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities”, “Is often easily distracted by extraneous stimuli”, and “Often has difficulty sustaining attention in tasks or play activities”. On the other hand, symptoms in the hyperactive-impulsive domain of ADHD describe a deficit in inhibition and behavioral regulation. Diagnostic criteria for the hyperactivity-impulsivity dimension include “Often fidgets with hands or feet or squirms in seat”, “Is often ‘on the go’ or often acts as if ‘driven by a motor’”, and “Often has difficulty awaiting turn” (APA, 2000).

Of note are a few problems with the predominantly hyperactive-impulsive subtype. First, for the purposes of my study, the H/I subtype does not apply well to the age range of interest (8-12 years). Applegate and colleagues (1997) note that H/I symptoms typically manifest before age 7 but inattention symptoms manifest later. Additionally, according to DSM-IV, most children and adolescents with ADHD have a diagnosis of ADHD-C. Thus, a common pathway to a diagnosis of ADHD-C is an initial diagnosis of ADHD-H/I, followed by a later diagnosis of ADHD-C once inattention symptoms are noticeable around the time children reach early to mid-elementary school. Likewise, some preschoolers who initially have hyperactive-impulsive symptoms learn to control them and do not warrant a diagnosis of ADHD at all once they are school age (Barkley, 2003). In essence, it is common for ADHD-H/I to become ADHD-C or dissipate completely, which is why the diagnosis applies better to preschoolers than to my age range of interest.

Some researchers go as far as proposing that ADHD-C is, in fact, a separate disorder from ADHD-PI, rather than a subtype of the same disorder. Behaviorally, individuals with ADHD-C and ADHD-PI are often found to have deficits differing from one another, suggesting that this might be the case. One proponent who suggests ADHD-C and ADHD-PI should be separate disorders is Russell Barkley, who states that behavioral inhibition, the ability to willfully inhibit a behavioral response to a stimulus, is the primary deficit of ADHD-C, whereas ADHD-PI is better categorized as its own diagnostic entity (Barkley, 1997). Specifically, in his theoretical model, the primary deficit in behavioral inhibition leads to secondary problems in executive functions which depend on it. Thus, the executive and behavioral inhibition problems, according to this model, would be characteristic of ADHD-C, whereas ADHD-PI would be characterized by different problems. This position is strengthened by a body of research indicating differences between those with ADHD-C and those with ADHD-PI on different measures of behavioral regulation and inhibition. Nigg, Blaskey, Huang-Pollock, and Rappley (2002a) found differences between groups on a number of measures including a motor inhibition measure called the Stop Task. Children of both genders with ADHD-C showed significantly impaired motor inhibition compared to controls without ADHD, and boys in particular displayed differences between the ADHD-C and ADHD-PI groups. These inhibitory deficits were also reflected in a simple output speed task, which suggested that children with ADHD-PI had slower motor output speed, compared to children with ADHD-C who responded more quickly, and possibly impulsively, to stimuli. Inhibitory deficits also were noted by Geurts, Verte, Oosterlaan, Roeyers, and Sergeant (2005), who observed differences between children with ADHD-C and controls on tasks of inhibition only, but not on other executive functioning tasks (discussed below). This supports the notion that a deficit in inhibition is central to ADHD-C.

Whereas behavioral regulation and inhibition, specifically, might differentiate ADHD subtypes and raise questions regarding the validity of subtypes versus separate disorders, research on cognitive functioning suggests they should be thought of as being subtypes of the same disorder. Cognitive executive functioning is commonly found to be commensurate between subtypes, with most finding similar functioning between ADHD-PI and ADHD-C (Lopez-Vergara & Colder, 2013; Nigg et al., 2002a), but some finding group differences on measures of planning (Klorman et al., 1999; Wilcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Nigg and colleagues (2002a) also found a small, non-significant difference between subtypes in planning. They noted that children with ADHD-C had worse planning than children with ADHD-PI, leading them to suggest that ADHD-C and ADHD-PI are related subtypes which differ mainly in severity when considering executive functioning deficits, with ADHD-C being the more severe as both symptom domains are affected rather than just one as in ADHD-PI. Wilcutt and colleagues' (2005) meta-analysis found that although both subtypes had worse cognitive executive functioning compared to controls, there was little evidence for subtype differences on any executive functioning measure. Whereas executive functioning deficits are common in ADHD, cognitive executive functioning, specifically, tends to be related to the inattention domain, as it is similarly impaired in ADHD-C and ADHD-PI (Geurts et al., 2013; Wilcutt et al., 2005). On the other hand, poor behavioral/response inhibition is more related to the hyperactivity-impulsivity domain, as it is affected in ADHD-C and ADHD-HI. Executive functioning in ADHD will be discussed further next.

Executive Functioning. Because executive functioning (EF) is related to some aspects of personality, such as Conscientiousness (MacDonald, 2008), in depth discussion of different areas of EF in ADHD is warranted. The relationships between EF and ADHD is complex, as

suggested by a unique community-based longitudinal study by Friedman and colleagues (2007). They found that attention problems between ages 7 and 14 could predict later EF, including inhibition, working memory, and shifting, at age 17, but two phenomena could explain this relationship. One explanation is that everyday attention problems in children are indicative of EF deficits in childhood which continue into adolescence. However, it may be that attention problems in childhood actually lead to EF deficits in adolescence. Nonetheless, this suggests, for our purposes, that a relationship between ADHD and EF exists over time. Thus, we might expect childhood ADHD to be associated with childhood EF deficits. This has been shown to be the case in several studies (Geurts et al., 2005; Sergeant et al., 2002; Willcutt et al., 2005).

Coinciding with this complexity, not all studies find EF deficits in ADHD, however. For example, Geurts and colleagues (2005) found no impairment in children with ADHD on a number of cognitive EF tasks representing visual working memory, planning, and mental flexibility. This may be related to modest effect sizes for EF in ADHD, which is what meta-analyses in this area have found. More specifically, Willcutt and colleagues' (2005) meta-analysis found large effect sizes for many executive function deficits in ADHD, including response inhibition, vigilance, spatial working memory, and some measures of planning. They noted that moderate effect sizes and inconsistent findings (only 65% of EF measures differed between groups), however, do not support EF deficits to be either necessary or sufficient to cause all cases of ADHD. They suggest, rather, that EF deficits represent just one area of weakness contributing to a constellation of neuropsychological problems in individuals with ADHD. I will discuss additional research on four major areas of EF: shifting, inhibiting, planning, and working memory next. These areas could be contributing to the personality differences seen in ADHD.

Shifting. Shifting is defined as the ability to shift between tasks or mental sets (Friedman et al., 2007). Studies of shifting commonly use the Wisconsin Card Sorting Task (WCST; Heaton, 1981; Heaton, Chelune, Tally, Kay, & Curtis, 1993), which requires participants to discover a classification technique with minimal feedback (correct/incorrect). The participant must continue using the discovered rule until the rule changes without warning, at which time he/she must discover the new rule (or set). The test yields scores for perseverative responses, which is indicative of maintaining the wrong set. In a meta-analysis, 17 out of 26 studies reported deficits on the WCST in children with ADHD, suggesting that only some individuals have this deficit and/or many have the deficit to a mild degree (Sergeant, Geurts, & Oosterlaan, 2002). A number of studies have found individuals with ADHD to perform worse than controls on the WCST, with some finding worse scores on both correct responses and perseverative errors (Lawrence et al., 2004), and some finding worse scores on only perseverative errors (Houghton et al., 1999). Furthermore, Houghton and colleagues (1999) found that perseverative answers were only impaired when comparing ADHD-C and controls, not when comparing ADHD-PI and controls. This suggests that ADHD-C might have a greater level of impairment in shifting, possibly related to hyperactive/impulsivity dimension. Of note is another measure of shifting, the Trail-Making Test, which gives participants detailed instructions on when to switch sets (unlike the WCST). One study of ADHD found no differences in scores on the Trail Making Test (Houghton et al., 1999), suggesting that children with ADHD can shift effectively when they are explicitly told when and how to do so, but not when the task demands are ambiguous.

Inhibition. We certainly would expect inhibition to be a problem area in children with ADHD –especially ADHD-C – as impulsivity is linked with poor inhibition. Sergeant and colleagues (2002) conducted a meta-analysis on the stop signal task in ADHD, which required

participants to inhibit a motor response that was being executed. This task measures behavioral inhibition, specifically, and allows estimation of the speed of the inhibitory process, known as stop signal reaction time (SSRT). In this meta-analysis, seven out of eight studies using a stop task found a deficit in SSRT in children with ADHD, with these children being, on average, 103 ms slower than controls. Geurts and colleagues (2005) examined ADHD subtypes and found that whereas both ADHD-C and ADHD-PI had slower SSRT than controls, the subtypes did not differ significantly from one another. The aforementioned meta-analysis also assessed studies using the Stroop test, in which subjects say the color of font (such as blue or red) and inhibit the reading of the actual text. Ten out of twelve studies reported interference deficits from the Stroop test, which is a measure of cognitive inhibition in ADHD, but the meta-analysis did not assess subtypes. Whereas individuals with ADHD often have trouble with the Stroop test, children with ADHD-C were shown to have problems beyond those of children with ADHD-PI on the color and color-word sections of the Stroop in one study (Houghton et al., 1999). This is in line with the behavioral inhibition literature previously discussed and suggests that deficits in perseveration and response inhibition are more severe in ADHD-C, consistent with the hypothesis put forth by Nigg and colleagues (Nigg et al., 2002a). One study that did not find differences between children with ADHD and controls on the Stroop test noted that the speed of responses did differ, with the ADHD group giving slower responses on the color section of the test compared to controls (Lawrence et al., 2004). This is consistent with other literature suggesting processing speed deficits in this population (Schweitzer, Handord, & Medoff, 2006).

Working Memory. Working memory (WM), broadly defined, is the ability to store and manipulate information, and is sometimes referred to simply as ‘update’. In adults, WM, as measured by a letter-number sequencing task, has been found to be impaired in ADHD

compared to controls (Schweitzer et al., 2006). In a review of WM studies in children with ADHD, Sergeant and colleagues (2002) noted that children with ADHD performed worse on a test of WM, called the self-ordered pointing task, compared to controls. On the other hand, Geurts and colleagues (2005) did not find differences between children with ADHD and controls on the same task, consistent with the heterogeneity in this disorder. When assessing ADHD subtypes, research is inconsistent and scant regarding WM performance. Of that available, some researchers do not find subtype differences but do find that children with ADHD differ from controls (Geurts et al., 2005; Schweitzer et al., 2006), whereas others have found that adults with ADHD-PI have worse WM than adults with ADHD-H/I (Gansler et al., 1998). Overall, literature regarding WM in ADHD suggests there is a deficit in this area, whereas subtype differences, when found, might be due to other factors, such as processing speed (Schweitzer et al., 2006). Since WM is related to the cognitive deficits that are characteristic of the inattention domain (Geurts et al., 2013; Wilcutt et al., 2005), we would expect deficits in both ADHD-C and ADHD-PI, but no differences between the subtypes.

Planning. The last executive function of interest is planning, which has implications for both ADHD and personality research. Planning is defined as “the ability to look ahead, to construct a plan, and to evaluate and monitor execution of a plan.” (Sergeant et al., 2002) In a meta-analysis examining two specific planning tasks, the Tower of Hanoi and the Tower and London tasks, Sergeant and colleagues (2002) found five studies differentiating ADHD from controls, with lower performance in the ADHD groups, whereas two studies did not find a difference on tower performance between ADHD and controls; one of which was Houghton et al. (1999). When examining subtypes, a number of studies suggest that planning is not affected differently in ADHD-C than in ADHD-PI (e.g., Geurts et al., 2005; Houghton et al., 1999).

Taken together, the literature suggests there are cognitive EF defects in ADHD in shift, WM, and planning. These deficits have been inconsistently found and yield moderate effect sizes across studies (Nigg et al., 2002a), which may be related to the heterogeneity of the disorder as not all individuals with ADHD have EF deficits, and many have deficits in only one or two areas of EF (Nigg et al., 2002a). Several studies find cognitive EF deficits in both ADHD-C and ADHD-PI with limited differences between the subtypes, whereas differences are found in inhibition between the subtypes, with ADHD-C having worse deficits. This suggests that cognitive executive deficits are related to the inattention domain, which is shared by ADHD-C and ADHD-PI, whereas behavioral inhibition problems are more pronounced in individuals with ADHD-C. Another EF area of interest that is affected in ADHD is emotion regulation. Many children with ADHD have deficits in emotional regulation (Walcott & Landau, 2004), which contributes to the comorbidity of ADHD with emotional disorders. This comorbidity will be discussed next.

Internalizing Traits. Internalizing disorders commonly co-occur in ADHD, with depressive disorders (Major Depressive Disorder/Dysthymia) estimated to co-occur in 20-30% of children with ADHD (Biederman, Faraone, Keenan, & Tsuang, 1991; Blackman, Ostrander, & Herman, 2005; Cuffe et al., 2001; Fischer, Barkley, Edelbrock, & Smallish, 1990), and as many as one third of children with ADHD may have comorbid anxiety disorders (Biederman et al., 1991; Bird, Gould, & Staghezza-Jaramillo, 1994). One study highlighting the high percentage of comorbid psychopathology in ADHD found that out of 579 children, only 31% had ADHD with no comorbid psychopathology, whereas 14% had comorbid ADHD and anxiety disorders, 30% had comorbid ADHD and ODD/CD, and 25% had comorbid ADHD, anxiety disorders, and ODD/CD (Jensen et al., 2001). These relationships, however, are unclear and might be mediated

by other factors, such as co-occurring conduct problems. For instance, one meta-analysis suggested that in the absence of CD, ADHD is not more likely to be associated with depression (Angold, Costello, & Erkanli, 1999).

Few studies have assessed subtypes when examining internalizing traits in ADHD, although some suggest that ADHD-PI is more of an internalizing-type disorder, compared to ADHD-C, which is viewed as having mostly externalizing problems (Triolo, 1998). In a sample of 8-18 year olds, Piper (2006) found that 11% of an ADHD group had comorbid depression, whereas 7% had comorbid anxiety. However, upon further examination, it was noted that children with ADHD-PI had internalizing traits consistent with the overall findings, whereas children with ADHD-H/I did not. This suggests that the inattentive symptoms may be what are correlated with internalizing symptoms. Consistent with this, Power, Costigan, Eiraldi, and Leff (2004) found that only children with ADHD-PI, and not children with ADHD-C, had parent-reported anxiety levels that were worse than controls. Nonetheless, rates of major depression and anxiety have been found not to differ between ADHD-PI and ADHD-C (Faraone, Biederman, Eber, & Russell, 1998). One explanation for this pattern of results could be that parents more readily notice externalizing problems in children with ADHD-C, in effect “washing out” internalizing problems, which are less salient. Furthermore, teacher-reports of internalizing symptoms in children with ADHD have not been found to differ between ADHD-PI and ADHD-C, suggesting that this pattern might not be specific to parent-report (Eiraldi, Power, & Nezu, 1997; Morgan, Hynd, Riccio, & Hall, 1996). Last, similar rates of internalizing between subtypes may be due to the shared inattention dimension (Mash & Barkley, 2003).

Taken together, the research suggests that comorbidity between ADHD and internalizing psychopathology and symptomatology is common. Findings are more variable when considering

subtypes. Although many studies find internalizing symptoms to be associated with ADHD-PI, rather than ADHD-C, the research is inconsistent regarding this pattern of findings, as internalizing symptoms may be associated with the inattention dimension.

Externalizing Traits. Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) frequently co-occur with ADHD. The associations between ADHD and DSM-IV ODD/CD are stable between parent- and teacher-reports, with both reporting that children with ADHD have high rates of comorbid ODD and CD. 20-50% of children and 44-55% of adolescents with ADHD have comorbid CD, and comorbidity rates between ODD and ADHD may be higher (i.e., 54-67% of children with ADHD will meet criteria for ODD by age 7; Mash & Barkley, 2003). Interestingly, and possibly related to personality, the presence of comorbid externalizing disorders is related to poor emotional self-awareness, as children with both ADHD and deficient emotional awareness are more likely to meet diagnostic criteria for an externalizing disorder (Factor, Biederman, Eber, & Russell, 2013).

In terms of subtypes, children with ADHD-C have higher rates of ODD (Humphreys, Aguirre, & Lee, 2012) and CD (Faraone et al., 1998) than children with ADHD-PI. ODD co-occurs with ADHD in approximately half of children and adolescents with ADHD-C, whereas it only co-occurs in about one quarter of children and adolescents with ADHD-PI (APA, 2013). CD co-occurs in approximately a quarter of children and adolescents with ADHD-C (APA, 2013). The rate of comorbidity between CD and ADHD-PI was not reported (this may be because it is likely low).

Related areas of externalizing problems, including delinquency, drug use, and aggression, also have been found in ADHD. One study concluded that all children with ADHD have some risk for delinquency over their lifetime, whereas those with comorbid CD are at the highest risk

for becoming delinquent (Sibley et al., 2011). This is in line with research suggesting that children with ADHD are more likely than controls to participate in heavy alcohol use, cigarette smoking, marijuana use, and delinquency during adolescence (Walther et al., 2012). However, when assessing risk for aggression in children with ADHD, results are less clear, with high rates of comorbid conduct-related problems emerging as a strong confound. Some researchers have examined different dimensions of aggression, including reactive (in response to threat/provocation) versus proactive (goal-directed, without provocation) and overt (hitting, pushing, threatening) versus relational (gossiping, social exclusion, rumor spreading) aggression. ADHD has most consistently been associated with reactive, rather than proactive aggression (Card and Little, 2008; King and Waschbusch, 2010) and with both overt and relational aggression (Becker, Luebke, Stoppelbein, Greening, & Fite, 2012). Furthermore, this relationship between ADHD and reactive aggression is related to emotional regulation (to be discussed further), with children with poor emotional regulation and ADHD having a heightened risk for reactive aggression (Card and Little, 2008). In one study by Becker and colleagues (2012), overt, proactive, reactive, and relational aggression were all associated with ADHD, with females with ADHD being more likely than males with ADHD to engage in relational aggression. Importantly, the relationship between ADHD and aggression in general was related more strongly to the hyperactive-impulsive dimension than to inattention. Last, when controlling for ODD, ADHD no longer predicted aggression, suggesting that ODD may be more important than hyperactive-impulsive symptoms in predicting aggression. This is consistent with the fact that children with hyperactive/impulsive symptoms (ADHD-C) are more likely to have co-occurring ODD, compared to those with only inattentive symptoms (ADHD-PI) (APA, 2013; Humphreys et al., 2012).

Taken together, the research suggests that comorbidity between ADHD and externalizing psychopathology, symptomatology, and related constructs (i.e. delinquency) is common. Furthermore, strong support exists for the relationship between externalizing symptoms and the hyperactivity/impulsivity domain of ADHD, rather than the inattention domain. Still, children with ADHD-PI are at a clear risk for externalizing problems, although not to the same degree as children with ADHD-C.

Summary. Overall, research indicates that children with ADHD have significant impairment in cognitive EF and behavioral inhibition and have higher rates of internalizing and externalizing traits and psychopathology, when compared to those without ADHD. Furthermore, the literature suggests that although children with ADHD-C and ADHD-PI do not differ from one another in cognitive EF commonly, children with ADHD-C do present with worse deficits in the area of behavioral inhibition. This deficit in behavioral inhibition seems to place children with ADHD-C at a higher risk for having externalizing problems than children with ADHD-PI, whereas children with ADHD-PI may be at greater risk for internalizing problems, but the findings are inconsistent. These deficits in EF may be contributing to the higher levels of certain personality traits found in ADHD and vice versa. Before I begin discussing personality in ADHD, I will present background information on personality germane to such a discussion.

Personality

Overview. Personality in general refers to a construct that is thought of as being stable throughout life, and models of personality emphasize peoples' consistent tendencies towards thoughts, behaviors, and feelings (Shiner & Caspi, 2003). Nonetheless, not all researchers agree on when it becomes stable and if it becomes completely stable. Whereas some psychodynamic theorists believe that personality is formed by as young as age 3, others believe that personality

continues to develop even into late adulthood (Erikson, 1950). In addition, some researchers suggest that personality does not stop developing even throughout adulthood (Caspi & Roberts, 2001). For instance, longitudinal studies show that the Big Five has test-retest correlations around 0.4 during childhood, and in adulthood this figure only rises to 0.55 (Fraley & Roberts, 2004). Furthermore, meta-analyses of developmental personality research have found that Extraversion and Openness are the least stable traits in children as young as 10 years, and noted that all traits show changes throughout life (Roberts, Walton, & Viechtbauer, 2006). Thus, personality is continually influenced by environmental factors (Clark, 2005), affecting its stability; nonetheless, it is clear that early temperament and personality traits are associated with later personality traits (Caspi, 2005).

The study of personality can take many forms, and a number of personality theories – including trait theories, type theories, psychoanalytic theories, behaviorist theories, social cognitive theories, humanistic theories, and biopsychosocial theories – are recognized as having scientific value. For the purposes of my study, one particular model of personality – the Big Five – was used. One reason for this is that the Big Five are, by some, considered to be emerging as clear traits by the age of my sample (8-12 year olds). In addition, the Big Five has strong empirical support in the adult literature, as well as for children and adolescents (Halverson, Kohnstamm, & Martin, 1994).

Five-Factor Model. The five-factor model of personality (FFM), made up of five traits and commonly referred to as simply the Big Five, was first identified by Fiske (1949), although other research groups came to similar conclusions around the same time (Norman, 1963; Tupes & Christal, 1961; for a detailed review of the history and development of the Big Five, see Digman, 1990). In its original form, the Big Five consisted of five personality traits:

Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness-to-Experience (Digman, 1990). Two of these are related to Eysenck's (1947) two-factor system of personality. Eysenck's "Big Two" includes Extraversion and Neuroticism (see below for a description), whereas a third factor, Psychoticism (aggression, hostility) was added later (Eysenck & Eysenck, 1976). Most researchers continue to include Extraversion and Neuroticism in the Big Five, as well as Agreeableness, Conscientiousness, and Openness-to-Experience (Caspi, Roberts, & Shiner, 2005). The Big Five typically does not include Psychoticism.

Individuals who are high on Extraversion are outgoing, expressive, energetic, and dominant, while those who score low on this dimension (introverts) are more quiet, inhibited, lethargic, and content to follow others' lead (Caspi et al., 2005). Neuroticism describes the tendency to see the world as distressing or threatening (Caspi et al., 2005), and it commonly is viewed as the same construct as the Neuroticism trait described by Eysenck (1947), as well as the Negative Emotionality trait described by Tellegen (1985). Next, Agreeableness includes characteristics such as altruism, nurturance, caring, and emotional support (Digman, 1990). Individuals who have high Agreeableness are cooperative, considerate, empathic, generous, polite, and friendly. In contrast, those who have low Agreeableness are aggressive, rude, stubborn, and cynical. (Caspi et al., 2005). Conscientiousness describes an individual's tendencies to be responsible, attentive, careful, persistent, orderly, and planful (Caspi et al., 2005). Those who have low Conscientiousness are irresponsible, unreliable, careless, and distractible. (Digman, 1990). Last, Openness includes openness to feelings, openness to new experiences, flexibility of thought, and readiness to indulge in fantasy (Digman, 1990). However, Openness has been proposed to be bifurcated into two traits: Openness (artistic,

curious, wide interests, original) and Intellect (intelligent, insightful, sophisticated) (John & Srivastava, 1999).

Many suggest these five factors to be universal to the human experience, as the five traits have been found across many, but not all, cultures and geographic locations (Gurven, von Rueden, Massenkoff, Kaplan, & Lero Vie, 2013). However, other personality models have also been validated, and various models have significant overlap (discussed below). Specifically, in addition to the five factor model, several three-factor models have significant support (John & Srivastava, 1999). Nonetheless, the Big Five is a widely validated personality model, as researchers have consistently found a five-factor model to explain personality through factor analyses (Digman, 1990), although the traits are likely less coherent in childhood than in adulthood (Lamb, Chuang, Wessels, Broberg, & Hwang, 2002). Some tools that are used for measuring the Big Five include the NEO Personality Inventory (NEO-PI; Costa & McCrae, 1985) and the Five-Factor Model (FFM; Digman, 1990; McCrae & John, 1992). Additionally, five factors have been identified when using the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1964; McCrae & Costa, 1985), whereas four of the five factors (all except Openness) were found when using the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1951; Costa, Busch, Zonderman, & McCrae, 1986). These four factors (Extraversion, Agreeableness, Conscientiousness, and Neuroticism) are the most widely validated factors in the research literature (Shiner & Caspi, 2003). However, tools for studying personality, and the Big Five, specifically, in children and adolescents are scarcer and less widely used. Nonetheless, a few personality measures have been developed specifically for children and adolescents.

Measurement. Measuring the Big Five in childhood is not a simple task. Issues specific to children include rater bias, as some tools use parent- or teacher-ratings to assess child traits. These different ratings often have low correlations with one another, as parents and teachers may not be accurate reporters of what children are thinking and why they are doing what they are doing (Jensen et al., 1999).

Although not a measure of the Big Five, the Junior Temperament and Character Inventory (JTCI) is a measure of temperament specifically designed for children and adolescents (ages 6 to 14), adapted from Cloninger's Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994). The JTCI is based on Cloninger's psychobiological model, which includes four broad traits: Novelty Seeking (tendency to seek out new experiences), Harm Avoidance (tendency to avoid situations seen as dangerous), Reward Dependence (tendency to be responsive to external rewards), and Self-Directedness (tendency to be adaptive in order to meet goals and match values). This measure has been validated in a number of countries, including Italy, France, Norway, and the United States, and the psychometrics of the JTCI are good in terms of internal consistency and validity (Moreira et al., 2012; Vangberg et al., 2013). According to De Fruyt, Mervielde, Hoekstra, & Rolland (2000a), when mapping the JTCI onto the Big Five, high Extraversion is associated with low Harm Avoidance and high reward dependence. Agreeableness is not associated with any of the TCI scales. Conscientiousness is associated with low Harm Avoidance and Novelty Seeking, as well as high Persistence. Neuroticism is associated with high Harm Avoidance. Openness is associated with low Harm Avoidance and high Novelty Seeking and Reward Dependence.

The Personality Inventory for Children, Second Edition (PIC-2; Lachar & Gruber, 2001) is a 275-item parent-report questionnaire for children age 5 through age 19. The PIC-2 assesses

behavioral, emotional, cognitive, and interpersonal adjustment with good internal consistency and test-retest reliability. However, one problem with the PIC-2 is that parent-ratings might not be indicative of their children's thoughts and feelings, which may be important when defining one's personality. Thus, it may provide inaccurate representations of some aspects of child/adolescent personality. Moreover, upon conducting a literature search, no research evaluating relationships between the PIC-2 factors and the Big Five was found.

Whereas the aforementioned measurement tools provide support for valid measurement of personality and temperament in childhood, they do not include scales for the Big Five. Upon conducting a literature search for measuring the Big Five in children and adolescents, I identified two scales, the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 1999) and the Big Five Questionnaire for Children (BFQ-C; Barbaranelli, Caprari, Rabasca, & Pastoralli, 2003). The HiPIC, which was developed as a parent-report personality measure for children between 6 and 12 years, includes 114 items representing dimensions that reflect a modified, child-relevant, Big Five structure: Extraversion, Benevolence, Conscientiousness, Emotional Stability, and Imagination. In a French study of 1,250 children between 8 and 12 years, alphas were high for Extraversion (.90), Benevolence (.92), Conscientiousness (.94), Emotional Stability (.92), and Imagination (.88) (Rossier, Quartier, Enescu, & Iselin, 2007). While this measure does assess the Big Five in children, it is a parent-report measure, with similar problems to the PIC-2 in this respect. Therefore, it was not chosen for this study as the BFQ-C does include a child-report measure.

The Big Five Questionnaire for Children (BFQ-C; Barbaranelli et al., 2003) is a 65-item questionnaire assessing the Big Five in children ages 6-13 through self-report, as well as parent- and teacher-report. During initial development, 5 factors were found, including

Energy/Extraversion, Agreeableness, Conscientiousness, Emotional Instability, and Intellect/Openness. Furthermore, parent-report on the BFQ-C was found to have good alphas in clinically anxious and non-clinical children, ages 6-13, for Extraversion (anxious sample = .75/non-clinical sample = .79), Agreeableness (.81/.87), Conscientiousness (.83/.88), Neuroticism (.87/.86), and Intellect/Openness (.77/.86) (Vreeke & Muris, 2012).

Correspondingly, this study found relationships between behavioral inhibition (using the behavioral inhibition questionnaire – BIQ) and extraversion (-.58) and agreeableness (-.40).

These data, along with the evidence of validity for the HiPIC, suggest that the Big Five is present in children as young as 6 years, and that it may be related to problems found in ADHD, such as poor inhibition. Thus, the BFQ-C was selected for use in my study.

Related Constructs. In order to better understand the five factors comprising the Big Five, it is helpful to consider other theories. First, examination of relationships between the Big Five model and other theories of personality aids in conceptual understanding of the five factors. Second, studying temperament theories as they relate to the Big Five also aids in this understanding, and it has the added benefit of allowing us to understand developmental issues related to the study of the Big Five and of trait taxonomy in general. While personality models were developed for adults and later applied to children, temperament theorists created models specifically for young children. As many studies investigating trait taxonomy in children utilize temperament models rather than personality models, discussion of common overlapping temperament theories is warranted.

Caspi and colleagues (2005) presented a helpful framework for conceptualizing personality and temperament in an article titled “Personality Development: Stability and Change”. They state, “childhood temperament should be conceptualized with an eye toward

adult personality structure, and adult personality should be understood in light of its childhood antecedents” (p. 454). This view stresses both the equal importance of the two types of theories and the important developmental considerations in this area of study. According to Shiner & Caspi (2003), the difference between temperament and personality is increasingly unclear past infancy. However, this lack of distinction is contested. Whereas temperament generally refers to more biologically-driven behaviors in infancy, young children quickly begin to have feelings, thoughts, and behaviors that are influenced more by the world around them than by inborn characteristics (Shiner & Caspi, 2003). This shift results in traits that could be classified through temperament or personality theories. Hence, it is likely that in early childhood, traits are more biologically driven and, thus, might be better conceptualized as temperament. When the transition from temperament to personality occurs remains under dispute (Shiner et al., 2012). Whereas there are differences between temperament and personality, many researchers claim that existing models of personality and temperament overlap, meaning that we can make connections from one model to another (Shiner & Caspi, 2003). Thus, when discussing the Big Five, I will concurrently discuss models of temperament (Buss & Plomin, 1984; Clark & Watson, 1999; Cloninger, Przybeck, Svrakic, & Wetzel, 1994; Rothbart, 1981; Tellegen, 1985), as well as other models of personality (Costa & McCrae, 1992a; 1992b; Eysenck, 1947; 1967; Zuckerman, Kuhlman, Thornquist, & Kiers, 1991).

Extraversion. When drawing connections between the personality trait, Extraversion, and temperamental traits from a variety of theories, a number of traits seem to describe a similar construct. For instance, many correlates between Extraversion and Cloninger’s temperamental domains exist, including Harm Avoidance, Novelty Seeking, and Reward Dependence (De Fruyt, Van De Wiele, & Van Heeringen, 2000b). Thus, we would expect an individual with high

Extraversion to show low Harm Avoidance, high Novelty Seeking, and high Reward Dependence. Another temperamental trait associated with Extraversion is Surgency (Rothbart, 1981), which was shown to fall under an umbrella of personality/temperament traits labeled Extraversion-Positive Emotionality (Clark & Watson, 1999). Extraversion-Positive Emotionality represents a combination of two traits, including Eysenck's Extraversion (Eysenck, 1947) and Tellegen's Positive Emotionality (Tellegen, 1985). Last, Extraversion is associated with Sociability and Activity from Zuckerman's alternative five-factor model (Zuckerman et al., 1991). These connections paint a picture of an Extraverted individual who is socially outgoing and active, novelty seeking, and who shows positive emotions often. One interesting finding which may underlie many features of Extraversion is that high behavioral inhibition in children is characterized by low levels of Extraversion (Muris et al., 2009; Vreeke & Muris, 2012). Further, lower behavioral inhibition may contribute to a higher likelihood of exploring the environment (Gomez et al., 2012), which is characteristic of extraverted individuals.

Agreeableness. Similar connections can be drawn between Agreeableness and other models. For example, Agreeableness is negatively correlated with Zuckerman's (1990) Aggression-Hostility trait, as well as Tellegen's (1985) Negative Emotionality trait (Zuckerman, 1990). Furthermore, Agreeableness is correlated with other Big Five traits, namely Openness, Neuroticism, and Conscientiousness (Caspi et al., 2005; Clark & Watson, 1999; Martin, Watson, & Wan, 2000; Zuckerman et al., 1993). Negative correlations between Agreeableness and Neuroticism may occur because both traits describe anger proneness, albeit different aspects of anger proneness. Positive correlations between Agreeableness and Conscientiousness might stem from inhibitory influences in each trait (i.e., inhibition is associated with high Conscientiousness and high Agreeableness; described in Caspi et al., 2005).

Neuroticism. Neuroticism, as already mentioned, is analogous to Eysenck's (1947) Neuroticism trait (Digman, 1990; Zuckerman et al., 1993). In addition, Tellegen's Negative Emotionality (Tellegen, 1985), is related to Neuroticism. A combination of these three models (Big Five, Eysenck, and Tellegen) led Clark and Watson (1999) to a trait which they labelled Neuroticism/Negative Emotionality (N-NE). Additionally, the N-NE dimension is very similar to Rothbart's (1981) Negative Affectivity. Using Cloninger's model of temperament, it was shown that Neuroticism is associated with higher Harm Avoidance (De Fruyt et al., 2000b), consistent with the view of Neurotic individuals as perceiving the world as distressing and threatening. People who are high on Neuroticism often take actions to avoid perceived threats. For this reason and others, another correlate of Neuroticism is anxiety, and this was mirrored with Zuckerman's (1990) Neuroticism-Anxiety trait.

Conscientiousness. Conscientiousness also has been associated with a number of temperament traits. De Fruyt and colleagues' (2000b) study yielded connections between Conscientiousness and lower Harm Avoidance and Novelty Seeking, as well as higher Persistence. This is consistent with the idea that Conscientious individuals are responsible, orderly, and planful. Similarly, Conscientiousness is related to lower Impulsive Sensation Seeking, from Zuckerman's model (Zuckerman et al., 1993). Furthermore, Conscientiousness is related to lower Psychoticism, which was the third trait that was later added by Eysenck (Eysenck & Eysenck, 1976) to his previous "Big Two". We would expect psychoticism, which is characterized by aggression and hostility, to be lower in individuals who are responsible and careful in their actions. Additionally, connections between impulse control and Conscientiousness suggest that conscientious individuals have more effective impulse control (Carver, 2005). This idea is reflected in Clark and Watson's (1999) three factor model that

includes a trait reflective of impulse control labeled Disinhibition vs. Constraint, This trait stems from Tellegen's (1985) Constraint trait, which is related to Conscientiousness. It may be, therefore, that effective impulse control is underlying aspects of Conscientiousness. In fact, Muris et al. (2009) found results suggesting that better behavioral inhibition is associated with higher Conscientiousness, although this only emerged after controlling for shared variance among the Big Five, and, thus, should be interpreted carefully.

Openness. Last, Openness is associated with fewer temperamental traits compared to the other four of the Big Five. Nonetheless, De Fruyt and colleagues (2000b) found Openness to be associated with lower Harm Avoidance, as well as higher Novelty Seeking and Reward Dependence. Interestingly, they found the same pattern of temperamental traits to be characteristic of Extraversion, suggesting that the two personality traits may have similar temperamental antecedents. This is in line with research suggesting considerable overlap between Openness and other Big Five traits, namely Extraversion and Agreeableness (Caspi et al., 2005; Clark & Watson, 1999). The lack of broad association with temperamental traits by other authors highlights both the uncertainty and the ubiquity of the Openness dimension.

So What? A brief historical view of the Big Five, as well as information about measurement issues and temperamental correlates, helps in imagining what children with ADHD might look like from a trait perspective of personality. Furthermore, I hope that this method of description will help to unveil some of the differences in symptom presentation commonly seen in ADHD. Integration of knowledge from disciplines other than those explicitly named in my study (i.e. ADHD subtypes and the Big Five) is paramount for my study; thus, I will do my best to integrate a number of complementary perspectives in subsequent sections.

Personality Characteristics in ADHD

Overview. Research on personality correlates of ADHD is sparse, especially regarding associations between ADHD and the Big Five in children. For those articles that are available, a number of approaches have been taken in this field of study. Some researchers use ADHD samples and compare mean scores on the Big Five between ADHD and control groups (Cukrowicz, Taylor, Schatschneider, & Iacono, 2006; De Pauw & Mervielde, 2011). Others take their research a crucial step further and include ADHD subtypes, typically ADHD-C and ADHD-PI, but sometimes ADHD-H/I, in their mean comparisons (Knouse, Traeger, O’Cleirigh, & Safren, 2013; Martel, Goth-Owens, Martinez-Torteya, & Nigg, 2010). Some forego the group approach in favor of correlational studies examining the relationships between personality scores and ADHD symptom domain scores (Parker, Majeski, & Collin 2004). Other approaches I will discuss include those examining attention as a predictive factor of personality (Miller, Miller, Newcorn, & Halperin, 2007), as well as temperamental studies of ADHD, which can inform my predictions regarding the Big Five in children.

Why is it important to study the relationship between ADHD and personality? First, identifying relationships between personality traits and psychopathology can help us understand developmental theories regarding origins, outcomes, and symptomatology of psychological disorders (Nigg et al., 2002b). For instance, a similar five-factor model structure, characterized by low Conscientiousness, low Agreeableness, and high Neuroticism, is consistent with both ADHD and antisocial personality traits in adults. This underscores the value of personality research in understanding both similarities and differences between different disorders. Second, this area of research is integrative, as common research findings in both the ADHD and personality literature include significant heritability (Jang, Livesly, & Vernon, 1996; Loehlin,

McCrae, Costa, & John, 1998; Sherman, Iacono, & McGue, 1997) and the involvement of similar neurobiological systems (Barkley, 1997; Zuckerman, 1991). Third, according to De Pauw and Mervielde (2011), there are two important reasons for evaluating personality traits associated with ADHD. One is that trait approaches broaden our understanding of diagnostic criteria and help us to better describe the heterogeneous nature of symptom presentation in ADHD. The second is that varying levels of problem behaviors in ADHD may be influenced by trait variation. Both of these reasons emphasize symptom presentation as important in the study of personality in ADHD, which was addressed in my study by evaluating differences in personality between children with ADHD-C or ADHD-PI subtypes and determining relationships between inattentive and hyperactive/impulsive domains and the Big Five.

Connections in the Literature. One question of importance is that of whether ADHD is merely an extreme expression of a certain set of personality traits. Nigg, Goldsmith, and Sachek (2004) note in their review that personality data suggest that personality might regulate ADHD symptom expression or predispose individuals to certain symptom manifestations. This is in line with an article by Nigg and colleagues (2002b) who found that variation in the Big 5 explained a little less than half of the variation in symptoms of ADHD. Thus, whereas personality does not completely explain ADHD, it can be a particularly useful construct in describing differences in symptom expression. This article (Nigg et al., 2002b) will be described in more detail next as it is particularly relevant to this project.

In a major study by Nigg and colleagues (2002b), 1,620 adults completed a number of questionnaires measuring personality and ADHD. This sample consisted of parents of children with ADHD, college undergraduates, and young non-college adults. They obtained self- and spouse-report of the Big Five from the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae,

1992) and used a number of instruments to obtain a multi-modal measurement of ADHD symptoms. For the purposes of my study, the findings from the Wender-Utah Rating Scale (Wender, 1985), including the derived Stein and colleagues (1995) factor scores from the scale, are of particular interest. Nigg and colleagues (2002b) found that Total ADHD score from the Wender-Utah was associated with self- and spouse-report of low Conscientiousness, low Agreeableness, and high Neuroticism. They noted the relationship between executive functioning and Conscientiousness, specifically, as one explanation for this relationship. The Total ADHD score was not associated with either Extraversion or Openness. At the symptom level, Attention Problems were only associated with low Conscientiousness and, to a lesser degree, high Neuroticism. Conduct-Impulsivity, which was noted as being the symptom domain most closely linked with impulsivity (*not* hyperactivity), was associated with low Agreeableness and high Neuroticism, but no others. Interestingly, another symptom domain of ADHD from the derived scale – Social Problems – correlated with low Extraversion, indicating that people with ADHD actually reported more withdrawal, loneliness, and isolation, rather than higher levels of sociability, activity, or assertiveness. As noted earlier, this relationship was not strong enough to account for any association between total ADHD symptoms and Extraversion. It is possible, therefore, that the relationship between low Extraversion and social problems is reflective of a specific group of individuals with ADHD. A retrospective recall of childhood ADHD symptoms, as classified by the DSM-IV, also was obtained in this sample, yielding relationships between high ADHD symptoms and low Conscientiousness, low Agreeableness, and high Neuroticism, but not Extraversion or Openness, similar to current symptoms (Total ADHD score). When considering symptom domains, Inattention predicted low Conscientiousness and,

to a lesser degree, high Neuroticism. The Hyperactivity/Impulsivity score only predicted low Agreeableness.

In another key study in this area, Parker et al. (2004) separated their sample of adults into three groups, ADHD predominantly inattentive type, ADHD hyperactive/impulsive type, and controls. Interestingly, there is no mention of combined type or any group consisting of people who met cutoff scores for both PI and H/I, which is unusual in adulthood. These groups were derived from the Conners' Adults ADHD Rating Scales (CAARS) scores, and the NEO-Five Factor Inventory (NEO-FFI) scales were used to assess the Big 5. When using a regression approach, the Big 5 accounted for 41 % of the variance in inattention, with high neuroticism and low Conscientiousness accounting for the most variance (Conscientiousness was almost 5-fold greater than Neuroticism, however). For H/I, the Big 5 predicted 26% of the variability, with low Agreeableness, high Neuroticism, and high Extraversion accounting for equal but small (10% or less) amounts of variability. Agreeableness was the best predictor of H/I scores. For total ADHD, high Neuroticism and low Conscientiousness were the best predictors. One-way ANOVAs showed that the inattentive group scored significantly higher on Neuroticism, compared to both other groups. The H/I group scored significantly higher than controls on Neuroticism and Extraversion. The inattentive group, however, did not differ on Extraversion compared to the other two groups. Their measure of Extraversion included both approach and positive emotionality, a point that will be elaborated upon subsequently. Both ADHD groups had lower Agreeableness than controls. Last, controls scored highest in Conscientiousness, with H/I group in the middle, and the inattentive group scoring lowest. Notably, this was a sample of college students, rather than a clinical sample or traditional community sample.

As demonstrated by these two studies on adults, our understanding of the complex personality profile of children with ADHD may be enhanced by examining the findings for each of the Big Five personality factors as they relate to the different domains of ADHD. Thus, similar to the previous section, personality and its relationship to ADHD and ADHD subtypes will be reviewed alongside temperamental associations. Specifically, this portion of my literature review focuses on two main types of findings. First, connections between ADHD diagnosis and each personality trait will inform us about possible personality profiles of children with ADHD. Second, connections between each symptom domain and each personality trait will guide our understanding of differences in symptom presentation within the ADHD population.

Extraversion. Extraversion has not been associated with ADHD consistently in either clinical or community samples in adults or children/adolescents. Extraversion is often studied in relation to ADHD due to the assertion that individuals with ADHD lack internal stimulation, thus compensating for this low level of arousal with disruptive behavior (Parker et al., 2004). This might hold true for the hyperactive-impulsive domain, or for individuals with comorbid behavioral problems such as ODD or CD, but it lacks evidence for the inattentive domain (Parker et al., 2004). As noted above, Parker and colleagues found high Extraversion to be predictive of H/I, but did not find differences in Extraversion for the inattentive type. Another complication to the study of Extraversion in ADHD is that Extraversion can denote either positive approach, sociability, or both (Nigg et al., 2004), which complicates conclusions based on what has been used as a marker for Extraversion. Parker and colleagues' measure included both aspects as noted above. Furthermore, although Extraversion often is not related to hyperactivity/impulsivity collectively, it might be related to hyperactivity when hyperactivity and impulsivity are measured as separate symptom domains. More specifically, Knouse and colleagues (2013)

found Extraversion to be predictive of hyperactivity, but not impulsivity, in an adult sample. Extraversion was positively correlated to both self- and spouse-reported hyperactivity. This suggests that Extraversion may be specifically related to hyperactivity but not impulsivity, and the relationship between Extraversion and hyperactivity might be missed by using the combined H/I dimension. Thus, the inconsistency of findings related to Extraversion might be due to a number of factors, including age, gender, how it is defined, and whether ADHD symptom domains are examined together or separately.

One method that has been used to evaluate personality in children is the California Child Q-Sort task (CCQ; Caspi et al., 1992), which requires parents to rate their children by placing cards into categories ranging from least descriptive to most descriptive. When using this method, Martel and colleagues (2010) found that some children with sub-threshold or clinical combined-type ADHD (ADHD-C) could be categorized as “high-extraversion” (high approach), whereas others fell into an “impulsive” (low conscientiousness) group. In essence, if the children with ADHD-C were not high in Extraversion/approach, they would have needed impulsivity/low conscientiousness to warrant a diagnosis of combined type. This finding is consistent with the study by Knouse and colleagues (2013) mentioned above which suggests that Extraversion may be related to hyperactivity but not impulsivity such that research using a combined H/I dimension may miss this relationship. Furthermore, the potential specificity of this relationship could explain why research on ADHD that does not examine subtype differences finds that children with ADHD do not differ from control groups on Extraversion as noted subsequently.

As an example, two studies finding null Extraversion results in children/adolescents with ADHD are presented. In one community sample of 11 - 17 year olds classified as having

ADHD, CD, comorbid ADHD and CD, or as non-ADHD/CD controls, Cukrowicz and colleagues (2006) used the MPQ (Tellegen, 2000) and a parent-report version developed by the research team, looking at Constraint, Negative Emotionality, and Positive Emotionality, to evaluate personality differences. The pattern of results that was characteristic of the ADHD, CD, and ADHD/CD groups included low constraint, high negative emotionality, and average positive emotionality, compared to controls, from both self and parent reports. As noted in the personality section, positive emotionality and Extraversion are related, suggesting that ADHD and CD both have average Extraversion when focused on positive emotionality. De Pauw and Mervielde (2011) examined traits using both Buss and Plomin's EAS (emotionality, activity, shyness) model and Rothbart's model (Effortful Control, Surgency, and Negative Affectivity) in children with and without ADHD, diagnosed according to parent ratings using DSM-IV criteria. However, they did not examine subtypes. To examine the Big Five, they used the HiPIC (Mervielde & De Fruyt, 2002), which measures Extraversion (including both approach and positive emotionality) among other traits, as discussed previously. They found no group differences for Extraversion.

Additionally, associations between ADHD subtypes and Cloninger's temperament domains have been made, but they are largely inconsistent. As noted in the personality section, Extraversion is associated with low harm avoidance, high novelty seeking, high reward dependence, and high positive emotionality. Some have found inattention to be related to higher Harm Avoidance in children, which is indicative of pessimistic anticipatory worry, fear of uncertainty, shyness, and rapid fatigability (Yoo et al., 2006; Gomez, Woodworth, Waugh, & Corr, 2012) which leads one to wonder about possible comorbid anxiety. Others note connections between inattention and higher Novelty Seeking (Lynn et al., 2005). The latter

associations, however, were made in adult samples. Hyperactivity/Impulsivity has been associated with higher Novelty Seeking (Yoo et al., 2006; Lynn et al., 2005) as well. Gomez and colleagues (2012) suggest that both inattention and high harm avoidance may reflect an overactive behavioral inhibition system (BIS; Gray and McNaughton, 2000), whereas hyperactivity/impulsivity might reflect an overactive behavioral activation system (BAS). This variability across temperament traits in ADHD may help explain some of the mixed results found with Extraversion, along with whether one is looking at approach versus positive emotionality, or hyperactivity specifically versus ADHD in general.

Taken together, research findings suggest a possible link between hyperactivity and Extraversion, when defining Extraversion in terms of high Novelty Seeking and approach. The aforementioned studies examining Positive Emotionality (Cukrowicz et al., 2006) suggest Positive Emotionality provides little in terms of predicting links between Extraversion and ADHD. However, this study, like most other literature, failed to evaluate subtype differences, whereas literature including subtype differences generally notes more links between the hyperactivity/impulsivity domain (ADHD-C) and Extraversion. This is particularly true when one examines hyperactivity specifically rather than hyperactivity/impulsivity in general (Knouse et al., 2013)

Agreeableness. Links between the Big Five trait of Agreeableness and ADHD are consistently found in the research, and subtype differences emerge when evaluating for them. In general, presence of ADHD is associated with lower Agreeableness in children (De Pauw & Mervielde, 2011) and adults (Knouse et al., 2013; Nigg et al., 2002b; Parker et al., 2004) with ADHD. In contrast, Miller et al (2007) found that presence of childhood ADHD did not predict *later* Agreeableness. However, in this same study, individuals with ADHD in childhood whose

symptoms persisted into late adolescence had lower Agreeableness than controls. This might mean that if childhood ADHD in total is not characterized by later low Agreeableness, persistent ADHD may be predicted by lower Agreeableness in childhood.

Furthermore, subtype domains differ in levels of Agreeableness, with the trait generally being linked more with the hyperactivity/impulsivity domain than the inattention domain. Parker and colleagues (2004) found that low Agreeableness was a better predictor of H/I than of inattention in adults, and Knouse and colleagues (2013) linked low Agreeableness specifically to impulsivity, rather than to hyperactivity or inattention. This is in line with the findings of Nigg and colleagues (2002b) discussed above, who demonstrated that Agreeableness was associated with Stein's Conduct-Impulsivity scale. Thus, Agreeableness seems to be negatively related to ADHD in general, and this relationship appears to be linked to the H/I dimension, particularly impulsivity. Still, subtype studies in children are lacking as these were the only studies I found on the topic.

Conscientiousness. Individuals with ADHD show considerable differences on measures of Conscientiousness when compared to controls. This Big Five trait is often lower in adults (Knouse et al., 2013; Nigg et al., 2002b; Parker et al., 2004) and children (De Pauw & Mervielde, 2011) with ADHD. Moreover, Knouse and colleagues (2013) found the strongest effect size for conscientiousness (over 2SD lower than controls) compared to the other four traits of the FFM, and Parker and colleagues (2004) found low Conscientiousness predicted ADHD symptoms. Parker et al. also found that the Big 5 accounted for 41 % of the variance in inattention specifically, with low conscientiousness and high neuroticism accounting for the most variance. Further, the variance accounted for by Conscientiousness was almost 5-fold greater than by Neuroticism, as noted above. Conscientiousness was also a significant predictor of

hyperactivity/impulsivity, although not as strong of a predictor as it was for inattention. In other studies on adults, low Conscientiousness has been linked to the inattention domain specifically, whereas H/I symptoms are not associated with low Conscientiousness (Knouse et al., 2013; Nigg et al., 2002b). In terms of development, it has been shown that persistent *and* non-persistent childhood ADHD predict low Conscientiousness in later adolescence (Miller et al., 2007).

Constructs related to Conscientiousness from other models also have been found to be related to ADHD. For instance, Cukrowicz and colleagues (2006) found that both children with ADHD and children with CD have low Constraint, which is closely related to Conscientiousness, compared to controls. As this study did not examine subtype differences, it is unclear whether Constraint, which reflects traits related to responsibility, dependability, and orderliness (Cukrowicz et al., 2006), is more related to the inattention or H/I domain. However, other literature on related constructs supports a relationship between Conscientiousness and inattention (Knouse et al., 2013; Nigg et al., 2002b). Effortful control has been described as the deliberate modulation of emotion and behavior (Martel & Nigg, 2006), and De Pauw and Mervielde (2011) found lower Effortful Control for a group of children with ADHD compared to controls. Because they did not look at subtypes, it is possible that this relationship was being driven by the inattention domain since both subtypes have inattention. Martel and Nigg (2006) found a relationship between Effortful Control and parent-rated inattention, but not teacher-rated inattention or parent- or teacher-rated hyperactivity/impulsivity. This supports the notion that the low Conscientiousness found in ADHD might be better related to the inattention domain, rather than to the H/I domain.

Taken together, these results suggest that individuals with ADHD have considerable impairment in Conscientiousness and related areas, and that low Conscientiousness found in

ADHD might be related to the inattention domain, rather than to the H/I domain. Additionally, low effortful control seems to be more related to inattention, whereas low reactive control (the automatic modulation of emotion and behavior or automatic control of reactivity) seems to be more related to H/I (Martel & Nigg, 2006). This relationship between ADHD and Conscientiousness may be related to executive functioning, as cognitive executive functions are related to Conscientiousness (MacDonald, 2008) and EF is affected in ADHD as noted earlier in the literature review.

Neuroticism. According to Nigg and colleagues (2004), although Neuroticism is associated with ADHD, it is also associated with a number of other disorders. Therefore, the question arises of whether Neuroticism, or Negative Emotionality, is indicative of psychopathology in general, rather than being a trait specifically affected in ADHD. Nonetheless, deficits in Neuroticism as they relate to ADHD, specifically, will be discussed as neuroticism is often affected in individuals with ADHD. High levels of Neuroticism have been found in adults (Knouse et al., 2013; Nigg et al., 2002b; Parker et al., 2004) and children (De Pauw & Mervielde, 2011) with ADHD. Additionally, childhood-persistent ADHD (persisting into late adolescence) predicts later high Neuroticism, whereas childhood ADHD that does not persist into adolescence does not correspond with higher Neuroticism (Miller et al., 2007). Thus, both Agreeableness and Neuroticism may be associated with persistent ADHD but not ADHD limited to childhood.

When examining the dimensions of ADHD, Nigg and colleagues (2002b) found that high Neuroticism was associated with more total ADHD symptoms, as well as more inattention symptoms. However, Neuroticism was not associated with H/I symptoms. Of note is the fact that this study involved retrospective accounts of childhood ADHD symptoms, which,

surprisingly, was not noted as a limitation to this study. Nevertheless, connections between Neuroticism and inattention are generally found, although they are somewhat inconsistent. For instance, in a sample of adults, Parker and colleagues (2004) found high Neuroticism to be related to both inattention and H/I, although inattention was a slightly better predictor of Neuroticism compared to H/I. Knouse and colleagues (2013) found high Neuroticism to be associated with self-reported inattention but not hyperactivity or impulsivity. As noted next, research on related traits from other models show a somewhat similar pattern of results, although most studies of this nature do not examine subtype differences.

Martel and Nigg (2006) examined subtypes as they relate to Negative Emotionality, which is closely linked with Neuroticism. The only association found was between Negative Emotionality and ADHD symptoms after controlling for gender. Specifically, parent-rated, but not teacher-rated, inattention and H/I symptoms were positively related to Negative Emotionality, such that higher levels of symptoms from either domain correlated with higher Negative Emotionality. In line with previously discussed literature, the correlation between inattention and Negative Emotionality (.25) was slightly higher than the correlation between H/I and Negative Emotionality (.20). Higher Negative Emotionality in ADHD also has been found in other studies (Cukrowicz et al, 2006; De Pauw & Mervielde, 2011).

Taken together, High Neuroticism may be commonly found in ADHD, and it may be related to both inattention and hyperactivity/impulsivity. Whereas personality and temperament research suggest that Neuroticism may be more strongly linked with the inattention dimension of ADHD, associations with the H/I dimension are inconsistently found. Thus, we might expect Neuroticism to be associated with ADHD dimensions and diagnosis, including both subtypes.

Furthermore, high Neuroticism in ADHD might be related to difficulties in emotional regulation commonly found in children with ADHD (Walcott & Landau, 2004).

Openness. Openness, as previously mentioned, is the least clear Big Five trait, especially in children. Researchers consistently struggle to define Openness with certainty, resulting in its definition being altered for use with children (De Pauw & Mervielde, 2011). Additionally, it has not been found to be associated with ADHD in the literature consistently. More specifically, although some find no differences on scores of Openness in individuals with ADHD (Parker et al., 2004; Nigg et al., 2002), some note significant, albeit small, effects. For example, De Pauw and Mervielde (2011) found that children with ADHD score about ½ SD lower than controls on their Imagination trait, and noted that one sub-facet of Imagination – Intellect – was particularly affected in children with ADHD, but not the Creativity or Curiosity facets. On the other hand, Knouse and colleagues (2013) found *higher* Openness scores in adults with ADHD, compared to controls, although neither inattention nor H/I predicted Openness, defined as the traditional openness to experience in this study. This is in contrast with the results of Parker and colleagues (2004), who found that total ADHD and inattention, but not H/I, could significantly predict *lower* Openness from the same measure.

This inconsistent pattern of results suggests that Openness as a trait may be affected in some individuals with ADHD. Nonetheless, it may be that sub-factors, such as intellect, which are associated with Openness, are responsible for the links between ADHD and Openness and not other aspects of personality that Openness includes. Of note, intelligence is commonly lower in ADHD than controls, although still in the Average range (Marshall, Hynd, Handwerk, & Hall, 1997).

Summary. The literature reviewed suggests that individuals with ADHD may have lower Conscientiousness and Agreeableness but higher Neuroticism compared to typically developing controls. The research has not consistently linked differences in Extraversion or Openness to ADHD, although Extraversion, when defined as approach/novelty seeking, may be related to ADHD, especially the combined type and hyperactivity in particular. Literature on subtypes suggests that inattention is related to low Conscientiousness and high Neuroticism, whereas hyperactivity/impulsivity is related to low Agreeableness, and possibly high Neuroticism and Extraversion. When the hyperactivity/impulsivity dimension is broken down into hyperactivity and impulsivity, hyperactivity may be related to approach/novelty seeking whereas impulsivity may be related to agreeableness.

ADHD/Personality/Emotion Regulation

Symptoms of emotional dysregulation are associated with negative emotionality (Frick & Morris, 2004; Nigg, 2006) and neuroticism (Dyce, 1997). The previously discussed personality and ADHD literature suggests that negative emotionality and neuroticism are higher in individuals with ADHD. Thus, we might expect more problems in this area in ADHD. Commensurate with this, King and Waschbusch (2010) note that ADHD (mixed sample in terms of subtypes) is most consistently associated with reactive, rather than proactive aggression, which may be a marker of emotional regulation difficulties. This is consistent with research suggesting there is impaired emotional regulation in ADHD (Walcott & Landau, 2004). Unfortunately, no research has examined the relationship between emotional regulation and personality in ADHD to determine if poor emotional regulation may be accounting for the relationship between ADHD and personality (Neuroticism, Agreeableness).

In terms of subtypes, Barkley's (1997) executive function theory suggests that emotional regulation is one of four primary areas of impairment in ADHD-C. What is less certain is whether it is an area of concern in ADHD-PI, although the comorbidity with anxiety and depression may lead one to believe it is. However, Factor and colleagues (2013) found that children with both ADHD and deficient emotional self-awareness were more likely to meet criteria for a comorbid externalizing disorder. Since children with ADHD-C have comorbid externalizing disorders more frequently than children with ADHD-PI, we might expect children with ADHD-C to have worse emotional regulation than ADHD-PI, which might have worse emotional regulation than controls. Consistent with this, children with ADHD-C tend to be more intense in both positive and negative emotional displays after receiving non-disappointing or disappointing prizes, respectively, compared to children with ADHD-PI and controls (Maedgen & Carlson, 2010). Moreover, when looking at ADHD from a dimensional approach, one study of emotional lability (with emphasis on the negative side of emotional regulation) found poor emotional lability to be more pronounced in relation to H/I symptoms than to inattention symptoms (Sobanski et al., 2010).

This research suggests that emotional regulation difficulties are common in ADHD, and they are worse in children with ADHD-C than in children with ADHD-PI. This would support the notion that deficits in emotional regulation are related to the H/I dimension, which was suggested by Sobanski and colleagues (2010) in their study of emotional lability. Furthermore, the emotional lability seen in ADHD-C may be affecting their Agreeableness and Neuroticism.

Purpose

De Pauw and Mervielde (2011) note two important reasons for evaluating personality traits in ADHD. First, trait approaches may broaden our understanding of diagnostic criteria and

help us better understand the heterogeneous nature of symptom presentation in ADHD. Second, the varying levels of problem behaviors in ADHD may be influenced by trait variation. For example, individuals with ADHD-C are hyperactive/impulsive and are more likely to have comorbid externalizing disorders (Faraone et al., 1998; Humphreys et al., 2012), whereas children with ADHD-PI are lower in H/I and may have more internalizing problems than children with ADHD-C (Piper, 2004; Power et al. 2006). Understanding personality traits associated with subtypes may help us gain insight into the actual symptom presentation of ADHD in children and the comorbidities associated with ADHD. More specifically, inattentive behaviors may be associated with high Neuroticism, which is also associated with anxiety. Hyperactivity/impulsivity is associated with low Agreeableness, which is also associated with conduct problems.

This study addressed two problems with research linking the Big Five to ADHD. First, research linking the Big Five to ADHD often fails to evaluate subtype differences. This study assessed personality differences between individuals with ADHD-PI and ADHD-C, as well as the relationships between symptom domains (inattention, hyperactivity/impulsivity) and the Big Five. Second, research that does address subtype differences has focused on adults with ADHD or adults' retrospective accounts of ADHD symptoms. This study utilized a sample of 8-12 year old children gathered from a larger prospective study, which will inform the generalization of results from adult studies to children.

My first two hypotheses were largely informed by the aforementioned studies evaluating personality correlates of ADHD diagnosis, ADHD subtypes, and ADHD symptom domains, many of which are based on adults. These studies suggested that children with ADHD have lower Agreeableness and Conscientiousness, and higher Neuroticism, compared to controls (De

Pauw & Mervielde, 2011). In addition, research indicates that Conscientiousness and Neuroticism are more related to the inattention domain, whereas Agreeableness is related to the H/I domain (Nigg et al., 2002b). Connections between Neuroticism and H/I are sometimes seen, but are of a lesser degree. (Parker et al., 2004) Hypotheses were not formed related to Extraversion, as the current literature suggests it may be more specifically related to hyperactivity (Parker et al., 2004), and relations with it may not show up when more heterogeneous ADHD samples are studied (Knouse et al., 2013). Furthermore, much of the research on Extraversion and ADHD is mixed in findings when ADHD is studied as a whole or the H/I dimension is not separated into hyperactivity/impulsivity (Knouse et al., 2013). Openness was not expected to be related to ADHD due to inconclusive or null findings in the literature.

The third hypothesis focused on emotional regulation's contribution to the relationship between ADHD and the Big Five. Research suggests that children with ADHD-C may have greater difficulties in emotional regulation, as evidenced by high emotional lability in relation to H/I symptoms (Sobanski et al., 2010) and greater displays of positive and negative emotions by children with ADHD-C than ADHD-PI (Maedgen & Carlson, 2010). As low Agreeableness and high Neuroticism are common in those with hyperactive/impulsive symptoms, and emotional dysregulation also appears to be associated with H/I symptoms, I evaluated whether emotional regulation accounts for the relationship between H/I and Agreeableness and Neuroticism.

Hypotheses

Hypothesis 1

Hypothesis 1a. Based upon the reviewed literature, I expected that children with ADHD would have lower scores on Agreeableness, lower scores on Conscientiousness, and higher scores on Neuroticism compared to children without ADHD.

Hypothesis 1b. When breaking ADHD down into its subtypes, I expected that children with ADHD-C would show the same pattern of lower Agreeableness, lower Conscientiousness, and higher Neuroticism compared to children without ADHD as they suffer from both inattention and hyperactivity/impulsivity. However, it was expected that children with ADHD-PI would have lower Conscientiousness and higher Neuroticism compared to controls but would be comparable to controls in Agreeableness. Last, it was expected that children with ADHD-C would have lower Agreeableness, but similar Conscientiousness and Neuroticism, compared to children with ADHD-PI (see Figure 1 for expected pattern of results).

Hypothesis 2

From a dimensional approach, it was expected that low Conscientiousness and high Neuroticism would predict high BASC-2 inattention scores, but the other personality traits would not be significantly predictive of inattention. Further, Conscientiousness was hypothesized to be a stronger predictor than Neuroticism. It also was expected that low Agreeableness and high Neuroticism would predict high BASC-2 hyperactivity/impulsivity scores.

Hypothesis 3

Emotional Regulation was hypothesized to be predictive of BASC-2 hyperactivity/impulsivity scores. When put in a hierarchical regression equation before Agreeableness and Neuroticism, I expected that Emotional Regulation would continue to be predictive of BASC-2 H/I, whereas Agreeableness and Neuroticism would not.

CHAPTER THREE

METHODS

Participants

Participants for my study included children who were initially recruited a for larger NIH-funded study (R15 HD065627) of neuropsychological functioning in children ages 8-12 years with Attention-Deficit/Hyperactivity Disorder (ADHD), Reading Disability (RD), comorbid ADHD and RD, and typically developing children. Recruitment involved posting flyers throughout the local community, sending information on the study through area schools, advertising in local media outlets, and obtaining referrals from local physicians and psychologists. Families were compensated with a free comprehensive neuropsychological assessment, including a full neuropsychological report containing descriptions of children's strengths and weaknesses, diagnoses, and recommendations. Overall, 96 children from Southern Illinois and nearby communities participated in the larger study.

Children who participated in the larger study were screened twice and excluded if they had a history of medical or neurological disorders (e.g., TBI, tics, immune disorders) or severe environmental problems (e.g., suspected abuse). In addition, children were excluded if they met criteria for psychiatric disorders, such as Major Depressive Disorder, Generalized Anxiety Disorder, Conduct Disorder, or Autism Spectrum Disorder. Children with a best estimate of intelligence below 80 also were excluded from this study. The method for determining the best estimate of intelligence was: 1) the Full-Scale Intelligence Quotient (FSIQ) when there was no significant discrepancies between the factor scores; 2) the General Ability Index (GAI) when the Verbal Comprehension Index (VCI) and the Perceptual Reasoning Index (PRI) were

commensurate but either the Processing Speed Index (PSI) or the Working Memory Index (WMI) was significantly worse than the VCI and/or the PRI; 3) the VCI or the PRI when a significant difference existed between the VCI and PRI. After all the exclusion criteria were applied, 83 children remained in the sample; 16 were removed due to meeting at least one exclusion criterion. Children with reading disabilities or comorbid reading disabilities and ADHD were retained in the sample as reading disabilities/dyslexia are not associated with personality disorders in the majority of studies (Swanson & Hsieh, 2009; Tops, Verguts, Callens, & Brysbaert, 2013), and by including them my N is nearly doubled.

Diagnosis of ADHD was based on criteria outlined in the *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition Text Revision* (DSM-IV-TR; APA, 2000), as this was the current edition at the time of data collection. Diagnostic criteria were obtained through a developmental parent interview, parent- and teacher-report questionnaires, and behavioral observations on the day of testing. Parents and teachers completed the Behavior Assessment System for Children – Second Edition (BASC-2; Reynolds & Kamphus, 2004), as well as a questionnaire containing DSM-IV diagnostic criteria. A diagnosis of ADHD was made based upon significant elevations (of at least one standard deviation) on the BASC-PRS and BASC-TRS Attention Problems and/or Hyperactivity subscales, along with parental endorsement of DSM-IV ADHD symptoms on the DSM-IV questionnaire. Diagnoses of ADHD-PI required only elevated Attention Problems scales from the BASC-2, whereas elevated Attention Problems and Hyperactivity scales on the BASC-2 were required for diagnoses of ADHD-C. Additionally, following DSM-IV diagnostic criteria, parent-report of at least six symptoms of inattention and/or hyperactivity/impulsivity and symptomatology present in at least two settings were required for ADHD diagnosis. The present study includes 35 children meeting criteria for

ADHD-PI and 23 children meeting criteria for ADHD-C. No children in the larger study or my study were diagnosed with ADHD-H/I, which is consistent with literature suggesting that ADHD-H/I is often not seen past preschool (Barkley, 2003). Psychostimulant medication for ADHD was withheld during testing and for 24 hours prior to testing. Twenty-five of the 58 children with ADHD had comorbid reading disabilities/dyslexia: 17 with ADHD-PI and 8 with ADHD-C.

Participants were categorized as controls if they did not meet diagnostic criteria for ADHD, in addition to meeting previously listed exclusionary criteria. If children had a reading disability but not ADHD, they were included in this group, as noted above. Twenty-five children were classified as controls. Twelve of these children had reading disabilities/dyslexia and 13 did not.

Measures

Questionnaires

Behavior Assessment System for Children – Second Edition (BASC-2; Reynolds & Kamphaus, 2004). The BASC-2 is a questionnaire designed to measure the level of internalizing and externalizing problems, as well as adaptive functioning, in a number of settings. For this study, the Parent Report Scale (PRS) and Teacher Report Scale (TRS) were used to assess symptoms of inattention and hyperactivity present at home and school, respectively. For this study, the school-age (ages 6-11) and adolescence (ages 12-21) forms were used. For the few children who were homeschooled, someone who supervised the child outside of the home completed the TRS. Scores were based upon gender-appropriate norms.

To measure attention problems, the Attention Problems subscale, which measures behaviors related to inattention to daily life, was used. The PRS version of this subscale has an alpha reliability coefficient of .87 for children and .88 for adolescents, and the TRS version has reliability coefficients of .95 for children and .94 for adolescents. To measure hyperactivity/impulsivity, the Hyperactivity subscale, which measures behaviors related to hyperactivity and impulsivity in daily life, was used. The PRS version of this subscale has an alpha reliability coefficient of .86 for children and .88 for adolescents, and the TRS version has reliability coefficients of .94 for children and .95 for adolescents. Norms for the child and adolescent forms were created from representative samples of 8- to 11-year-olds and 12- to 14-year-olds, respectively. In addition, separate gender norms for each age group were used.

DSM-IV Questionnaire. The DSM-IV questionnaire is a parent-report questionnaire consisting of diagnostic criteria from the DSM-IV to detect a number of common childhood psychological disorders, including Major Depressive Disorder, Dysthymia, Generalized Anxiety Disorder, Separation Anxiety Disorder, Social Phobia, Obsessive Compulsive Disorder, Oppositional Defiant Disorder, Schizophrenia and ADHD (including ADHD-PI, ADHD-H/I, and ADHD-C). This questionnaire includes questions regarding age of onset, settings in which symptoms are present, and duration and degree of impairment, in order to align with diagnostic criteria from DSM-IV. The psychometrics are not known, but with APA permission, the questionnaire was developed by directly copying diagnostic criteria from the DSM-IV.

Big Five Questionnaire. The Big Five Questionnaire (see Appendix A) is 65-item parent- and child-report measure translated from the Italian Big Five Questionnaire for Children (BFQ-C; Barbaranelli et al., 2003). The Big Five Questionnaire consists of 5 factors – Energy/Extraversion, Agreeableness, Conscientiousness, Emotional Stability (opposite of

Neuroticism), and Intellect/Openness – which map onto the Big Five suggested by Costa & McCrae (1985). Each factor contains 13 Likert-type items rated 1 = Rarely, 2 = Sometimes, and 3 = Almost Always. The overall alpha coefficient for the scale is $\alpha = .91$, and coefficients for Energy/Extraversion (.78), Agreeableness (.88), Conscientiousness (.82), Emotional Stability (.78), and Intellect/Openness (.79) using the larger database from which this project was drawn suggest good internal consistency (Klaver, 2013). Worthy of note is that Klaver (2013) found that alphas were somewhat higher when omitting a few items, and that a factor analysis revealed a better factor structure with four factors (all but Openness) than with all five factors. However, as my sample differs in both exclusionary criteria and sample size, I used the original 65-item version and tested the scale's alphas with my sample. For the child report, Cronbach's alphas for Extraversion (.77), Agreeableness (.87), Conscientiousness (.79), Neuroticism (.77), and Openness (.77) were all acceptable. On the parent-report BFQ-C, Cronbach's alphas for Extraversion (.70), Agreeableness (.83), Conscientiousness (.80), Neuroticism (.87), and Openness (.77) were also acceptable.

Behavior Rating Inventory of Executive Function (BRIEF). The BRIEF is an 86-item parent-report questionnaire that was developed to assess executive functioning in the everyday environment of children. The BRIEF contains items representing a Behavioral Regulation scale and a Metacognition scale. Within the Behavioral Regulation scale are three subscales: Inhibit, Shift, and Emotional Control. For my study, the Emotional Control scale, which represents that ability to appropriately regulate emotional responses in everyday life, will be used as a measure of emotional regulation. The BRIEF has been demonstrated to have good reliability, including

test-retest reliability ($r = .82$) and internal consistency between items (alphas ranging from .80 - .98).

Procedure

Each questionnaire (DSM-IV, Big Five, and BRIEF) was completed by parents prior to bringing their children in for a full day of neuropsychological testing. The BFQ-C was administered verbally to children by graduate students. Parent and child data were used in all analyses as we do not have teacher data for those tested over the summer. Parent and teacher questionnaires were completed prior to the testing session. Throughout the day, children were administered a full assessment battery that contained the WISC-IV along with other cognitive, academic, social-emotional, and behavioral measures including the Big Five. Child and parent report were used separately in each main analysis to determine whether results differ based on reporter. All research procedures were approved by the Institutional Review Board of Southern Illinois University – Carbondale before data collection began, as well as throughout the process of data collection.

CHAPTER FOUR

RESULTS

Preparation for Main Analyses

Skewness and Kurtosis Statistics

I ran descriptive statistics on all continuous variables to check for skewness and kurtosis prior to conducting further analyses. Parent-rated Attention Problems from the BASC-2 was negatively skewed (the skewness statistic was greater than two times the standard error). I used a squared transformation to meet statistical assumptions for the main analyses. Additionally, parent-rated Extraversion, Conscientiousness, and Openness from the BFQ-C were all positively skewed. Log transformation normalized the distribution for Extraversion and Openness, and improved Conscientiousness (although the skewness statistic remained greater than two times the standard error; see Table 1). All other variables met assumptions.

Potential Covariates

I used a one-way ANOVA to determine if there were group differences (ADHD-PI, ADHD-C, controls) in age and reading ability. I then used Chi-square tests to determine if there were group differences in gender and SES (maternal education). Groups did not differ in age, $F(2, 80) = .183, p = .83$, reading ability, $F(2, 80) = .283, p = .75$, maternal education, $F(2, 71) = 1.848, p = .165$, or gender, $X^2(2, N = 83) = 5.74, p = .057$ (see Table 2).

There also were no group differences when comparing the ADHD and control groups in age, $F(1, 81) = .168, p = .683$, reading ability, $F(1, 81) = .001, p = .975$, maternal education, $F(1, 72) = 3.729, p = .057$, or gender, $X^2(1, N = 83) = .361, p = .548$ (see Table 3).

Primary Analyses

ADHD vs. Controls

To test Hypothesis 1a, I used a MANOVA to compare children with and without ADHD on each of the Big Five traits. This was done initially using the parent-report, and then was re-run using the child-report data. First, I used the three transformed parent-rated BFQ-C variables (Extraversion, Conscientiousness, and Openness), along with raw scores for Agreeableness and Emotional Instability as these were not skewed. Findings showed that parents' ratings of children with ADHD differed significantly from those of children without ADHD on the Big Five, Wilks' $\Lambda = .814$, $F(5, 75) = 3.425$, $p = .008$. Specifically, parents of children with ADHD rated their children as having lower Agreeableness, $F(1, 79) = 5.557$, $p = .021$, $\eta^2 = .066$, and lower Conscientiousness, $F(1, 79) = 14.457$, $p < .001$, $\eta^2 = .155$. Group differences approached significance for Openness, $F(1, 79) = 3.407$, $p = .069$, $\eta^2 = .041$, with children with ADHD being rated as being lower than those without it on this trait. Ratings were not different for Extraversion, $F(1, 79) = .197$, $p = .658$, $\eta^2 = .001$, or Emotional Stability, $F(1, 79) = 1.160$, $p = .265$, $.014$ (see Table 5).

MANOVA also was used to determine whether children with ADHD differed from those without ADHD on the child-report Big Five. Despite the overall equation not reaching significance, Wilks' $\Lambda = .901$, $F(5, 77) = 1.696$, $p = .146$, three out of the five personality variables were significantly different between groups. Between-subjects analyses showed that children with ADHD rated themselves as having lower Agreeableness, $F(1, 81) = 6.292$, $p = .014$, $\eta^2 = .072$, lower Conscientiousness, $F(1, 81) = 4.232$, $p = .043$, $\eta^2 = .050$, and lower Openness, $F(1, 81) = 5.403$, $p = .023$, $\eta^2 = .063$, compared to those without ADHD. They did not rate themselves as having different levels of Extraversion $F(1, 81) = 1.344$, $p = .25$, η^2

=.016, or Emotional Stability, $F(1, 81) = .034, p = .854, \eta^2 < .001$, compared with how children without ADHD rated themselves (see Table 6). Hence, despite the overall equation not reaching significance, their results were quite similar to the findings from parent ratings.

ADHD-C vs. ADHD-PI vs. Controls

To test Hypothesis 1b, I broke down the ADHD group into its subtypes and used a MANOVA to compare ADHD-PI, ADHD-C, and controls on the Big Five traits. This was done first using the parent-report, and then was re-run using the child-report data (see Figures 2 and 3). Analysis of the parent-report BFQ-C including the three transformed variables indicated that the three groups do differ on parent-rated personality traits, Wilks' $\Lambda = .680, F(10, 148) = 3.152, p = .001$. Between-subjects tests indicated that the parent ratings of the three groups differed for Conscientiousness, $F(2, 78) = 7.164, p = .001, \eta^2 = .155$, and Openness, $F(2, 78) = 4.079, p = .021, \eta^2 = .095$. Differences approached significance for Agreeableness, $F(2, 78) = 2.987, p = .056, \eta^2 = .071$. Groups did not differ on Extraversion, $F(2, 79) = 1.631, p = .202, \eta^2 = .040$, or Emotional Stability, $F(2, 79) = 2.425, p = .095, \eta^2 = .059$ (see Table 7).

Games-Howell post-hoc analyses revealed that ADHD-PI ($p = .003$) and ADHD-C ($p = .018$) had lower parent-rated Conscientiousness compared to those without ADHD. However, they did not differ from one another. ADHD-PI had lower Openness than ADHD-C ($p = .04$). There were no significant differences between subtypes or controls on Agreeableness ($ps > .10$).

MANOVA also was used to determine whether children with ADHD-C, ADHD-PI, and controls differed from one another on the child-reported Big Five. Although the overall equation was not significant, Wilks' $\Lambda = .819, F(10, 152) = 1.593, p = .113$, the same three variables that emerged as significantly different between ADHD and control groups were either significant or

had p-values under .10 when comparing the three groups. Results indicated that groups differed on Agreeableness, $F(2, 80) = 3.311, p = .042, \eta^2 = .076$, but did not differ on Openness, $F(2, 80) = 2.902, p = .061, \eta^2 = .068$, Conscientiousness, $F(2, 80) = 2.588, p = .081, \eta^2 = .061$, Extraversion, $F(2, 80) = 1.796, p = .173, \eta^2 = .043$, or Emotional Stability, $F(2, 80) = .023, p = .977, \eta^2 = .001$ (see Table 8).

The same three variables that continued to be either significant or less than $p = .10$ showed post-hoc differences. Those with $p < .10$ were inspected due to low power for the main analysis. Games-Howell post-hoc analyses revealed that ADHD-PI had lower self-rated Agreeableness than controls ($p = .031$), whereas ADHD-C did not differ from controls on Agreeableness ($p = .155$). ADHD-C had lower Conscientiousness compared to controls ($p = .050$), but no other group differences emerged on Conscientiousness. Last, ADHD-PI had lower Openness compared to controls ($p = .039$), but no other group differences emerged on Openness.

Dimensional Approach

To Test Hypothesis 2, which takes a dimensional approach, I used multiple regressions with the Big Five traits entered as the independent variables and inattention or hyperactivity/impulsivity entered as the dependent variables. This was conducted for both parent and child report. The first section focuses on hyperactivity/impulsivity.

Parent-report BFQ-C and H/I. Parent-report of the Big Five, including the three transformed variables, was a significant predictor of hyperactivity/impulsivity, adjusted $R^2 = .260, F(5, 75) = 6.614, p < .001$. Specifically, Conscientiousness negatively predicted H/I, $t(75) = -2.517, p = .014$, Extraversion positively predicted H/I, $t(75) = 2.918, p = .005$, and Emotional Instability positively predicted H/I, $t(75) = 2.799, p = .007$. Neither Agreeableness, $t(75) = -$

1.697, $p = .094$, nor Openness, $t(75) = .547$, $p = .586$ were significant predictors of H/I (see Table 9).

Parent-report BFQ-C and Inattention. Parent report of the Big Five (using the three transformed variables) also significantly predicted the transformed inattention variable (adjusted $R^2 = .228$, $F(5, 75) = 5.718$, $p < .001$). Specifically, Conscientiousness negatively predicted inattention ($t(75) = -3.739$, $p < .001$), but none of the other personality traits were significant predictors of inattention (see Table 10).

Child-Report BFQ-C. I also examined the contributions of child-reported Big Five to the two symptom domains of ADHD as rated by their parents. The overall equation approached significance when predicting H/I, adjusted $R^2 = .068$, $F(5, 77) = 2.195$, $p = .063$. None of the individual coefficients for the Big Five traits were significant (See Table 11). Child-reported Big Five did not predict inattention for the transformed variable, adjusted $R^2 = -.022$, $F(5, 77) = .639$, $p = .670$ (see Table 12).

I ran three additional tests using the Backward method as exploratory analyses. This was done as my power is low, and I wanted to determine if fewer independent variables, as determined by SPSS, may better predict H/I and inattention. The Backward approach allows independent variables to interrelate in the equation before determining which is non-significant. Using this method, the equation predicting hyperactivity/impulsivity was significant, adjusted $R^2 = .069$, $F(1, 81) = 7.101$, $p = .009$, but the one predicting the transformed attention variable, adjusted $R^2 = .019$, $F(1, 81) = 2.616$, $p = .110$, was not. Child-rated Conscientiousness was predictive of H/I, $t(81) = -2.665$, Beta = $-.284$, $p = .009$.

Emotional Regulation. To test Hypothesis 3, hierarchical regression was used to determine whether the relationships between H/I symptoms and both Agreeableness and Emotional Instability are accounted for by deficits in emotional regulation as measured by the BRIEF. Thus, Emotional Control was entered into the first step, and Agreeableness and Emotional Instability were entered into the second step to predict the H/I dimension. The first step predicted H/I, adjusted $R^2 = .175$, $F(1, 77) = 17.595$, $p < .001$. Emotional Control was a significant predictor, $t(77) = 4.195$, $p < .001$. The second step also predicted H/I, adjusted $R^2 = .206$, $F(3, 75) = 7.737$, $p < .001$. Emotional Control remained a significant predictor, $t(75) = 2.291$, $p = .025$. However, neither Agreeableness, $t(75) = -1.411$, $p = .162$, nor Emotional Instability, $t(75) = 1.088$, $p = .280$, were significant after controlling Emotional Control. Thus, Agreeableness and Emotional Instability lessened in their ability to predict H/I when emotional regulation was controlled, going from a trend (Agreeableness) or significant (Emotional Instability) to non-significant (see Table 13).

To verify that this relationship exists if the order of the steps is reversed, I entered Emotional Instability and Agreeableness into the first step of the regression and added BRIEF Emotional Control in the second step to predict H/I. The first step significantly predicted H/I, adjusted $R^2 = .161$, $F(2, 76) = 8.506$, $p < .001$. Emotional Instability, $t(76) = 2.686$, $p = .009$, was a significant predictor of H/I, but Agreeableness, $t(76) = -1.504$, $p = .137$, was not. The second step also significantly predicted H/I, adjusted $R^2 = .206$, $F(3, 75) = 7.737$, $p < .001$. Emotional Instability was no longer a significant predictor of H/I, $t(75) = 1.088$, $p = .280$, and neither was Agreeableness, $t(75) = -1.411$, $p = .162$, whereas Emotional Control was a significant predictor of H/I, $t(75) = 2.291$, $p = .025$ (see Table 14).

Exploratory Analysis. In order to better understand relationships between the Big Five and the hyperactivity/impulsivity dimension of ADHD, I separated the BASC-2 H/I scale into two subscales reflecting hyperactivity or impulsivity (see Appendix C). I then calculated mean scores on hyperactivity and impulsivity separately for each participant, since the child version of the BASC-2 has a different number of items representing H/I compared to the adolescent version. Cronbach's alpha indicated that both the child (.84) and adolescent (.71) hyperactivity scales had acceptable internal reliability. Both the child (.71) and adolescent (.73) impulsivity scale also had acceptable internal reliability (see Table 15). Hyperactivity and Impulsivity were entered into a multiple regression as dependent variables, with parent-reported Big Five scores as independent variables. Results showed that the Big Five (including transformed variables) significantly predicted both hyperactivity, adjusted $R^2 = .336$, $F(5, 72) = 8.790$, $p < .001$, and impulsivity, adjusted $R^2 = .129$, $F(5, 73) = 3.311$, $p < .05$. Specifically, Conscientiousness and Emotional Instability predicted both hyperactivity and impulsivity. In addition, Extraversion was significantly predictive of hyperactivity only, and Agreeableness approached significance ($p = .062$) as a predictor of hyperactivity but not impulsivity. Last, Openness was not predictive of either hyperactivity or impulsivity (see Tables 16 and 17).

I re-ran this same analysis, but used the child-report BFQ-C data. Results showed that the child-report BFQ-C did not significantly predict hyperactivity (adjusted $R^2 = .059$, $F(5, 74) = 1.995$, $p = .089$). However, child-report BFQ-C scores were significant predictors of impulsivity (adjusted $R^2 = .078$, $F(5, 75) = 2.348$, $p = .049$). None of the individual BFQ-C score coefficients were significant for either hyperactivity or impulsivity (see Tables 18 and 19)

When evaluating the above relationships, I noticed that results differed between parent- and child-report Big Five for some of the analyses, especially the regression analyses. Thus, I

examined the correlations between the parent- and child-report BFQ-C. Correlations were low for Extraversion ($r = .12, p = .288$), Agreeableness ($r = .19, p = .080$), Conscientiousness ($r = .02, p = .870$), and Emotional Instability ($r = .13, p = .241$). The only statistically significant correlation between parent- and child-report was for Openness ($r = .30, p < .01$) (see Table 20).

CHAPTER FIVE

DISCUSSION

Overview

The current study investigated relationships between ADHD, specific ADHD symptoms, and Big Five personality traits. The review of literature outlined deficits commonly seen in children with ADHD, including deficits in several areas of executive functioning (Geurts et al., 2005; Sergeant et al., 2002; Wilcutt et al., 2005), as well as associated features such as comorbid internalizing (Biederman et al., 1991) and externalizing (Mash & Barkley, 2003) problems. Additionally, I highlighted the heterogeneity of ADHD, even when diagnostically defining subtypes. I proposed that using a personality model to describe children with ADHD would aid in the understanding of this heterogeneity and add to the existing literature regarding the use of trait approaches in understanding psychopathology. Subsequently I will discuss each trait of the Big Five Model and how it relates to ADHD in my sample.

Main Findings

Agreeableness

Based upon the literature reviewed, I hypothesized that children with ADHD would have significantly lower Agreeableness than controls. This hypothesis was supported. Both parent- and child-report personality data suggest that children with ADHD do indeed have lower Agreeableness compared to controls. This is consistent with existing literature in children (De Pauw & Mervielde, 2011) and adults (Knouse et al., 2013; Nigg et al., 2002b; Parker et al., 2004).

I also hypothesized that children with ADHD-C would have lower Agreeableness than both ADHD-PI and controls. Subtype differences on Agreeableness have not been widely reported in the literature, although a few studies have linked Agreeableness with the H/I dimension in adults (Parker et al., 2004), conduct problems in children (Nigg et al., 2002b), and impulsivity specifically in adults (Knouse et al., 2013). Hence, I expected it to be associated with ADHD-C. In my study, according to children's own report, those with ADHD-PI actually have lower Agreeableness than controls, whereas those with ADHD-C do not differ from any group. Interestingly, the parent-report showed the expected pattern of lowest Agreeableness in ADHD-C, followed by ADHD-PI and then controls, although differences were not significant. As the parent subtype comparison approached significance, it may be that a decrease in power due to the addition of an extra group resulted in a lack of significance at the subtype level. The parents' pattern of results may be due to the fact that children with ADHD-C often have externalizing comorbidity, compared to less externalizing problems in children with ADHD-PI (Faraone et al., 1998; Humphreys, Aguirre, & Lee, 2012), leading parents to rate them lower. The children's pattern of results may suggest that children with ADHD-C have reduced insight into their own level of Agreeableness, and that parents may be better reporters of this facet of personality. This conclusion is supported by the notion that children with ADHD often have worse insight into areas in which they are weaker (Mash & Barkley, 2003). Moreover, the literature on symptom domains suggests that Agreeableness is related to H/I (Parker et al., 2004), which would support lower Agreeableness in ADHD-C, compared to ADHD-PI and controls, and parents being the better raters here. Furthermore, agreeableness approached significance in predicting Hyperactivity/Impulsivity, and Hyperactivity in particular, in my sample despite low power as noted subsequently.

Agreeableness was related to the Hyperactivity scale at the .10 level in my exploratory regression analyses based upon parent report, even though it was not related to the Impulsivity dimension ($p = .99$). For child report Agreeableness approached significance with both hyperactivity and impulsivity. The only other study to have utilized this method of separating Hyperactivity and Impulsivity found the opposite pattern of results, with Agreeableness being related to self-reported impulsivity but not hyperactivity (Knouse et al., 2013). As my study utilized parent-report to measure these individual traits, it may be that rater differences contribute to these two relationships and/or differences in age of the sample as my study used children and Knouse and colleagues used adults with ADHD. Given that hyperactivity/impulsivity is associated with conduct problems (Mash & Barkley, 2003), it is not surprising that both of these aspects, hyperactivity in my study and impulsivity in the Knouse study, are associated with lower agreeableness. Further research is needed to determine if lower agreeableness is more associated with hyperactivity or impulsivity or both when using parent and child report.

The primary findings for Agreeableness are that children with ADHD display lower Agreeableness compared to controls, whereas subtype differences should be interpreted with caution but are worthy of further research. One explanation for the relationship between ADHD and Agreeableness is that Agreeableness on the BFQ-C is a social trait. Items such as number 13. “My child understands when others need his/her help”, 38. “My child is polite when he/she talks to others”, 45. “If a classmate has some difficulty, my child can help him/her” describe both the ability to recognize the feelings of others and respond to those feelings in a socially adaptive way. It is likely that children with both ADHD-PI and ADHD-C have difficulty noticing these feelings in others due to the simple fact that they are not paying attention well enough to notice. If attention to others is related to this trait, it would make sense that ADHD as a whole is

affected, as inattention is central to both subtypes. However, I did not find Agreeableness to be predictive of inattention specifically; thus, it may be that a combination of social and other factors leads to this link. For instance, a deficit in insight in children with ADHD (Loe & Friedman, 2007) might affect social awareness and, thus, be reflected in low scores on Agreeableness.

Multiple areas of EF (shift, working memory, and planning) are affected in ADHD and may affect the social traits making up Agreeableness. Research suggests that in ADHD, executive deficits impact both inattentive and H/I symptoms which in turn lead to social problems (Kofler, Rapport, Bolden, Sarver, & Raiker, 2011). Working memory (WM), for instance, influences social functioning: children with ADHD have difficulty with tasks such as maintaining focus of attention while holding information in WM (having a conversation). The influence of executive functioning on social functioning, and Agreeableness specifically, is an area worthy of further research.

Conscientiousness

Consistent with my hypotheses, children with ADHD had significantly lower Conscientiousness compared to controls, according to both child- and parent-report. Additionally, parents of both children with ADHD-C and ADHD-PI rated their children as having lower Conscientiousness than controls, which is in line with my hypotheses. However, only children with ADHD-C, and not children with ADHD-PI, rated themselves as having lower Conscientiousness than controls.

Conscientiousness also was predictive of both symptom domains according to parents, which is consistent with my MANOVA findings and with the literature (De Pauw & Mervielde,

2011; Knouse et al., 2013; Nigg et al., 2002b; Parker et al., 2004). However, children's report of Conscientiousness was not predictive of either symptom domain (nor was child report predictive of any other Big Five trait). Since the literature has not used children's own report of Conscientiousness when evaluating ADHD, my study suggests an area of further research. However, Muris and colleagues (2009) found that children ages 9-12 (with anxiety and controls) and parents had significant correlations from the BFQ-C on all of the Big Five traits, including Conscientiousness ($r = .43, p < .001$). In my study, however, parent-child correlations were lowest for conscientiousness and very non-significant ($r = .018, p = .870$). Again, issues related to insight (mentioned above) suggest that children with ADHD may not be the best reporters of Conscientiousness. Since in my study parent-report of Big Five is associated with observed behavior (ADHD diagnosis), it is likely that parents' report is a better estimate of trait variation.

In my study, Conscientiousness was the most robustly related trait to ADHD, showing differences between groups, as well as relationships between both symptom domains (Inattention and H/I) and both hyperactivity and impulsivity when evaluated separately based upon parent report. This pattern of results is consistent with low Conscientiousness not being unique to inattention, and rather being a general area of weakness among all children with ADHD, regardless of subtype. Hence, Conscientiousness is an over-arching affected area in ADHD, which may be related to shared underlying neuropsychological features. For instance, overlapping connections between EF and Conscientiousness (MacDonald, 2008) and EF and ADHD (Geurts et al., 2005; Wilcutt et al., 2005) might suggest that low Conscientiousness in children with ADHD reflects an EF deficit, which we know is a common one in many with individuals with ADHD.

Specifically, research suggests that cognitive executive deficits are related to the inattention domain, as most research finds similar functioning between ADHD-PI and ADHD-C on cognitive EF tasks (Lopez-Vergara & Colder, 2013; Nigg et al., 2002a). On the other hand, behavioral inhibition problems are more pronounced in individuals with ADHD-C and are related to Hyperactivity/Impulsivity (Barkley, 1997, Nigg et al., 2002a). Thus, further research might reveal specific relationships between Conscientiousness and cognitive executive functions such as shifting, WM, and planning, rather than with poor behavioral inhibition. However, Conscientiousness was also related to the H/I dimension in my study, which helps to inform us regarding the debate over subtypes being true subtypes or separate disorders. The fact that Conscientiousness is a commonality between subtypes and dimensions and is lower in children with ADHD is in line with research indicating that there are some shared cognitive features lending to a subtype approach (Lopez-Vergara & Colder, 2013; Nigg et al., 2002a) rather than subtypes actually being separate disorders (Barkley, 1997). Specifically, the relationship between Conscientiousness and EF (MacDonald, 2008) supports the notion that deficits in cognitive EF (which is possibly being captured by the Conscientiousness trait) are central to both ADHD-C and ADHD-PI.

Emotional Instability

My hypothesis regarding Emotional Instability (EI) was not supported as I did not find EI to differ between children with ADHD and controls, or between subtypes; however, there was a trend toward significance when comparing ADHD-C to ADHD-PI and controls, with children with ADHD-C having the highest level of EI according to parents. Furthermore, parent-rated Emotional Instability was predictive of the hyperactivity/impulsivity dimension, but not inattention scores, which partially supports my hypothesis and partially is in line with literature

suggesting relationships between Neuroticism and both inattention and H/I (Parker et al., 2004). The relationship between Emotional Instability and the H/I domain is consistent with the results from my exploratory analysis, which showed that Emotional Instability is related to both hyperactivity and impulsivity when parents were the raters. Hence, EI may be related to the Hyperactivity/Impulsivity dimension, which is affected more in ADHD-C than in ADHD-PI. The specific nature of this relationship to H/I but not inattention may be why the comparison between ADHD and controls and subtypes and controls was not significant, as ADHD-C has deficits in both inattention and hyperactivity/impulsivity. Furthermore, some with ADHD-PI have subclinical hyperactivity/impulsivity problems.

Knouse et al. (2013) found inattention to predict Neuroticism, whereas neither hyperactivity nor impulsivity did. However, the mean age of their sample was 42 years, suggesting that in adulthood, but not in childhood, Neuroticism might be more related to inattention. Nigg and colleagues (2002b) also found Neuroticism to be related to inattention in adults, as well as inconsistently related to H/I. Based upon my study, it could be that negative emotions in childhood are displayed more by externalizing behavior (which would line up more with H/I and ADHD-C) than they are in adulthood, possibly due to developmental differences in behavioral regulation.

It also may be that the BFQ-C Emotional Instability factor is different from traditional Neuroticism. In fact, many items representing Emotional Instability seem to reflect a trait more related to externalizing problems on this measure (8. “My child enjoys arguing with others”, 15. “My child easily gets angry”, 39. “If my child wants to do something, he/she is not capable of waiting and has to do it immediately”, 49. “My child easily loses his/her calm”). In fact, these seem to line up more with the temperament trait of negative emotionality than with the

personality trait of neuroticism. As comorbid externalizing behaviors are common in ADHD-C, it may be that Emotional Instability would be affected in a sample with comorbid conduct problems.

Nigg and colleagues (2004) noted that negative approach and negative withdrawal traits were most affected in children with comorbid oppositional problems or aggression. Although these comorbid problems occur frequently in children with ADHD, my sample had relatively low levels of non-aggressive conduct problems (number with elevated scores beyond 60: 6 with ADHD-C, 2 with PI, 0 controls) and aggression (7 with ADHD-C, 4 with PI, 1 control). It is likely that a stronger connection between ADHD-C and Emotional Instability might emerge in a sample with more behavioral problems, including higher levels of comorbid oppositional defiant disorder (ODD) and conduct disorder (CD).

Some of the items on the BFQ-C Emotional Instability scale also suggest that this measure may relate not only to comorbid externalizing problems, but also to comorbid internalizing problems. For instance, items 31. “My child is sad” and 58. “My child sobs” relate to depressive symptoms, whereas items 4. “My child gets nervous about minor things”, 54. “My child is tense when he/she does things”, and 61. “My child worries about minor things” relate to anxious symptoms. My sample did not have substantial depression (number with elevated scores beyond 60: 10 with ADHD-C, 6 with PI, 2 controls) or anxiety (6 with ADHD-C, 2 with PI, 3 controls). It is likely that with an ADHD sample with more comorbidity with depression and anxiety, as well as with the aforementioned externalizing problems, EI would be more highly elevated.

When analyzing Emotional Regulation in my exploratory analysis, therefore, it is not surprising that Emotional Regulation was a better predictor of H/I than Emotional Instability

(since the emotional instability factor may be more related to negative emotionality). This raises the question of whether some of the behaviors that we describe using personality might be better explained by neuropsychological constructs. I would argue that in this case, BRIEF Emotional Regulation encompasses a broader spectrum of behaviors including BFQ-C Emotional Instability. This is not evidence for Emotional Regulation being the same construct as Emotional Instability, but rather suggests that Emotional Instability, which may reflect emotional reactivity and regulation, is an important component of Emotional Regulation, which involves additional processes related to executive functioning, including inhibition, behavioral regulation, and broader emotional regulation/control (Barkley, 1997). As both Emotional Instability and Emotional Regulation may be more closely linked with the H/I domain than with inattention, it is not surprising that Emotional Instability was no longer significant when entered into an equation with Emotional Regulation. Given Emotional Instability was predictive of H/I despite subtypes not being different on it, other traits besides Emotional Instability (e.g., inhibition, emotional regulation/control, behavioral regulation) may be important in differentiating between groups.

Although research suggests a clear link between Emotional Instability and ADHD in adults and children (De Pauw & Mervielde, 2011; Knouse et al., 2013; Parker et al., 2004), my study suggests that Emotional Instability may be related to H/I but not strongly enough for it to differ between subtypes. Again, this may be due to differences between the BFQ-C Emotional Instability measure and true neuroticism in adults. It is difficult to distinguish if my findings reflect low power, low Emotional Instability as a whole in my sample due to low prevalence of comorbidities (EI had the lowest mean scores out of all of the personality traits), or developmental differences. The BFQ-C has been used to examine a clinical sample only once, and found children with anxiety to have higher parent-reported EI, as expected (Muris et al.,

2009). This suggests that the BFQ-C EI factor can differentiate between some clinical symptoms in childhood, although it may not be powerful with my ADHD sample and smaller sample size (Muris et al. (2009) had 377 participants). However, research has only examined anxiety symptoms as they relate to child personality traits, and we would expect that anxiety is related to EI. Again, the low prevalence of internalizing and externalizing problems in my sample may have contributed to the lack of group differences, and these comorbidities should be considered when interpreting results and future research on ADHD. Another possibility is that the association between Agreeableness and ADHD is not found consistently until later adolescence, as Miller et al. (2007) noted that only childhood-persistent ADHD (persisting into late adolescence) predicts later Agreeableness and Neuroticism, whereas childhood ADHD that does not persist into adolescence does not correspond with lower Agreeableness or higher Neuroticism. Hence, a childhood sample may be too heterogeneous to find a relationship between Agreeableness, Neuroticism, and ADHD consistently at a significant level.

Extraversion

Extraversion was not significantly different between groups, whether looking at ADHD as a whole or subtypes. Despite this lack of group differences, Extraversion emerged as a significant predictor of H/I in this study. This is consistent with literature suggesting a specific link between Extraversion and H/I (Knouse et al., 2013; Parker et al., 2004). Furthermore, results from my exploratory analysis suggest that this link is likely due to the relationship between Extraversion and hyperactivity, as this relationship was significant, whereas that between Extraversion and impulsivity was not. This is concordant with the results of Knouse and colleagues' (2013) study, which showed the same pattern of relationships between

Extraversion, hyperactivity and impulsivity, underscoring the relationship extroversion and ADHD may be specific to hyperactivity.

The relationship between Extraversion and H/I, and hyperactivity in particular, likely reflects the fact that Extraversion includes both “approach” and “sociability” traits (as noted by Nigg et al., 2004). The multifaceted nature of Extraversion is highlighted by construct differences in individual items from the Extraversion scale. For instance, items such as 35. “My child does something so he/she doesn’t get bored” and 63. “My child is happy and energetic” describe traits specifically related to positive approach. On the other hand, items such as 1. “My child likes to meet with other people” and 57. “My child easily makes friends” describe a willingness to interact with others socially. Moreover, some items also include components directly related to hyperactivity – Items 14. “My child likes to move and to do a great deal of activity.” and 35. “My child does something so he/she doesn’t get bored” both describe a need for a high level of activity. It makes sense that this combination of approach traits, along with some items that are reflective of hyperactivity, were related to H/I and to hyperactivity specifically. However, the fact that these items do not describe main deficits of ADHD related to inattention (like Conscientiousness, Agreeableness, Openness) and impulsivity is likely part of why group differences did not emerge between subtypes on Extroversion. In sum, the specificity of the relationship between Extraversion and hyperactivity suggests that once impulsivity and inattention are included as symptoms, the overall relationship between Extroversion and ADHD is lost, which likely is the reason why group comparisons were not significant, especially in light of my small sample size.

Some researchers have suggested that a subset of children with ADHD-C have elevated Extraversion, whereas another subset presents with more impulsivity and low Conscientiousness

(Martel et al., 2010). This theory would suggest that more children in my ADHD-C group fall into the high-impulsivity subset rather than the high-Extraversion subset, since Conscientiousness seems to have been more of a deficit in the ADHD-C group than Extraversion in my sample. These differences help to highlight the heterogeneity of ADHD subtypes, as even within subtypes we might see different behavioral patterns (i.e., social and Extraverted versus impulsive with low Conscientiousness).

Openness

My dimensional approach showed that, as expected, Openness was not predictive of either hyperactivity or inattention. However, I found parent- and child-ratings of Openness were lower for children with ADHD compared to controls. Since this was true of both parent and self-report, it suggests the group differences are not spurious. Hence, my results are consistent with research showing lower Openness in children with ADHD compared to controls (De Pauw & Mervielde, 2011), but not with the adult literature which does not typically reveal differences on Openness (Parker et al., 2004; Nigg et al., 2002). In fact, some even find higher Openness in adults with ADHD compared to controls (Knouse et al., 2013).

Differences in Openness might reflect differences related to IQ, as the definition of Openness in childhood often reflects more intellectual and creative abilities (Caspi et al., 2005). For instance, De Pauw and Mervielde (2011) found lower Imagination (analogous to Openness on their measure) in children with ADHD compared to controls. Specifically, out of the three facets of Imagination in children (Intellect, Creativity, and Curiosity), they found that Intellect was particularly affected in children with ADHD. Although research on Openness in general is inconsistent, it appears to be a trait that, in childhood, has some direct connections with ADHD.

In my study, which includes a clinical ADHD sample, some important underlying areas of Openness in childhood, such as the tendency to seek stimulation, IQ, and stimulatory sensitivity (Raine et al., 2002; Rothbart et al., 2000) may have been captured by the trait. Thus, the inconsistency of existing literature on Openness in childhood may be due to the lack of clinical samples and/or differences in what Openness measures. It seems as though in childhood, Openness might be better described in terms of imagination (intellect, creativity, and curiosity) (De Pauw & Mervielde, 2011), areas in which we might expect children with ADHD to have lower scores, especially intelligence (Mash & Barkley, 2003). If this finding is due to reduced intellect in the ADHD group, it may explain why Openness was not related to the inattention or hyperactivity/impulsivity domain specifically.

It is clear that the more traditional Openness-to-Experience is different than Openness on the BFQ-C, which describes imagination/intellect. For instance, items 12. “My child easily learns what he/she studies at school”, 18. “When the teacher asks my child a question, he/she is able to answer it correctly”, 46. “My child is able to solve mathematics problems”, and 62. “My child understands immediately” describe traits related to academic achievement. The IQ and academic impairment found in ADHD would greatly affect Openness when described in this way, making the interpretation of this factor more difficult. In addition to these intellect/academic-based items, some items from the Openness scale describe creativity (e.g. item 10. “My child has a lot of fantasies”) and curiosity (e.g. item 52. “My child likes to know and learn new things”). Thus, a child with a low score might be less creative or curious (more similar to traditional “Openness-to-Experience”), or might be less bright/academically inclined. Of note is the fact that these items reflecting intellect, curiosity, and creativity are consistent with items on other childhood measures of personality (HiPIC; De Pauw & Mervielde, 2011).

When defining Openness in its traditional sense (Openness-to-Experience), we might actually expect Openness to be higher in children with ADHD-C due to inhibitory deficits (Geurts et al., 2005; Sergeant et al., 2002), which might encourage individuals to be more adventurous and open to new experiences. In fact, this very different pattern has been found in adults, with individuals with ADHD having higher Openness scores than those without ADHD (Knouse et al., 2013). This highlights the developmental considerations that must be made in terms of defining and studying personality.

Despite a lack of support for a clear Openness factor in children in many previous studies (e.g., De Pauw & Mervielde, 2011), I found subtype differences in Openness based on both child- and parent-report. Both child- and parent-reports indicate that the children with ADHD-PI had the lowest scores on the Openness scale compared to ADHD-C and controls (although ADHD-PI and ADHD-C did not differ according to children). Areas possibly affecting this relationship include internalizing and academic achievement. For instance, some research finds higher rates of anxiety in children with ADHD-PI compared to ADHD-C (Power et al., 2004), which could be reflected in lower Openness (less willing to approach novel experiences). Additionally, some researchers have found evidence suggesting that children with ADHD-PI actually have worse academic achievement compared to children with ADHD-C (Marshall et al., 1997). Thus, it could be that Openness is partially related to both symptom domains – and therefore lower in children with ADHD – but not strongly enough with either domain to yield a significant prediction.

Last, I noted that this pattern of relationships is similar to what I found for Agreeableness, suggesting that the two traits might be related in my sample, which is consistent with the literature regarding overlapping Big Five domains, which often finds Agreeableness and

Openness to be correlated with each other (Caspi et al., 2005; Clark & Watson, 1999). Although items in the Agreeableness scale are more social in nature than items from the Openness scale, both scales describe adaptive abilities that have overlapping qualities. For instance, the Agreeableness item 45. “If a classmate has some difficulty, my child can help him/her” would relate to the intellectual abilities described by the Openness factor as well as social factors. In fact, in my sample, Openness was correlated significantly with Extraversion, Agreeableness, and Conscientiousness according to both parents and children (r ’s range from .35 to .66). It is possible that Openness is a more encompassing scale than some of the others, and this heterogeneity may be contributing to why Openness was significant at the group level but not predictive of inattention or H/I specifically.

One interesting finding of my study is that parents’ and children’s reports of child personality variables were not consistent with one another across most traits. This is not surprising given literature on parent and child consensus on other measures. Whereas parents and teachers may not be accurate reporters of a child’s thoughts, children may have difficulty reporting their own behavior, especially externalizing or disruptive behavior. For instance, one study found that in children ages 6-18 years, parent-child agreement regarding behavior was low-to-moderate, with higher agreement for conduct-related problems, and lower agreement for anxiety and other internalizing symptoms (Edelbrock, Costello, Dulcan, Conover, & Kala, 1986). The only significant correlation between parent and child ratings of personality in my study was on Openness, which could be related to the content of the Openness factor. Many of the Openness items reflect academic achievement, an area in which feedback is frequent (e.g. report cards, grades), thus allowing children to more accurately rate themselves. However, Muris and colleagues (2009) found that all five factors had significant parent-child correlations on the BFQ-

C in 9-12 year olds. One possible explanation for this discrepancy is the fact that my sample included a clinical group with executive problems, whereas most studies including that by Muris and colleagues (2009) have been conducted in non-clinical samples. Specifically, since children with ADHD typically have lower insight than typically-developing children, low parent-child correlations may reflect a weakness in self-rating/insight.

Theoretical Implications

The main purpose of this study was to evaluate temperament/personality characteristics of children with and without ADHD, as well as its subtypes. The most consistent findings across raters include relationships between ADHD and lower Agreeableness, Conscientiousness, and Openness at the group level. Children with ADHD appear to have lower Conscientiousness, Agreeableness, and Openness compared to controls. In addition, my subtype analyses showed that whereas subtype differences in Openness and Agreeableness are inconsistent and differ based upon rater, low Conscientiousness is shared by both subtypes, as would be expected given the executive functioning deficits common to both subtypes.

As ADHD is a heterogeneous clinical disorder, classifying children in multiple ways helps to understand differences due to subtype, symptom domains, and individual differences. It is important to note that data of this nature suggest links between ADHD symptoms and personality, but do not imply cause or equivalence. These complex links could be explained conceptually through three pathways (as described in Carey & DiLalla, 1994). For instance, we could think of a particular personality trait, say Neuroticism, as causing a disorder like anxiety or depression. However, we could also view disorders like anxiety and depression as causing elevated Neuroticism. Last, we might look for a common factor, possibly genetic, that would cause anxiety, depression, and Neuroticism.

Consistent with this third notion, one theory states that personality and psychopathology are reciprocal processes and that temperament is a precursor to both. Clark (2005) wrote that “personality and psychopathology are linked primarily through their shared genetic diatheses of broad temperament dimensions” (p. 511). In this sense, the interaction between temperament and the environment might underlie psychopathology, including ADHD. For instance, a child with negative and disinhibited temperament, according to Clark, might develop both a particular personality profile (including low Agreeableness and Conscientiousness) and psychopathology (such as ADHD).

Nigg and colleagues (2002) note that “personality traits seem to reflect an important element of the ADHD syndrome, whereas ADHD itself includes “surplus” symptoms and problems not fully captured by the personality measures” (p. 463). ADHD is not a personality disorder, but is rather a neurodevelopmental disorder with personality correlates. It is likely that personality differences in ADHD are reflective of genetic, neuropsychological, and psychosocial differences.

The nature of personality research is an attempt to better understand people by describing trait differences. We look for commonalities, as well as group and individual differences. However, just because a particular group exhibits a particular personality profile, we cannot infer that this personality profile fully describes the psychopathology. For instance, it may be that a particular personality profile or high trait level is more indicative of psychopathology in general, rather than of a specific disorder like ADHD. Nigg and colleagues (2004) noted that high Neuroticism is associated with a number of psychological disorders. Comorbidity is, thus, of interest in personality and psychopathology research. For instance, research findings of high Neuroticism in ADHD could be confounded by common comorbid internalizing and

externalizing disorders. In my sample, the relationship between Emotional Instability and ADHD was somewhat unclear, which may be due to developmental differences or power, but it also may reflect relatively low levels of comorbidity.

I would argue that since ADHD is a neurodevelopmental disorder, we would be more likely to see differences in traits that are more conceptually linked with neuropsychological deficits (EF, for instance, being associated with Conscientiousness). Furthermore, we might find differences in other traits due to comorbidities, such as anxiety, depression and conduct problems, which would likely cause a child with ADHD to exhibit higher levels of Emotional Instability as defined by the BFQ-C. Comorbidities are not discussed often in the existing personality literature on ADHD; thus, further research in this area would help us to understand the complex relationships between psychopathology and personality.

Personality traits allow us to evaluate the heterogeneity of ADHD, but what does this trait variation really mean? Although some subtype differences were noted, it does not appear that the Big Five as measured by the BFQ-C is sufficient to differentiate subtypes reliably in this sample. Whereas I was able to discern relationships between the H/I dimension and Extraversion, Conscientiousness, and Emotional Instability, these traits did not reliably differentiate between children with ADHD-PI and ADHD-C. This lack of subtype differences highlights some of the shared features between subtypes that are overarching in ADHD which may be masking subtype differences in personality. These shared features may include factors not being measured directly by the BFQ-C that are similar between subtypes (e.g., EF dysfunction). There also may be factors that help differentiate between subtypes that do not map onto personality as defined by the Big Five (specific behavioral problems, comorbidities, and problem severity). Additionally, as the personality profiles of children with ADHD differ from

one study to another, it is clear that not all ADHD is created equal. For instance, one child with ADHD might not have low Emotional Instability but poor Conscientiousness, whereas another child with ADHD could be emotionally unstable with high negative emotionality. Future research should investigate individual differences in the relationship between ADHD and personality traits.

My results are somewhat surprising in that they are not in line with the idea that ADHD-C has all of the shared features as ADHD-PI plus a behavioral regulation deficit, which was suggested by Nigg and colleagues (2002a). In fact, it appears that in my sample, children with ADHD-PI actually may have a number of areas impacted *more than* those with ADHD-C. Specifically, it appears that children with ADHD-PI may have the lowest Openness, as well as the lowest parent-reported Conscientiousness. It may be that other problems in children with ADHD-C (externalizing, for instance) are “washing out” parents’ perceptions of personality. In this sense, parents of children with ADHD-C (higher externalizing) might not take note of problems in Openness since they are more concerned with behavior. Likewise, children with ADHD-PI might not have behavioral problems to the same degree; thus, their parents notice differences in more subtle areas related to Openness. As noted above, there are individual differences that may ‘wash out’ subtype findings as well.

Comparing my results with those from the adult literature provides insight into the developmental considerations that should be made when examining the Big Five. First, it appears that my findings related to Conscientiousness and Agreeableness are generally consistent with the adult literature. However, differences in findings and measures related to Openness, Extroversion and Emotional Instability suggest that these traits may be defined differently in childhood than they are in adulthood, and that they are still developing such that they may not

yet be associated with ADHD consistently (they may be more characteristic of adolescent and/or adult ADHD than childhood ADHD). In adults, Parker and colleagues (2004) found that the Big Five (NEO-FFI) accounted for 41% of the variance in inattention, and 26% of the variance in H/I. In my sample, according to parents, the Big Five accounts for 23% of variance in inattention (almost all because of Conscientiousness) and 26% of variance in H/I (due to all factors except Openness). This suggests that using the Big Five to describe problems related to H/I may be similarly effective in children and adults, whereas the personality traits may provide more insight into inattention problems in adulthood, compared to in childhood.

It is also important to note some issues related to the theoretical construct of personality. I utilized a personality questionnaire to describe traits of 8-12-year-olds, which is not uncommon in research. Lamb et al. (2002) noted, however, that the Big Five traits are less coherent in childhood, which may explain divergences in findings from the adult literature. A more theoretical question about personality development, and what true “personality” entails, is of considerable interest. Did I measure personality in my sample of children? Most researchers would agree that what I measured was likely not personality – meaning that I was not measuring stable traits in children that will remain at this level through adulthood. This area of discussion may be largely semantic, with some researchers using terms from the temperament literature to describe similar tendencies. Shiner & Caspi (2003) pointed out that a distinction between temperament and personality is increasingly unclear past infancy, although research comparing models throughout development will aid in this understanding. In general, one theme is that temperament is usually not measured via self-report, but is rather measured using parent-report of behavior. My study seems to suggest that child-report differs from parent-report in a number of ways, although it is difficult to determine which ratings are the most veritable. Comparing

personality results from both parent and child report with temperament measures helps in understanding the relationships between the two areas, but eliminating rater bias altogether is not possible. Whereas children are biased by their self-image and cognitive abilities required to self-rate, parent ratings are influenced by a plethora of other factors including social desirability, comorbidities and effects of comparing multiple children. Additionally, as both personality and ADHD have a significant genetic component, it could be that parents of children with ADHD (who themselves might have ADHD or subclinical ADHD) rate their children differently due to shared genetic effects.

Despite these issues, personality development throughout the lifespan remains a widely-studied area. For instance, a recent article by Bleidorn (2015) describes the drastic changes in personality that occur during early adulthood. Particularly, Bleidorn notes that throughout early adulthood, increases in Agreeableness, Conscientiousness, and Emotional Stability (opposite of Neuroticism) occur – a set of changes that represents a maturation of personality. Thus, looking not only at personality traits, but also at personality development/change, may help to explain differences especially as they relate to psychopathology. We might find that although the personality trait levels are average overall in children with certain psychopathologies, those same children might show different developmental trajectories of these traits when compared with controls. Comparing differences in this trajectory between temperament and personality may help to determine the developmental appropriateness of the different models.

Strengths

Overall, this project fills a gap in the available research in a number of ways. First, my study includes a clinically-defined sample of children compared to controls, whereas the vast majority of existing literature in this area is done with community samples and adults and may

use participants with subclinical deficits. In addition, my study includes analyses of ADHD subtypes, which are often neglected in research. Last, this is the first study to use an American English version of the Big Five Questionnaire for Children (BFQ-C), to study any clinical disorder.

Out of the sixteen studies to date that have used the BFQ-C, fifteen of them included only non-clinical participants, whereas only one included children with reading disability (Gagliano et al., 2014). Thus, this is the first study to use the BFQ-C to evaluate personality traits in an ADHD sample. I only located one other study using an American English version of the BFQ-C, a Master's thesis from 2011 (Gaio, 2011), which included an American English version of the questionnaire used to evaluate a community sample of typically developing adolescents. This study found that a six factor structure yielded the best fit. Specifically, the Neuroticism scale was separated in to aggressive and non-aggressive scales (as discussed in Emotional Instability section).

Another strength of this study is that it did not utilize only self- or parent-report to determine ADHD, but also included a clinical diagnosis by a neuropsychologist. Thus, whereas all results are notable, group comparisons on the Big Five are cross-rater comparisons (Big Five rated by parent/child, and diagnosis made by a psychologist based on interview, parent and teacher report) and may be viewed as more clinically valid. Furthermore, the rating forms used to measure parental (BASC-2 and BRIEF) perceptions of ADHD symptoms and executive functioning are some of the most commonly used instruments in clinical practice, aiding generalizability of findings.

Limitations and Future Directions

A few limitations should be considered in regards to my study. First, although this project included both clinical and control groups, the clinical sample was limited to children with ADHD and RD. As discussed above, it may be difficult to determine whether a certain personality profile is indicative of a specific psychological disorder or of psychopathology in general. Further research should continue to utilize a control group, but should also include groups of children with other psychological disorders to better understand links between psychopathology and personality traits. Furthermore, as my sample did not come from a traditional psychological clinic, many children had milder forms of ADHD than traditional clinic samples. Hence, findings may change if a clinic sample is used.

Additionally, the novel use of a translated personality measure to evaluate psychopathology presents challenges. In the only other study to utilize an American English translation of the BFQ-C, Gaio (2011) noted problems with the Emotional Instability scale; specifically that it may be better described by two factors representing aggressive and non-aggressive traits. Additionally, in a sample overlapping with that of my study, Klaver (2013) found that omitting a few items from the scale improved internal consistency, and that a factor analysis revealed a better fit for four factors, rather than the intended five. The presence of only four factors in that sample is consistent with some research suggesting a better four factor structure than a five factor structure (Costa et al., 1986). Hence, this study should be replicated using other measures of personality and temperament.

Next, a confound exists in that some of my analyses used parent-report (BFQ-C) to predict parent-report (BASC-2, BRIEF). Specifically, some of the regressions analyzing the subtype domains of ADHD (inattention and H/I) utilized multiple parent-report measures. This

highlights a need in our field for more child-report measures of specific ADHD symptoms. Additionally, this raises the question of rater-bias in my study, as parents represent only one view of their children. Because of this, the group analyses may be seen as more valid as groups were formed based upon the results of comprehensive neuropsychological evaluations.

Last, the use of personality measures in children as young as 8 years presents a limitation. In general, most researchers would not agree that personality is stable by this age range, and note that personality change occurs throughout the lifespan (especially in late adolescence /early adulthood). For this reason, it would be irresponsible to claim that, based on my study, a certain type of personality is stably associated with ADHD. We can, however, say that at this point in development, some traits described by the BFQ-C were associated with ADHD using a variety of methods. It is likely that personality development will lead the trait levels of my participants to change throughout their lives. Therefore, future research should utilize longitudinal methods to study ADHD on a variety of temperament and personality measures.

Clinical Implications

This study informs clinical practice in a number of ways. First, as both diagnoses and the percentage of children taking psychotropic medication for ADHD are on the rise (Visser et al., 2014), individuals conducting psychological assessments for ADHD should take into account individual differences related to personality traits. For instance, given generally lower levels of Agreeableness and Conscientiousness in children with ADHD, cooperation and on-task behavior during testing may be negatively impacted, which could potentially affect test performance and results. Thus, practitioners administering psychological assessments and suspecting ADHD may need to alter typical testing procedures in order to obtain best estimates of functioning (including, but not limited to, cognitive and academic achievement testing). Practitioners may

find a need to incorporate more extensive rapport building with children with suspected ADHD, as well as to provide more frequent encouragement and breaks during testing procedures to get their best performance.

This study also provides insight into the differences between subtypes of ADHD. Subtype distinctions help in clinical practice to determine the course of treatment. Although diagnoses of ADHD-C differ from those of ADHD-PI based upon the presence of H/I symptoms, overlapping deficits support the subtype approach, rather than the subtypes actually representing two separate, distinct disorders. Low Conscientiousness likely is related to the overlapping qualities of the two subtypes, whereas subtypes differed in my sample on Openness and somewhat in Agreeableness. Additionally, ADHD-PI should not be viewed simply as a “less severe” form of ADHD, as my study suggests that children with ADHD-PI may have additional deficits that are unique to the subtype.

Interventions can be informed by this study when practitioners target behaviors related to personality differences commonly seen in ADHD. These include social skills training (related to Agreeableness), executive functioning and organizational skills training (related to Conscientiousness) and interventions focused on academic difficulties related to ADHD (related to Openness and Conscientiousness). When considering subtypes, it is important to note differences related to comorbidities, given that children with ADHD-C are more likely to exhibit comorbid externalizing problems (Factor et al., 2013), whereas subtypes seem to have similar levels of risk for internalizing problems (Faraone et al., 1998). In practice, children with ADHD are likely to experience difficulty in a number of areas aside from simply inattention and hyperactivity/impulsivity (social problems, executive functioning difficulties, internalizing/externalizing problems). Therefore, treatment should address these associated

features and personality disorders when they occur. Given the high rates of comorbidity, assessing only for ADHD may result in overlooking other problems.

The use of questionnaires (e.g., BASC-2) to detect the possibility of comorbid psychopathology is recommended (in addition to a standard battery of psychological tests) based upon the high rates of comorbidity with ADHD. Use of temperament and/or personality measures may be helpful as well given the results of this study. Nevertheless, differences between child- and parent-report from my study highlights the need for multi-rater assessment of symptoms. This should not be limited to only parents and children, but should include raters from other settings, such as teachers.

Table 1

Skewness and Kurtosis Statistics for Continuous Variables

	Skewness			Kurtosis		
	Statistic	Std. Error	Statistic/Std. Error	Statistic	Std. Error	Statistic/Std. Error
P_H/I	0.459	0.264	1.738636	-0.484	0.523	-0.92543
P_Attention	-0.56	0.264	-2.12121	-0.027	0.523	-0.05163
P_BRIEFEC	0.508	0.267	1.902622	-0.27	0.529	-0.5104
P_Extraversion	1.833	0.266	6.890977	11.172	0.526	21.23954
P_Agreeableness	-0.488	0.266	-1.83459	-0.528	0.526	-1.0038
P_Conscientiousness	2.694	0.266	10.12782	14.417	0.526	27.40875
P_Emotional Instability	0.297	0.267	1.11236	-0.641	0.529	-1.21172
P_Openness	1.247	0.266	4.68797	4.46	0.526	8.479087
C_Extraversion	-0.452	0.264	-1.71212	-0.224	0.523	-0.4283
C_Agreeableness	-0.205	0.264	-0.77652	-0.371	0.523	-0.70937
C_Conscientiousness	-0.268	0.264	-1.01515	0.093	0.523	0.17782
C_Emotional Instability	0.343	0.264	1.299242	-0.418	0.523	-0.79924
C_Openness	-0.331	0.264	-1.25379	0.283	0.523	0.541109
SQRT_P_Extraversion	1.076	0.266	4.045113	6.814	0.526	12.95437
SQRT_P_Conscientiousness	1.674	0.266	6.293233	7.456	0.526	14.1749
SQRT_P_Openness	0.704	0.266	2.646617	2.258	0.526	4.292776
LG10_P_Extraversion	0.458	0.266	1.721805	4.028	0.526	7.657795
LG10_P_Conscientiousness	0.882	0.266	3.315789	3.415	0.526	6.492395
LG10_P_Openness	0.243	0.266	0.913534	1.144	0.526	2.174905

Table 2

Covariate Tests for Subtype Analyses

	Controls		ADHD-PI		ADHD-C				
	Mean	SD	Mean	SD	Mean	SD	<i>F</i>	<i>X</i> ²	<i>p</i>
Age	9.6	1.19	9.4	1.38	9.57	1.56	0.183		0.83
Reading	91.12	20.35	89.74	10.24	92.91	16.84	0.283		0.75
SES	6.13	0.94	5.61	1.2	5.57	1.12	1.848		0.165
Gender	48% male		43% male		74% male			5.735	0.057

Table 3

Covariate Tests for Children with and without ADHD

	Controls		ADHD		<i>F</i>	<i>X</i> ²	<i>p</i>
	Mean	SD	Mean	SD			
Age	9.6	1.19	9.47	1.44	0.168		0.683
Reading	91.12	20.35	91	13.21	0.001		0.975
SES	6.14	0.94	5.6	1.16	3.729		0.057
Gender	48% male		55% male			0.361	0.548

Table 4

Internal Reliability for the BFQ-C

BFQ-C Trait	Cronbach's alpha	
	Parent	Child
Extraversion	0.70	0.77
Agreeableness	0.83	0.87
Conscientiousness	0.80	0.79
Emotional Instability	0.87	0.77
Openness/Intellect	0.77	0.77

Table 5

ADHD/Control Comparisons on the Big Five (Parent-Report with Transformed Variables)

	ADHD		Controls		<i>F</i>
	Mean (95% CI)	SD	Mean (95% CI)	SD	
Extraversion	1.50 [1.48 - 1.51]	.05	1.50 [1.48 – 1.52]	.06	0.113
Agreeableness	31.75 [30.67 - 32.85]	4.00	34.13 [32.45 - 35.80]	4.49	5.557*
Conscientiousness	1.36 [1.34 – 1.38]	.07	1.42 [1.39 – 1.45]	.08	14.457**
Emotional Instability	22.86 [21.45 - 24.27]	5.19	21.46 [19.29 - 23.63]	5.71	1.160
Openness	1.41 [1.39 – 1.43]	.07	1.44 [1.41 – 1.47]	.10	3.407

* $p < .05$; ** $p < .001$

Table 6

ADHD/Control Comparisons on the Big Five (Child-Report)

	ADHD		Controls		<i>F</i>
	Mean (95% CI)	SD	Mean (95% CI)	SD	
Extraversion	28.78 [27.56 - 29.97]	5.00	30.04 [28.23 - 31.85]	3.30	1.344
Agreeableness	28.67 [27.36 - 29.98]	5.27	31.68 [29.69 - 33.67]	4.34	6.292*
Conscientiousness	26.93 [25.75 - 28.11]	4.56	29.16 [27.36 - 30.96]	4.46	4.232*
Emotional Instability	21.40 [20.24 - 22.56]	4.64	21.20 [19.43 - 22.97]	3.94	0.034
Openness	25.47 [24.28 - 26.66]	4.66	28.00 [26.29 - 29.81]	4.31	5.403*

* $p < .05$

Table 7

ADHD-PI/ADHD-C/Control Comparisons on the Big Five (Parent-Report with Transformed Variables)

	Control		ADHD-PI		ADHD-C		<i>F</i>	
	Mean (95% CI)	SD	Mean (95% CI)	SD	Mean (95% CI)	SD		
Extraversion	1.50 [1.48 – 1.52]	.06	1.49 [1.47 – 1.50]	.05	1.51 [1.49 – 1.53]	.05	1.631	
Agreeableness	34.13 [32.44 - 35.81]	4.485	32.06 [30.64 - 33.48]	3.700	31.30 [29.58 - 33.03]	4.405	2.987	
Conscientiousness	1.42 [1.39 – 1.45]	.08	1.35 [1.33 – 1.38]	.07	1.36 [1.33 – 1.39]	.08	7.164**	PI/C < controls
Emotional Instability	21.46 [19.32 - 23.60]	5.710	21.77 [19.97 - 23.56]	5.147	24.48 [22.30 - 26.66]	4.926	2.425	
Openness	1.44 [1.41 – 1.47]	.10	1.39 [1.37 – 1.42]	.06	1.43 [1.40 – 1.47]	.06	4.079*	PI < C

* $p < .05$; ** $p < .01$.

Table 8

ADHD-PI/ADHD-C/Control Comparisons on the Big Five (Child-Report)

	Control		ADHD-PI		ADHD-C		<i>F</i>	
	Mean (95% CI)	SD	Mean (95% CI)	SD	Mean (95% CI)	SD		
Extraversion	30.04 [28.24 - 31.84]	3.297	28.06 [26.54 - 29.58]	4.677	29.87 [27.99 - 31.75]	5.362	1.796	
Agreeableness	31.68 [29.68 - 33.68]	4.337	28.34 [26.65 - 30.04]	5.583	29.17 [27.09 - 31.26]	4.830	3.311*	PI < controls
Conscientiousness	29.16 [27.36 - 30.96]	4.460	27.40 [25.88 - 28.92]	4.906	26.22 [24.34 - 28.10]	3.965	2.588	C < controls
Emotional Instability	21.20 [19.42 - 22.98]	3.937	21.34 [19.84 - 22.85]	4.256	21.78 [13.62 - 23.33]	5.265	0.023	
Openness	28.00 [26.18 - 29.82]	4.311	25.14 [23.60 - 26.68]	4.387	25.96 [24.06 - 27.85]	5.103	2.902	PI < controls
* $p < .05$								

Table 9

Big Five (Parent-Report) as Predictors of BASC-2 Hyperactivity/Impulsivity Using Transformed Values

Variable	Hyperactivity/Impulsivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion (t)	83.497	28.612	0.345	.005
Agreeableness	-0.652	0.384	-0.229	.094
Conscientiousness (t)	-46.211	18.357	-0.3	.014
Emotional Instability	0.71	0.254	0.314	.007
Openness (t)	9.835	17.994	0.063	.586
Note: R2 = .306; adjusted R2 = .260				

Table 10

Big Five (Parent-Report) as Predictors of BASC-2 Attention Problems Using Transformed Values

Variable	Attention Problems (squared)			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion (t)	1637.646	2775.259	0.071	.557
Agreeableness	-23.794	37.292	-0.088	.525
Conscientiousness (t)	-6657.41	1780.584	-0.454	< .001
Emotional Instability	21.594	24.591	0.101	.383
Openness (t)	1745.362	1745.362	-0.026	.827
Note: R2 = .276; adjusted R2 = .228				

Table 11

Big Five (Child-Report) as Predictors of BASC-2 Hyperactivity/Impulsivity

Variable	Hyperactivity/Impulsivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion	0.361	0.426	0.136	.399
Agreeableness	-0.799	0.495	-0.341	.110
Conscientiousness	-0.668	0.436	-0.255	.130
Emotional Instability	-0.082	0.33	-0.03	.804
Openness	0.553	0.419	0.214	.191
Note: R2 = .125; adjusted R2 = .068				

Table 12

Big Five (Child-Report) as Predictors of BASC-2 Attention Problems

Variable	Attention Problems			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion	0.223	0.356	0.105	.532
Agreeableness	-0.367	0.414	-0.195	.377
Conscientiousness	-0.129	0.365	-0.061	.725
Emotional Instability	-0.121	0.276	-0.055	.663
Openness	-0.177	0.351	-0.085	.616
Note: R2 = .055; adjusted R2 = -.006				

Table 13

Emotional Instability, Agreeableness, and Emotional Regulation as Predictors of H/I

	Hyperactivity/Impulsivity				R2	Adjusted R2
	<i>B</i>	<i>SE B</i>	β	<i>p</i>		
Model 1					.186	.175
Emotional Regulation	.458	.109	.431	< .001		
Model 2					.236	.206
Emotional Regulation	.308	.135	.290	.025		
Emotional Instability	.340	.312	.148	.280		
Agreeableness	-.462	.327	-.162	.162		

Table 14

Emotional Instability, Agreeableness, and Emotional Regulation as Predictors of H/I (Verification)

	Hyperactivity/Impulsivity				R2	Adjusted R2
	<i>B</i>	<i>SE B</i>	β	<i>p</i>		
Model 1					.183	.161
Emotional Instability	.726	.270	.315	.009		
Agreeableness	-.505	.336	-.177	.137		
Model 2					.236	.206
Emotional Instability	.340	.312	.148	.280		
Agreeableness	-.462	.327	-.162	.162		
Emotional Regulation	.308	.135	.290	.025		

Table 15

Internal Reliability for Separate Hyperactivity and Impulsivity Scales

BASC-2 Scale	Cronbach's alpha	
	Adolescent	Child
Hyperactivity	0.71	0.84
Impulsivity	0.73	0.71

Table 16

Big Five (Parent-Report Transformed) Predicting Hyperactivity

Variable	Hyperactivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion (t)	5.165	1.557	0.371	.001
Agreeableness	-0.04	0.021	-0.244	.062
Conscientiousness (t)	-2.918	0.9944	-0.338	.004
Emotional Instability	0.044	0.014	0.349	.002
Openness (t)	1.09	0.969	0.123	.264
Note: R2 = .379; adjusted R2 = .336				

Table 17

Big Five (Parent-Report Transformed) Predicting Impulsivity

Variable	Impulsivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion (t)	2.105	1.331	0.203	.118
Agreeableness	0	0.018	0.001	.992
Conscientiousness (t)	-1.771	0.854	-0.273	.042
Emotional Instability	0.032	0.012	0.336	.008
Openness (t)	0.308	0.833	0.046	.713
Note: R2 = .185; adjusted R2 = .129				

Table 18

Big Five (Child-Report) Predicting Hyperactivity

Variable	Hyperactivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion	.039	.025	.248	.120
Agreeableness	-.049	.029	-.355	.093
Conscientiousness	-.041	.025	-.277	.100
Emotional Instability	-.012	.020	-.080	.525
Openness	.037	.025	.247	.137
Note: R2 = .119; adjusted R2 = .059				

Table 19

Big Five (Child-Report) Predicting Impulsivity

Variable	Impulsivity			
	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Extraversion	.010	.018	.086	.595
Agreeableness	-.037	.021	-.373	.086
Conscientiousness	-.020	.018	-.182	.275
Emotional Instability	-.001	.014	-.009	.941
Openness	.017	.018	.159	.338
Note: R2 = .135; adjusted R2 = .078				

Table 20

BFQ-C Parent-Child Correlations

	<i>r</i>	<i>p</i>
Extraversion	0.12	.288
Agreeableness	0.19	.080
Conscientiousness	0.02	.870
Emotional Instability	0.13	.241
Openness/Intellect	0.30	<.01

Hypothesized Personality Differences by Subtype

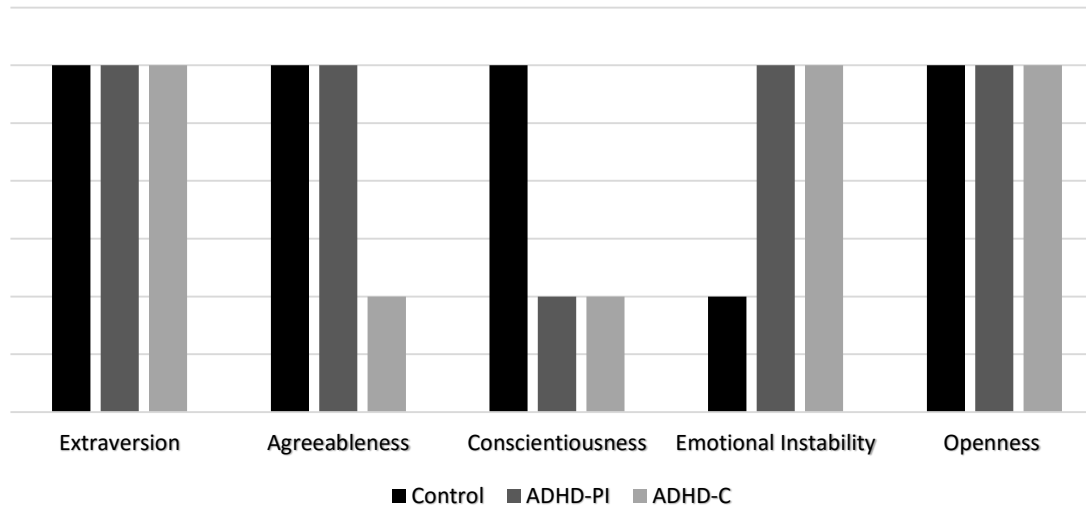


Figure 1. Expected personality difference patterns for controls, ADHD-PI, and ADHD-C

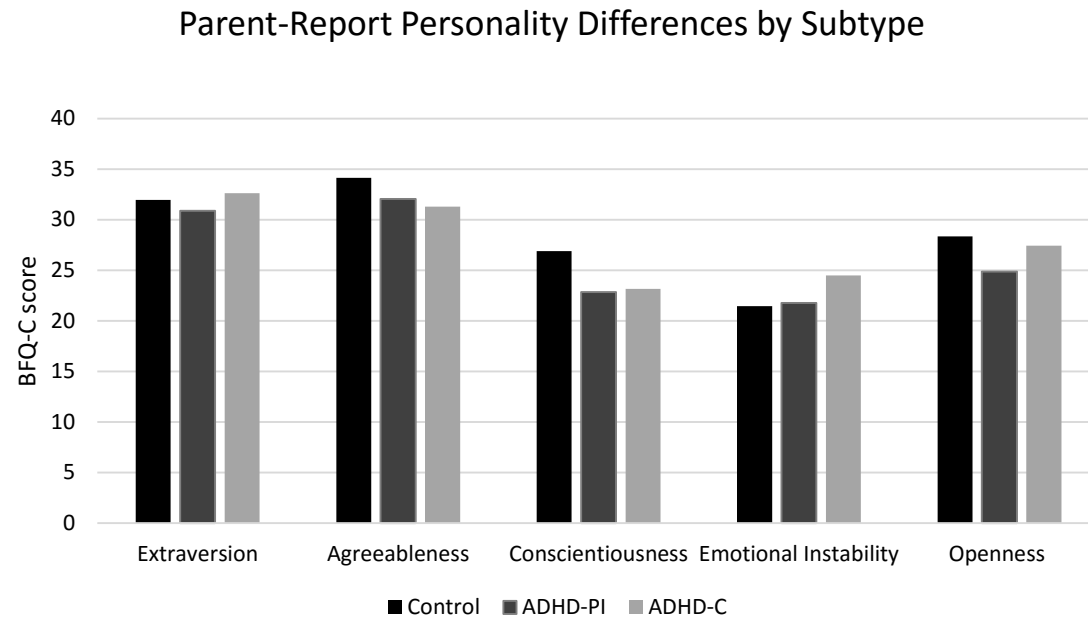


Figure 2. Observed parent-report personality differences (ADHD-PI/C significantly lower than controls on Conscientiousness, ADHD-PI significantly lower than ADHD-C on Openness)

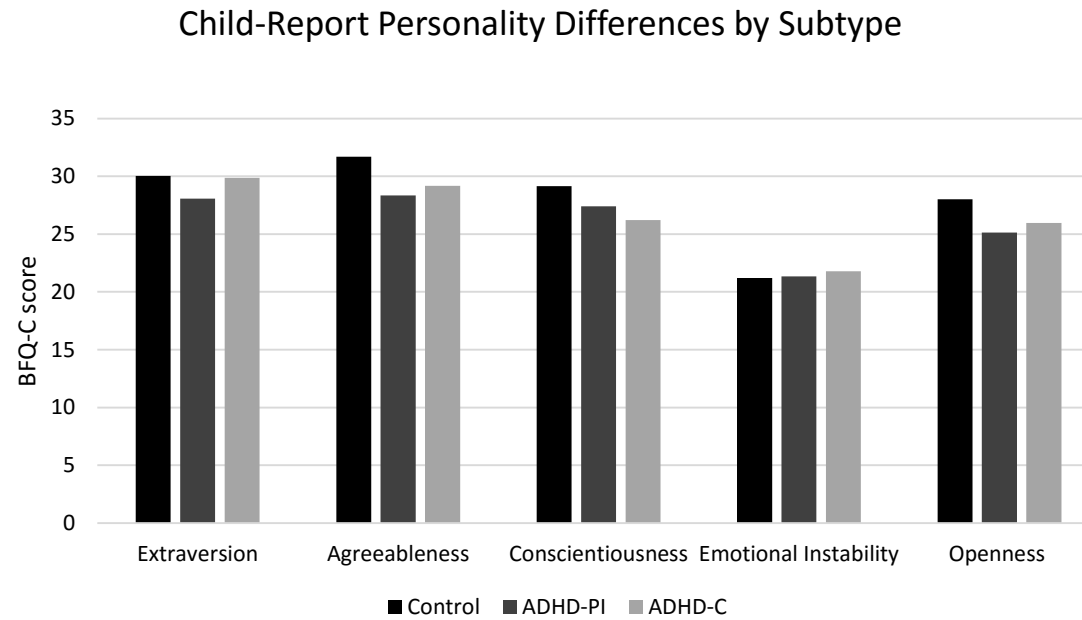


Figure 3. Observed child-report personality differences (ADHD-PI significantly lower than controls on Agreeableness, ADHD-C significantly lower than controls on Conscientiousness, ADHD-PI significantly lower than controls on Openness)

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APPENDICES

Appendix A

Big 5 Questionnaire: Parent Report

	Rarely=1	Sometimes=2	Almost Always=3
1. My child likes to meet with other people.	1	2	3
2. My child shares his/her things with other people.	1	2	3
3. My child does his/her job without carelessness and inattention.	1	2	3
4. My child gets nervous about minor things.	1	2	3
5. My child knows many things.	1	2	3
6. My child is in a bad mood.	1	2	3
7. My child works hard and with pleasure.	1	2	3
8. My child enjoys arguing with others.	1	2	3
9. My child likes to compete with others.	1	2	3
10. My child has a lot of fantasies.	1	2	3
11. My child behaves correctly and honestly with others.	1	2	3
12. My child easily learns what he/she studies at school.	1	2	3
13. My child understands when others need his/her help.	1	2	3
14. My child likes to move and to do a great deal of activity.	1	2	3
15. My child easily gets angry.	1	2	3
16. My child likes to give gifts.	1	2	3
17. My child argues with others.	1	2	3
18. When the teacher asks my child a question, he/she is able to answer it correctly.	1	2	3
19. My child likes to be with others.	1	2	3
20. My child actively focuses on the things he/she does.	1	2	3
21. If someone commits an injustice to my child, he/she will forgive him/her.	1	2	3
22. During class-time, my child is concentrated on the things he/she does.	1	2	3

23. My child can easily say what he/she thinks to others.	1	2	3
24. My child likes to read books.	1	2	3
25. When my child finishes his/her homework, he/she checks it many times to see if she/he did it correctly.	1	2	3
26. My child says what he/she thinks.	1	2	3
27. My child is friendly with his/her peers.	1	2	3
28. My child respects the rules and order.	1	2	3
29. My child easily gets offended.	1	2	3
30. When the teacher explains something, my child understands immediately.	1	2	3
31. My child is sad.	1	2	3
32. My child is very kind to others.	1	2	3
33. My child likes scientific TV shows.	1	2	3
34. If my child has a meeting, he/she keeps it.	1	2	3
35. My child does something so he/she doesn't get bored.	1	2	3
36. My child likes to watch the news and to know what happens in the world.	1	2	3
37. My child's room is neat.	1	2	3
38. My child is polite when he/she talks to others.	1	2	3
39. If my child wants to do something, he/she is not capable of waiting and has to do it immediately.	1	2	3
40. My child likes to talk to others.	1	2	3
41. My child is not patient.	1	2	3
42. My child is able to convince someone of his/her point of view.	1	2	3
43. My child is able to create new games and activities.	1	2	3
44. When my child starts to do something, he/she has to finish it at all costs.	1	2	3
45. If a classmate has some difficulty, my child can help him/her.	1	2	3
46. My child is able to solve mathematics problems.	1	2	3
47. My child trusts in others.	1	2	3

48. My child likes to keep all his/her school things very organized.	1	2	3
49. My child easily loses his/her calm.	1	2	3
50. When my child speaks, others listen to him/her and do what he/she says.	1	2	3
51. My child is kind to people whom he/she dislikes.	1	2	3
52. My child likes to know and learn new things.	1	2	3
53. My child plays only when he/she has finished his/her homework.	1	2	3
54. My child is tense when he/she does things.	1	2	3
55. My child likes to joke.	1	2	3
56. My child has difficulty diverting his/her attention.	1	2	3
57. My child easily makes friends.	1	2	3
58. My child sobs.	1	2	3
59. My child would like to travel and learn more about other countries.	1	2	3
60. My child thinks other people are good and honest.	1	2	3
61. My child worries about minor things.	1	2	3
62. My child understands immediately.	1	2	3
63. My child is happy and energetic.	1	2	3
64. My child lets other people use his/her things.	1	2	3
65. My child does what he/she should do.	1	2	3

Appendix B

Big 5 Questionnaire: Child Self-Report

	Rarely=1	Sometimes=2	Almost Always=3
1. I like to meet with other people.	1	2	3
2. I share my things with other people.	1	2	3
3. I do things with great care and attention.	1	2	3
4. I get nervous about minor things.	1	2	3
5. I know many things.	1	2	3
6. I am in a bad mood.	1	2	3
7. I work hard and with pleasure.	1	2	3
8. I enjoy arguing with others.	1	2	3
9. I like to compete with others.	1	2	3
10. I have a lot of fantasies.	1	2	3
11. I behave correctly and honestly with others.	1	2	3
12. I easily learn what I study at school.	1	2	3
13. I understand when others need my help.	1	2	3
14. I like to move and to do a great deal of activity.	1	2	3
15. I easily get angry.	1	2	3
16. I like to give gifts.	1	2	3
17. I argue with others.	1	2	3
18. When the teacher asks me a question, I am able to answer it correctly.	1	2	3
19. I like to be with others.	1	2	3
20. I actively focus on the things I do.	1	2	3
21. If someone is unfair to me, I forgive her/him.	1	2	3
22. During class-time, I concentrate on the things I do.	1	2	3
23. I can easily say what I think to others.	1	2	3
24. I like to read books.	1	2	3

25. When I finish my homework, I check it many times to see if I did it correctly.	1	2	3
26. I say what I think.	1	2	3
27. I am friendly with my peers.	1	2	3
28. I respect the rules and order.	1	2	3
29. I easily get offended.	1	2	3
30. When the teacher explains something, I understand immediately.	1	2	3
31. I am sad.	1	2	3
32. I am very kind to others.	1	2	3
33. I like scientific TV shows.	1	2	3
34. If I have a meeting, I keep it.	1	2	3
35. I do something so I don't get bored.	1	2	3
36. I like to watch the news and to know what happens in the world.	1	2	3
37. My room is neat.	1	2	3
38. I am polite when I talk to others.	1	2	3
39. If I want to do something, I am not capable of waiting and I have to do it immediately.	1	2	3
40. I like to talk to others.	1	2	3
41. I am not patient.	1	2	3
42. I am able to convince someone of my point of view.	1	2	3
43. I am able to create new games and activities.	1	2	3
44. When I start to do something, I have to finish it at all costs.	1	2	3
45. If a classmate has some difficulty, I can help her/him.	1	2	3
46. I am able to solve mathematics problems.	1	2	3
47. I trust in others.	1	2	3
48. I like to keep all my school things very organized.	1	2	3
49. I easily lose my calm.	1	2	3
50. When I speak, others listen to me and do what I say.	1	2	3

51. I am kind to people whom I dislike.	1	2	3
52. I like to know and learn new things.	1	2	3
53. I play only when I have finished my homework.	1	2	3
54. I am tense when I do things.	1	2	3
55. I like to joke.	1	2	3
56. I have difficulty diverting my attention.	1	2	3
57. I easily make friends.	1	2	3
58. I sob.	1	2	3
59. I would like to travel and learn more about other countries.	1	2	3
60. I think other people are good and honest.	1	2	3
61. I worry about minor things.	1	2	3
62. I understand immediately.	1	2	3
63. I am happy and energetic.	1	2	3
64. I let other people use my things.	1	2	3
65. I do what I should do.	1	2	3

Appendix C

Hyperactivity and Impulsivity Items from the BASC-2 (PRS-C/PRS-A)

Inattention

- 9/35. Has a short attention span
- 17/5. Pays attention
- 41/65. Listens to directions
- 49/76. Pays attention when being spoken to
- 73/136. Is easily distracted
- 105/106. Listens carefully

Hyperactivity/Impulsivity

- 6/15. Cannot wait to take turn (I)
- 20. Is unable to slow down (H)
- 38/135. Disrupts other children's/adolescents' activities (I)
- 52/75. Acts out of control (H)
- 70/105. Fiddles with things while at meals (H)
- 84. Is overly active (H)
- 102/80. Interrupts others when they are speaking (I)
- 116./20 Acts without thinking (I)
- 134/50. Interrupts parents when they are talking on the phone (I)
- 148/45. Has poor self-control (H)

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