

## Big Five Dimensions and ADHD Symptoms: Links Between Personality Traits and Clinical Symptoms

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Attention-deficit/hyperactivity disorder (ADHD) in adulthood is conceptualized as originating in childhood. Despite considerable theoretical interest, little is known about how ADHD symptoms relate to normal personality traits in adults. In 6 studies, the Big Five personality dimensions were related to ADHD symptoms that adults both recalled from childhood and reported concurrently (total  $N = 1,620$ ). Substantial effects emerged that were replicated across samples. First, the ADHD symptom cluster of inattention-disorganization was substantially related to low Conscientiousness and, to a lesser extent, Neuroticism. Second, ADHD symptom clusters of hyperactivity-impulsivity and oppositional childhood and adult behaviors were associated with low Agreeableness. Results were replicated with self-reports and observer reports of personality in community and clinical samples. Findings support theoretical connections between personality traits and ADHD symptoms.

Consider Richard, who is 34 years old. He often feels restless, has problems sitting at a desk for more than a few minutes, cannot get organized, does not follow through on plans he made because he forgets them, loses his keys and wallet, and fails to achieve up to his potential at work. During conversations, his mind wanders and he interrupts others, blurting out what he is thinking without considering the consequences. He gets into arguments. His mood swings and periodic outbursts make life difficult for those around him. Now his marriage is in trouble (Weiss, Hechtman, & Weiss, 1999).

From a personality perspective, Richard's behaviors and experiences implicate his personality traits, although it is hard to see how any one trait might account for this particular configuration of

behaviors. Two additional facts about Richard may explain why his behavioral profile is more familiar to clinical than personality researchers: Richard's problems have persisted from childhood onward, and they are now accompanied by significant impairment in his work and interpersonal life. In fact, clinicians are increasingly faced with cases like Richard's, diagnosing them (if not explained by another disorder) as adults with attention-deficit/hyperactivity disorder (ADHD; American Psychiatric Association [APA], 2000).

Linking personality traits with symptoms of clinical disorders is useful to enhance understanding of the diatheses and structure of psychopathology (Watson, Clark, & Harkness, 1994). The degree to which constructs from personality psychology are associated with apparently related constructs in other fields, such as psychopathology, is thus of significant interest to personality researchers. Efforts to relate personality traits to psychopathology have emphasized Axis II personality disorders, with fruitful results (Costa & Widiger, 1994). However, it is likely that broader connections are possible. Such connections are fairly direct for some disorders (e.g., Neuroticism with depression/anxiety), but may seem less obvious for a disorder, such as ADHD, that is conceptually associated with neuropsychological dysfunction. However, neuropsychological and personality models may often reflect different levels of analysis of the same phenomena, opening the way to conceptual integration (Nigg, 2000). Further, because there are close connections between the executive (or action selection) and motivation systems of the brain (Nigg, 2001), symptoms of a disorder such as ADHD might well be related to personality traits. Understanding these relationships may be especially useful for shedding light on developmental theories of the origins and out-

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The research reported in this article was supported by National Institute of Mental Health (NIMH) Grant MH57244 awarded to Joel T. Nigg, by NIMH Grants MH49255 and MH43948 awarded to Oliver P. John, by NIMH Grant MH45064 awarded to Stephen P. Hinshaw, and by NIMH Grant MH38820 and National Institute of Child Health and Human Development Grants HD04024 and HD27802 awarded to Bruce Pennington. We extend our appreciation to the many research participants.

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comes of ADHD, and clarifying likely correlates and outcomes for adults. However, such theoretical considerations require more data regarding the empirical association between ADHD symptoms and personality traits.

Indeed, links to personality may also seem uncertain for ADHD because in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* (APA, 1994), ADHD is an Axis I disorder first evident in childhood. One view might even be that ADHD should not be related to normal personality traits. Yet an opposing view might be that personality traits are the fundamental building blocks of individual differences, so ADHD may merely reflect some combination of the basic traits. The truth probably lies between these extremes. Some personality traits may represent the adult manifestation of early temperamental precursors for ADHD, such that both ADHD and adult personality reflect outcomes of a core temperamental propensity. In addition, some personality traits may reflect a developmental endpoint of childhood ADHD symptoms in adulthood. If associations between personality traits and ADHD symptom reports were known, the likelihood of such developmental possibilities could be better evaluated.

The conceptual connection between traits and ADHD is drawing theoretical interest (White, 1999) due in part to parallel findings in the personality and psychopathology literatures. For example, heritability is substantial for both ADHD symptoms (Sherman, Iacono, & McGue, 1997) and personality traits (Jang, Livesly, & Vernon, 1996; Loehlin, McCrae, Costa, & John, 1998). Molecular genetic findings also suggest possible parallels between ADHD and key personality traits (Nigg & Goldsmith, 1998; Plomin & Caspi, 1999). Developmental considerations suggest that temperament (Rothbart & Bates, 1998), personality (Zuckerman, 1991), and ADHD (Barkley, 1997) are related to neurobiological systems that are conceived of in similar ways in each of those literatures. Thus, it seems plausible that these domains may overlap. Clarifying such an association would enrich understanding of outcomes of childhood ADHD in adulthood, as well as stimulating theoretical integration between early development of ADHD and early development of personality.

#### ADHD: Some Background

Having suggested the value of integrating ADHD symptoms and personality traits, we step back to provide background on ADHD that can guide specific hypotheses about that linkage. ADHD is one of the most widely diagnosed and widely discussed child psychiatric syndromes in the United States (Barkley, 1997, 1998). Yet unlike the rather well established diagnostic and developmental picture in children, the emergence of ADHD as a recognized entity in adulthood is fairly recent and still somewhat controversial (Barkley, 1998; Faraone et al., 2000; Sachdev, 1999). Media discussion (Morrow, 1997), meetings at the National Institutes of Health (Lahey & Willcutt, 1998), and burgeoning research publications (see Barkley, 1997) all point to keen public and scientific interest in better understanding of this widespread syndrome and its persistence in some adults.

#### *The Importance of Childhood ADHD Symptoms in Studies of Adults*

Adult ADHD is conceptualized theoretically as a neurodevelopmental disorder that originates in childhood (APA, 2000; Bark-

ley, 1998; Wender, 1995) and entails behavioral, cognitive, and affective difficulties that emerge early and persist chronically (APA, 2000; Barkley, 1997). In adults, a childhood history of ADHD symptoms is considered crucial to distinguishing ADHD from other clinical syndromes that can cause similar symptoms, such as mood disorders, substance abuse, and certain personality disorders (Wender, 1995; Stein et al., 1995; Barkley, 1998).

Assessment of childhood symptoms of ADHD is therefore integral to clinical and research efforts to understand adult correlates associated with ADHD. Although recalled symptoms are wisely viewed with caution (Kessler, Mroczek, & Belli, 1999), self-report of childhood symptoms is widely used as a standard means of assessment (Murphy & Gordon, 1998). Data about the correlates of these self-reports can aid in evaluating their construct validity as well. At the same time, there is some evidence for the utility of adults' self-reports of ADHD symptoms. Self-ratings of current ADHD symptoms correspond well with ratings by observers (Downey, Stelson, Pomerleau, & Giordiani, 1997); recollections of childhood symptoms also correlate with reports obtained independently from parents (Biederman, Faraone, Knee, & Munir, 1990; Ward, Wender, & Reimherr, 1993).

#### *Structure and Validity of the ADHD Construct*

ADHD, like most psychopathologies, has been viewed both as a categorical syndrome and as a reflection of extreme standing on a continuous dimension or trait. The question of category versus dimension remains undecided for ADHD in terms of etiology (Todd, 2000), but some statistical modeling and genetic evidence support a dimensional view (Levy, Hay, McStephen, Wood, & Waldman, 1997; Willcutt, Pennington, & DeFries, 2000). Thus, studies of subclinical symptom levels in nonclinical as well as clinical samples are informative about the structure and etiology of the clinical problems subsumed by the ADHD construct.

Extensive evidence supports the construct validity of child ADHD with regard to neurobiological and neuroimaging correlates, family studies, impairment, and outcomes data (for a review, see Barkley, 1998). Factor analytic and other construct validity studies also support the *DSM-IV* ADHD construct (Hudziak et al., 1998; Wolraich, Hanna, Pinnock, Baumgaertel, & Brown, 1996). Although most studies have been carried out in the United States or Europe, data also support the validity of ADHD in adolescents in developing countries (Rohde et al., 2001) and the prevalence of ADHD is rather consistent across a range of cultures (for a review, see Barkley, 1998).<sup>1</sup> In adults, although more questions obviously remain, a similar picture is emerging: The adult syndrome is associated with impairment, family history, neuropsychological deficits, treatment response, and factorial stability similar to the

<sup>1</sup> These studies now include China (Leung et al., 1996), India (Bhatia, Nigam, Bohra, & Malik, 1991), Puerto Rico (Bird et al., 1988), New Zealand (e.g., McGee et al., 1990), the Netherlands (Verhulst, van der Ende, Ferdinand, & Kasius, 1997), Canada (Szatmari, Offord, & Boyle, 1989), as well as the United States (August, Realmuto, MacDonald, Nugent, & Crosby, 1996). Prevalences varied from 2%–9%, with apparently higher rates in India and China than in the United States or the Netherlands. However, some of this variation may be due to some methodological variation across studies. More conclusive epidemiological studies are certainly needed cross culturally.

child syndrome (for a review, see Faraone et al., 2000). Thus, ADHD and its symptoms warrant investigation in adults both because of growing evidence for a valid and impairing adult syndrome, and because there remains a need for clarification of the structure and etiology of the adult symptom profile.

*DSM-IV* field trial studies using parent and teacher ratings of children supported distinguishing two symptom domains: (a) inattention-disorganization (e.g., mind off task, loses materials), and (b) hyperactivity-impulsivity (e.g., child talks out in class, runs about, leaves seat; Lahey et al., 1994; McBurnett et al., 1999); subtypes are defined by problems in one or both domains. However, the *DSM-IV* conception does not provide adult-specific criteria (Barkley, 1998), and other conceptions suggest additional dimensions when assessing adults, as we note in the *Method* section where we consider various assessment instruments. Studies of personality correlates can be informative here by helping to clarify the structure of the symptom reports by adults.

### Adult Outcomes

In contrast to earlier belief, prospective follow-up data now show that the overwhelming majority of children with ADHD continues to manifest the disorder through late adolescence and that a strong minority persists into adulthood (Mannuzza & Klein, 1999; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998). In addition, many of those who fail to meet full diagnostic criteria in adulthood still have multiple ongoing subthreshold problems with inattention, impulsivity, mood problems, and other adjustment and health concerns (Barkley, 1998; Weiss & Hechtman, 1993). Problems in personality, including possible personality disorders, may be one outcome overlooked by current diagnostic approaches (Lewinsohn, Rohde, Seeley, & Klein, 1997). Preliminary prospective data suggest that childhood ADHD confers risk for future antisocial personality disorder (Mannuzza et al., 1998) and "cluster B" personality disorders generally (Tzelepis, Schubiner, & Warbase, 1995), which include antisocial as well as borderline, histrionic, and narcissistic personality disorders. These disorders share behaviors described as "dramatic, emotional, or erratic" (APA, 2000). Overall, individuals in whom ADHD symptoms persist, in whole or in part, are at considerable risk for adjustment problems, employment and relationship difficulties, auto accidents, and other psychiatric complications (Mannuzza & Klein, 1999). Such findings underscore the importance of considering personality correlates of ADHD symptoms as reported by adults.

### ADHD and the Big Five Dimensions of Normal Personality

Several studies have examined childhood personality and temperament in relation to the broader concept of "externalizing disorder," which includes conduct problems, aggression, and oppositional behavior, as well as hyperactive and impulsive behaviors. Negative affectivity, poor self-regulation, and impulsivity emerge as relevant, early temperamental correlates (Campbell, Pierce, March, Ewing, & Szumowski, 1994; Huey & Weisz, 1997; John, Caspi, Robins, Moffitt, & Stouthamer-Loeber, 1994; Kochanska, Murray, & Coy, 1997; Rothbart & Ahadi, 1994; Sanson, Smart, Prior, & Oberklaid, 1993; Shea & Fisher, 1996; for a review, see Sanson & Prior, 1999). ADHD symptoms, however,

have generally not been well-specified in those studies. Likewise, there is a noteworthy literature suggesting that adult antisocial personality, which is one possible outcome of ADHD, is related to low Big Five Conscientiousness, low Agreeableness, and (though less clearly) to elevated Neuroticism, and to an even weaker extent, Extraversion (Axelrod, Widiger, Trull, & Corbitt, 1997; Blais, 1997; Costa & McCrae, 1990; Sher & Trull, 1994; Trull, 1992; for a review, see Miller & Lynam, in press). A related pattern might exist for ADHD, though the aforementioned literature has largely ignored ADHD. In fact, only a few small self-report studies address ADHD symptoms and adult personality (e.g., Braaton & Rosen, 1997; Ranssen, Campbell, & Baer, 1998).

We focus on the Big Five (Goldberg, 1993; John & Srivastava, 1999; McCrae & Costa, 1999) to represent the major dimensions of normal adult personality. The Big Five dimensions provide the most widely accepted taxonomy of higher order personality traits; they also converge with the three-factor models advocated by Tellegen (1985) and H. J. Eysenck and Eysenck (1985) in systematic ways (Clark & Watson, 1999; John & Srivastava, 1999). The Big Five have also been a centerpiece of the recent work on the integration of clinical and personality constructs in the domain of personality disorders (Costa & Widiger, 1994; Nigg & Goldsmith, 1994; Wiggins & Pincus, 1989). As we noted, antisocial personality disorder is relevant to the present research on ADHD. Thus, although debate still continues about the number and nature of personality trait dimensions (Block, 1995), these five dimensions seem a good starting point for investigation of links between personality and ADHD. We consider relations to ADHD for each Big Five dimension in turn.

### Extraversion

One might expect ADHD to be related to Extraversion, especially as originally defined by H. J. Eysenck (1967) to include impulsiveness along with activity and sociability. However, S. B. Eysenck, Eysenck, and Barrett (1985) subsequently found that impulsiveness did not correlate with the other traits defining Extraversion and thus dropped it from the Extraversion construct. Indeed, most current conceptions view the core of Extraversion as positive emotionality and an energetic approach to the social and material world, including such traits as sociability, activity, and assertiveness (Clark & Watson, 1999; John & Srivastava, 1999; Lucas, Diener, Grob, Suh, & Shao, 2000). Not surprisingly, extroverts tend to have better social skills than introverts, get more attention from others, and attain higher status in social groups, at least in studies in the United States (Akert & Panter, 1988; Anderson, John, Keltner, & Kring, 2001; Riggio, 1986). This portrait contrasts with the poor social skills, negative reactions, and social ostracism that often characterize individuals with ADHD as children, adolescents, and adults (Hoy, Weiss, Minde, & Cohen, 1978; Weiss & Hechtman, 1993). Thus, we might expect little or no association of ADHD with Extraversion as now defined. A study using the revised Eysenck scales found an association of *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; *DSM-III-R*; APA, 1987) ADHD symptoms with Extraversion in self-reports of college undergraduates (Braaton & Rosen, 1997); but a small self-report study of adults diagnosed with ADHD failed to link Big Five Extraversion and ADHD (Ranssen et al., 1998).

### Conscientiousness

Deficits in maintaining task focus and concentration implicate problems with low Conscientiousness. This Big Five dimension refers to “*socially prescribed impulse control* that facilitates task- and goal-directed behavior” (John & Srivastava, 1999, p. 121); thus, conscientious individuals are well-organized, responsible, and perform tasks, projects, and assignments in an efficient, diligent, and self-controlled way. Not surprisingly, Conscientiousness predicts school performance in children as young as age 12 (John et al., 1994) and predicts work performance in adults across most job categories (Barrick & Mount, 1991). Ranssen et al. (1998) found lower Big Five Conscientiousness in adults referred for ADHD evaluation than in controls. In another study of adults, Conscientiousness was marginally lower in the biological parents of ADHD than non-ADHD children (Nigg & Hinshaw, 1998). A study of children showed that attention span and persistence (a measure of effortful control in children that has been linked conceptually to adult Conscientiousness; see Rothbart & Ahadi, 1994) were lower in ADHD than control children (McIntosh & Cole-Love, 1996). Robins, John, and Caspi (1994) found that children’s externalizing problems and delinquency were associated with low Conscientiousness and low Agreeableness, as rated by caregivers.

### Agreeableness

The interpersonal and conduct problems that accompany ADHD symptoms suggest problems with the Big Five dimension of Agreeableness. This interpersonal dimension of personality is defined by traits like altruism, trust, compliance and tender-minded concern for others (Costa & McCrae, 1992; Graziano & Eisenberg, 1997); individuals low in Agreeableness exhibit antagonism, bullying, aggression, and hostility towards others. *DSM-IV* includes some ADHD symptoms that directly suggest low levels of Agreeableness (e.g., “interrupts others”). Nigg and Hinshaw (1998) found that parents of oppositional ADHD children tended to have lower Agreeableness than parents of non-ADHD children. Ranssen et al. (1998) did not find significantly lower Agreeableness in their sample of ADHD adults. Overall, though, little is known about the link between Agreeableness and ADHD, and exploration of this link was an important goal of our study.

### Neuroticism

The Neuroticism dimension in the Big Five reflects individual differences in negative emotionality, including vulnerability to stress, anxiety, depression, and other negative emotions (Costa & McCrae, 1992). Although negative emotion and mood regulation are not part of the formal criteria for ADHD in the text revision of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-R; APA, 2000)*, individuals with ADHD appear to exhibit more mood variability, negative affect, and difficulty coping with stress than controls (Shea & Fisher, 1996; Wender, 1995). Further, ADHD conveys higher than average risk for mood disorders, depression, and anxiety in both children and adults across all ADHD subtypes (Biederman, Faraone, Keenan, & Tsuang, 1991; Biederman et al., 1993). Moreover, Costa and McCrae (1992) included one aspect of impulsivity (i.e., resisting cravings) as a

facet of Neuroticism, suggesting a possible link between ADHD symptoms and Neuroticism. A study of college undergraduates linked Eysenck Neuroticism with elevated *DSM-III-R* symptoms of ADHD (Braaton & Rosen, 1997). This finding was echoed in a self-report study of Big Five Neuroticism in adults referred for ADHD assessment (Ranssen et al., 1998).

### Openness to New Experience

The fifth Big Five dimension describes “the breadth, depth, originality, and complexity of an individual’s *mental and experiential life*” (John & Srivastava, 1999, p. 121; McCrae, 1996). We did not expect Openness to show substantial associations with symptoms central to ADHD. However, high levels of Openness are related to children’s performance in school and on cognitive tests (John et al., 1994) and so might be inversely related to learning problems seen in ADHD.

### Overview: Aims and Hypotheses

The aim of the present research was to provide a more thorough and definitive examination of adult personality and ADHD symptoms than heretofore available. We were particularly interested in the relation of the Big Five in adulthood to ADHD symptoms and associated problems recalled from childhood. To bolster confidence in results, we sought replication across self- and spouse report of the Big Five, childhood, and current (adult) ADHD symptoms, multiple ADHD assessment instruments, and multiple independent samples. We expected that (a) the core ADHD “attention problems” domain would be associated with low Conscientiousness; (b) this ADHD symptom domain would also be related to high Neuroticism, consistent with their relation to internalizing problems (anxiety, depression) in the literature as cited earlier; and (c) hyperactivity-impulsivity in *DSM-IV* and related domains in other ADHD models would be related to low Agreeableness.

### Method

#### *Samples and Participants*

In selecting samples, we sought to (a) achieve large *Ns* to enable us to estimate effect sizes and look at within-gender effects, (b) ensure replicability and generalizability across different age ranges and across referred and nonreferred groups, and (c) enable findings to be related to the existing adult ADHD literature. Because the goal included studying correlates of the full range of ADHD symptoms, we sought samples that would include both normal and disordered individuals.

In choosing specific types of samples, we first noted that many studies of adults with ADHD use college student samples. Indeed, one of the few ADHD and personality studies extant relied on college students (Braaton & Rosen, 1997). College student samples are convenient and potentially enable larger *Ns* (and thus more stable estimates of effects sizes); perhaps this is why they are often used in personality research generally. However, prospective data suggested that only a minority of ADHD children complete college (Weiss & Hechtman, 1993; Weiss, Hechtman, Milroy, & Perlman, 1985), calling into question whether the problem domain of interest would be adequately represented in a college sample.

More recently, however, scientific and policy concern about ADHD symptoms and syndromes in college populations has grown, perhaps in part because of a greater focus on accommodations in college for these individuals (Wolf, 2001). Recent data suggest that the prevalence of problem-

atic levels of ADHD symptoms in college populations may be nearly equivalent to that expected in community samples (DuPaul et al., 2001; Faigel, 1995; Heiligenstein, Conyers, Berns, & Smith, 1997; Weyandt, Linterman, & Rice, 1995; also see Wender, 1995). Perhaps related to these phenomena, clinicians have considerable interest in data about ADHD symptoms in college samples, as reflected in clinically oriented outlets (Lewandowski et al., 2000; Murphy, Gordon, & Barkley, 2000; Smith & Johnson, 1998) and reviews (Heiligenstein & Keeling, 1995; Nadeau, 1995). Also perhaps for related reasons, studies of ADHD in adults often emphasize college samples (e.g., Dooling-Litfin & Rosen, 1997; Heiligenstein, Johnston, & Nielsen, 1996; Kern, Rasmussen, Byrd, & Wittschen, 1999; Kirsch & Sapp, 2000; Ramirez et al., 1997; Richards, Rosen, & Ramirez, 1999; Smith & Johnson, 1998). Overall, it was apparent that even though many children with ADHD do not go on to college, college samples would have an adequate range of ADHD symptoms for our purposes. It also seemed essential to include such samples so that our results could be connected to this important aspect of the literature on adults and ADHD.

At the same time, we wished to determine whether findings would generalize to the community at large and to other age ranges than the college population. A sample often used in the literature for this purpose has been parents of children with ADHD (e.g., Stein et al., 1995; Zimetkin et al., 1990). The core reasoning is that these parents have substantially higher levels of ADHD disorder and ADHD symptoms than the general population (Biederman et al., 1995; Faraone, Biederman, & Friedman, 2000; Faraone, Biederman, Jetton, & Tsuang, 1997; Frick, Lahey, Christ, Loeber, & Green, 1991; Lahey et al., 1988) yet include individuals ranging from normal, to subthreshold, to fully disordered, thus ensuring considerable variance on the symptoms of interest and coverage of a fairly complete range of the behavioral continuum that we wished to investigate. We viewed such samples as a core of our investigation.

Finally, although clinically referred samples can introduce inferential biases (Goodman et al., 1997), it was clearly essential to know whether what we would find in the above samples would hold in a clinically referred sample. We therefore included such a sample as well, to assure that any results obtained in the preceding samples would generalize to a bona fide clinical population. In summary, we judged that college student, community, and clinical samples were needed to ensure that we would obtain adequate coverage of the full range of ADHD symptoms that we wanted to study, to enable replication across sample types, ages, and gender, and to assure that findings would be generalizable and be readily related to the existing literature on ADHD symptoms in adults.

In view of concerns that ADHD correlates may differ by gender (Arnold, 1996), we obtained large enough samples to enable checking of results

separately for men and women. Overall, our research design enabled us to report findings for six independently obtained samples for men and women. Table 1 summarizes the samples and the major measures obtained for each. Measures are described in the subsequent section.

*Sample 1: Michigan undergraduates.* This sample consisted of 535 students in introductory psychology courses at Michigan State University (MSU) who participated in exchange for extra course credits. To reduce the potential of random responding, measures were administered either individually or in small groups. In addition, 55% of the sample completed infrequency items from the Personality Research Form (Jackson, 1989), which were developed to detect random responding. Only 6 (2%) of the participants endorsed more than two infrequency items, suggesting that random responding was not a common problem. Nonetheless, these 6 participants were excluded, resulting in a final  $n = 529$  (64% women). Mean age was 19.7 years ( $SD = 1.6$  years). In terms of ethnicity, this sample closely mirrored the university population, with 81% Caucasian, 8% African American, 5% Asian/Pacific Islander, and 6% other.

*Sample 2: Denver undergraduates.* This sample consisted of 293 undergraduate students (71% women) at the University of Denver who participated in exchange for extra course credits in introductory psychology courses. On average, they were 20.4 years old ( $SD = 1.4$  years). Reflecting the ethnic composition of this university, they were 85% Caucasian, 3% African American, 6% Asian/Pacific Islander, 3% Latino/Hispanic, and 3% other.

*Sample 3: Michigan parents.* These 142 parents (52% women) and their children participated in an ongoing study of child ADHD at MSU. Half were parents of children with ADHD whereas the other half were parents of non-ADHD control children. As expected, parents of children with ADHD had higher levels of ADHD symptoms than did the control parents; across both groups, 11% met diagnostic research criteria for ADHD. Participants were on average 39.2 years old ( $SD = 6.1$  years); the ethnic composition was 73% Caucasian, 16% Latino/Hispanic, 6% African American, 1% Asian/Pacific Islander, 3% Native American, and 1% other.

*Sample 4: Denver parents.* These 290 parents (57% women) participated along with their children in the Colorado Learning Disabilities Research Center twin project (Alarcon & DeFries, 1997). The sample included parents of children who had ADHD (36%), reading disability (29%), and control children (35%). The sample had only modest elevations in ADHD symptoms, perhaps because only a minority of parents had a child with ADHD. Overall, 5% of parents met criteria for ADHD on a structured interview of *DSM-III-R* symptoms. Mean age in this sample was 40.2 years ( $SD = 6.3$  years). The ethnic composition was 81%

Table 1  
Summary of Six Samples and Measures Collected

Sample	N	Mean age (years)	ADHD symptom ratings				
			Big Five		Wender child	DSM-IV child	Achenbach adult
			Self	Spouse			
1. Michigan undergraduates	529	20	xx		xx	xx	
2. Denver undergraduates	293	20	xx		xx		
3. Michigan parents	142	39	xx	xx	xx	xx	
4. Denver parents	290	40	xx		xx		
5. Bay Area parents	278	43	xx	xx	xx		
6. Michigan adult ADHD	88	22	xx		xx	xx	xx
Total N	1,620		1,620	345	1,500	734	88

*Note.* Measures and methods are described in text. ADHD = attention-deficit/hyperactivity disorder; Wender = Wender-Utah Rating Scale; *DSM-IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., American Psychiatric Association, 1994); Achenbach = Achenbach (1997) Young Adult Rating Scale; Michigan = Mid-Michigan Area; Bay Area = San Francisco Bay Area.

Caucasian, 10% Latino/Hispanic, 6% African American, 1% Asian/Pacific Islander, 1% Native American, and 1% other.

*Sample 5: Bay Area parents.* This sample included 278 parents (56% women) of boys with ADHD (60%) and comparison boys (40%); children participated in summer program studies of child ADHD at the University of California, Berkeley (e.g., Hinshaw, Zupan, Simmel, Nigg, & Melnick, 1997). Families were recruited from throughout the San Francisco Bay Area, representing a wide range of socioeconomic classes. In the total sample, 10% exceeded cutoffs for an ADHD diagnosis, with higher percentages in the families with an ADHD boy than in those with a non-ADHD boy (Nigg & Hinshaw, 1998). Both biological and adoptive parents (including step parents) were included in the present analyses. Mean age in this sample was 43.3 years ( $SD = 6.0$  years). The ethnic composition was 63% Caucasian, 8% Latino/Hispanic, 14% African-American, and 15% Asian/Pacific Islander.

*Sample 6: Michigan young adults with ADHD.* These 88 individuals (62% women) participated in a study of adults with persistent ADHD. A prerequisite of inclusion was that they had been previously seen clinically and diagnosed in the clinical setting. They were recruited at a major university and at a community college in Michigan through campus offices offering disability services, and from newspaper advertisements for clinically diagnosed individuals (however, 93% of the final sample were at least part-time undergraduate or graduate students). Students with ADHD can register at the campus disability offices to obtain assistance with studying and diagnosed in the clinical setting. The community college is a 2-year college that includes part-time students, and that may often be an option chosen for individuals with learning disabilities or ADHD who find a regular 4-year University too difficult (Wolf, 2001). The mean age was 21.6 years ( $SD = 3.9$  years). In this sample, clinical diagnosis of adult ADHD was confirmed by us on the basis of an established face-to-face structured diagnostic interview, the National Institute of Mental Health Diagnostic Interview Schedule for *DSM-IV* (Robins et al., 1995). Participants were diagnosed if they had (a) the required number of childhood symptoms, early onset, persistent course, and impairment in childhood and adulthood, and (b) elevated levels of current symptoms compared with normative data on standardized symptom rating scales. This approach was used because, like its predecessors, the *DSM-IV* does not provide explicit diagnostic criteria for adults. Thus, the diagnosis of these individuals is similar to the concept of "residual ADHD" established in *DSM-III-R* (APA, 1987) and retained in *DSM-IV-R* under the concept of "partial remission" (APA, 2000). In all, 39 participants met research-diagnostic criteria for ADHD ( $n = 26$  combined subtype,  $n = 11$  inattentive subtype), 23 participants were borderline ADHD (i.e., they were diagnosed as ADHD in the community but fell shy of research diagnostic cutoffs for ADHD), and 26 participants were non-ADHD comparison participants who completed all of the same diagnostic procedures. Ethnically, the sample was 78% Caucasian, 7% African American, 3% Latino/Hispanic, 4% Asian/Pacific Islander, and 8% other.

### Personality Measures: Self- and Spouse Reports on the Big Five

*NEO Five Factor Inventory (NEO-FFI): Self-reports.* For all six samples, we scored the 60-item self-report NEO-FFI (Costa & McCrae, 1992). The five scales each include 12 items and have excellent psychometric characteristics, including internal consistency, temporal stability, and construct validity with other self-report Big Five measures, peer ratings, and spouse ratings. An example item illustrates the item content for each scale: Extraversion: "I really enjoy talking to people"; Agreeableness: "I would rather cooperate with others than compete with them"; Conscientiousness: "I keep my belongings neat and clean"; Neuroticism: "When I'm under a great deal of stress, sometimes I feel like I'm going to pieces"; and Openness to Experience: "I have a lot of intellectual curiosity."

In the present samples, coefficient alpha reliabilities were similar for men and women and similar to the values published in the literature (for a

review, see John & Srivastava, 1999). As in previous research, reliability was highest for Neuroticism (averaging .87 across our samples) and Conscientiousness (.84), followed by Extraversion (.79) and Agreeableness (.77), and then Openness (.76). Moreover, the NEO-FFI scale scores showed the age and gender differences documented previously. In particular, women scored slightly higher than men in Neuroticism and Agreeableness across all samples (Benet-Martinez & John, 1998; Costa & McCrae, 1992). Also, the middle-aged adults of the parent samples scored somewhat higher than the younger student samples in Agreeableness and Conscientiousness (McCrae et al., 1999).

*Spouse Reports on the NEO-FFI and the Big Five Inventory (BFI).* In the Michigan parents sample, participants also completed the observer version of the NEO-FFI, describing the personality of their spouse. Again, the NEO-FFI scales were highly reliable for both men and women; alpha reliabilities ranged from .75 to .90. Moreover, convergent validity between self- and spouse reports was similar to previous research (e.g., Costa & McCrae, 1992). The self-spouse validity correlations were all significant ( $p < .01$ ) and substantial; they all exceeded  $r = .50$ , except for Agreeableness ( $r = .42$ ), which often shows somewhat lower convergence between self and informant (John & Robins, 1993).

In the Bay Area parents sample, spouse ratings were obtained with the 44-item BFI (John, Donahue, & Kentle, 1991). It uses short phrases for the most prototypical traits that define each of the Big Five dimensions (John & Srivastava, 1999). The trait adjectives (e.g., "thorough") that form the core of each of the 44 BFI items (e.g., "Does a thorough job") were selected because experts judged them as the most clear and prototypical markers of the Big Five dimensions (John, 1989, 1990). The five BFI scales have shown substantial reliability and a clear factor structure, as well as convergent and discriminant validity (Benet-Martinez & John, 1998; John & Srivastava, 1999). The spouse ratings on the BFI in the Bay Area parents sample showed substantial reliability for all five scales, with coefficient alphas ranging from .78 to .91. Convergent correlations with self-report NEO-FFI scores were similar to those found in the literature and in the Michigan parent sample.

### Measures of ADHD Symptoms

Consensus on the best way to assess adults' ADHD symptoms is lacking. To assure that findings would not be attributable to one particular approach to assessing ADHD symptoms, we included three widely recognized approaches: (a) the Wender-Utah approach, (b) the mainstream *DSM-IV* approach, and (c) Achenbach's multifactorial approach for concurrent adult symptoms. We first discuss the Wender-Utah instrument, because it was available for all six samples.

*Wender-Utah Rating Scale for recalled childhood symptoms.* The 61-item Wender-Utah Rating Scale (Wender, 1985) is a broadband measure that includes ADHD symptoms as well as associated problems that are not part of the *DSM-IV* definition of ADHD, but are important in the Utah model (Wender, 1995). Ward et al. (1993) developed an abbreviated set of 25 Wender-Utah items that best discriminated adults with ADHD (as diagnosed by clinical interviews) from both normal adults and a clinical sample of depressed adults. Scores on the 25-item scale correlated with retrospective ratings of childhood symptoms by the participants' mothers and were linked with positive response to stimulant medication in adults, supporting its validity. We scored the 25-item scale as to measure overall ADHD severity under the Utah model ( $\alpha = .91$  over all samples).

In addition, we scored the five symptom scales identified in a factor analysis of the 61-item scale by Stein et al. (1995) separately in men and women (item contents were slightly different for men and women). We refer to these factor-based scales as the Wender-Stein subscales. We labeled the factors as: *Attention Problems* (e.g., "Concentration problems, easily distracted"); *Sloppy, disorganized* ("Sloppy, disorganized"); *Conduct-Impulsivity* (e.g., "Got in fights"; "Stubborn, strong-willed"); *Negative Affect* (e.g., "Feel guilty, regretful"; "Feel angry"); *Learning Problems* (e.g., "Slow in learn-

ing to read”; “Overall a poor student, slow learner”); and *Social Problems* (e.g., “Unpopular with other children, didn’t keep friends for long”; “Have friends, popular”). The scales ranged in length from 5 to 11 items. Alpha reliability was acceptable for each of these scales, with coefficients ranging from .69 to .89 in the Stein et al. (1995) sample and from .71 to .94 in the present research.

*DSM-IV-based rating scale for recalled childhood ADHD symptoms.* We obtained self-ratings of *DSM-IV* childhood ADHD symptoms with the *DSM-IV* version of the Swanson, Nolan, and Pelham rating scale (Swanson, 1992; Swanson, Lerner, March, & Gresham, 1999), modified so that the individual can report on 18 ADHD symptoms recalled from childhood between the ages of 6–10 on a 4-point scale. We used all 18 items to obtain an overall ADHD score. Reliability, similar across the three samples with *DSM-IV* data, was  $\alpha = .89$  in all samples combined.

As in previous research, the 18 *DSM-IV* symptoms defined two factors in our samples, reproducing the two-factor symptom profile in *DSM-IV*. We thus also computed nine-item symptom scale scores for Inattention-Disorganization (e.g., “Fails to give close attention to details or makes careless mistakes in school work or tasks”; “Has difficulty organizing tasks and activities”; “Loses things necessary for activities”) and Hyperactivity-Impulsivity (e.g., “Fidgets with hands or feet or squirms in seat”; “Is on the go or often acts as if driven by a motor”; “Interrupts or intrudes on others, butts into conversations or games”). Alpha reliabilities were substantial and similar for men and women, ranging from .84 to .94 across samples for both symptom scales. The two scales captured distinct but correlated symptom clusters, with an overall  $r = .56$  intercorrelation across all samples.

*Achenbach’s adult symptoms of psychopathology and attention problems.* Our third measure focused on concurrent adult symptoms, using a third approach. Sample 6 completed a well-established multifactorial measure, Achenbach’s (1997) Young Adult Self-Report rating scale. This questionnaire includes broadband Externalizing and Internalizing symptom scales, as well as multiple narrowband scales for specific problem areas. Although no specific scale is dedicated to the assessment of *DSM-IV* ADHD (which lacks formal criteria for adults), three are particularly relevant: Attention Problems, Intrusive, and Aggressive Behavior. These three scales also showed the highest intercorrelations of all the Achenbach scales with one another (all about .50). To obtain an ADHD total score that might compare with the total score from the other two measures, then, we aggregated these three scales ( $\alpha = .87$ ). Achenbach (1997) reported generally satisfactory internal consistency and test-retest reliability for these scales. In the present research,  $\alpha = .77$  for the seven-item Attention Problems scale, .70 for the seven-item intrusive scale, and .79 for the 12-item Aggressive Behavior scale.

### *Convergences and Differences Among the Three Approaches to ADHD Symptoms*

The available measures clearly vary in the bandwidth of problems that they seek to assess. We evaluated the degree of convergence among the three ADHD instruments with the largest sample available, combining across all studies (see Table 1). Correlations were initially computed separately for men and for women. Because they were quite similar, we report the averages across gender. All correlations reported in this section were significant ( $p < .01$ ).

*Overall ADHD.* The convergence correlations among the three overall ADHD scores were all substantial in size. The *DSM-IV* total ADHD scale correlated .60 with the Wender 25-item ADHD scale and .71 with the Achenbach-based ADHD total score, and those two scales correlated .65 with each other. When corrected for attenuation, the convergence correlations were .67, .81, and .73, respectively. These values indicate that the three measures assess similar but not identical constructs; personality correlates may differ somewhat depending on the measure used.

*Two core symptom domains.* The domain of attention problems was similar across the three instruments. When corrected for attenuation be-

cause of unreliability, the mean intercorrelation was .91, suggesting strong convergence of “attention problems” across instruments. The second ADHD symptom domain is somewhat less consistently defined. Achenbach’s intrusive scale was the closest match for *DSM-IV* Hyperactivity-Impulsivity ( $r = .66$ ) and Achenbach Aggressive Behavior was the closest match for Wender-Stein Conduct-Impulsivity ( $r = .64$ ). The convergence of Wender-Stein Conduct-Impulsivity with *DSM-IV* Hyperactivity-Impulsivity was a bit lower ( $r = .54$ ).

*Other symptom domains.* Unlike the two-domain *DSM* model, the Wender-Utah approach represents a broader set of symptom domains with three additional scales. The Wender-Stein Negative Affect scale was conceptually and empirically most similar to the Achenbach Anxious/Depressed scale ( $r = .46$ ). The Wender-Stein Social Problems scale was most similar to Achenbach’s Withdrawn scale ( $r = .43$ ). The Wender-Stein Learning Problems scale had no clear parallel on the other instruments.

*Summary.* Two ADHD symptom domains showed considerable convergence across the three approaches and thus provided our primary focus. We also include results for the additional Wender-Stein symptom domains as well as for the full set of Achenbach symptom scales.

*Notes on the data analysis.* Because men and women might differ in ADHD correlates, we analyzed the data separately by gender, treating findings for men and women as replications and combining results through weighted averages whenever a descriptive summary was needed. This conceptual decision was also appropriate methodologically: The parent samples included couples (leading to some nonindependence of male and female scores) and the Wender-Stein scales differed somewhat in item content by gender. However, rather than consider all the specific findings by gender, study (samples of early or middle adulthood), and Big Five data sources (self or spouse), we focus primarily on the overall pattern of findings across gender and all the samples. To estimate effect sizes, we conducted a “mini” meta-analysis, computing correlations separately in each sample and then averaging them weighted by sample size across all studies. Fisher’s  $r$ -to- $z$  transformation (Cohen, 1988) was used in all computations involving correlations.

## Results

### *Relations Between Wender-Stein Childhood ADHD Symptom Scales and the Big Five*

We begin with the Wender-Utah Scale, which offers the broadest definition of the ADHD syndrome, and was available for all six samples. We then consider links with the *DSM-IV*-based scales and with the Achenbach scales. For the self-reported Big Five, effect sizes are based on six studies, and for the spouse-reported Big Five, effect sizes are based on two studies. Table 2 reports the average correlations across those studies. The first row in Table 2 shows that the total ADHD symptom score was related to low Conscientiousness, low Agreeableness, and high Neuroticism. Extraversion was not related positively to total ADHD-related symptoms; instead, the correlation was small and negative,  $r = -.20$ . As expected, Openness had the smallest correlation with the total score. Supporting the generalizability of these findings, spouse reports of the Big Five showed a pattern very similar to those obtained with the self-reports, including significant negative correlations for Conscientiousness and Agreeableness, a significant positive correlation for Neuroticism, and essentially zero correlations for both Extraversion and Openness. Across data source, then, three of the Big Five dimensions had reliable links with overall symptom severity.

We next consider the five more specific symptom domains in the Wender-Stein scales. Correlations that were both predicted and

Table 2  
*Mean Correlations Between Wender–Stein ADHD Scales and Big Five Self- and Spouse Ratings Across All Six Samples (Weighted by Sample Size)*

Wender scales	Big Five reporter	Big Five Scales				
		E	A	C	N	O
“ADHD Total”	Self	-.20	<b>-.41</b>	<b>-.38</b>	<b>.47</b>	-.10
	Spouse	-.05	<b>-.21</b>	<b>-.25</b>	<b>.33</b>	.01
Social Problems	Self	<b>-.41</b>	-.07	-.19	.30	.04
	Spouse	<b>-.30</b>	-.06	-.26	.24	-.04
Conduct-Impulsivity	Self	-.03	<b>-.45</b>	-.19	.17	.09
	Spouse	.09	<b>-.22</b>	-.04	.18	.00
Attention Problems	Self	-.13	-.25	<b>-.58</b>	.34	.15
	Spouse	-.03	-.03	<b>-.40</b>	.18	.01
Negative Affect	Self	-.25	-.34	-.26	<b>.49</b>	.08
	Spouse	-.15	-.22	-.19	<b>.34</b>	.02
Learning Problems	Self	-.08	-.08	-.14	.15	<b>-.13</b>
	Spouse	-.10	.04	-.09	.10	<b>-.11</b>

*Note.* Predicted correlations are set in bold. “ADHD Total” refers to the Ward et al. (1993) 25-item total score. Results were essentially the same with the 61-item total score. The Big Five measures and data sources are described in the text. All self-report correlations larger than absolute value of  $r = .064$  are significant at  $p < .01$ . Spouse correlations larger than absolute value of  $r = .138$  are significant at  $p < .01$ . ADHD = attention-deficit/hyperactivity disorder; Wender = Wender-Utah Rating Scale; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience.

the largest in their row are set in bold; the predicted correlations appear on the diagonal in the rest of Table 2. A convergent and discriminant pattern of findings is apparent: except for Openness, the numbers on the diagonal were the highest in each row. This pattern of findings replicated closely across both self- and spouse reports of the Big Five.

Attention problems were most clearly associated with low Conscientiousness, with overall correlations of  $-.58$  for self-reported Conscientiousness and  $-.40$  for spouse-reported Conscientiousness. Attention Problems also showed a secondary, smaller association with Neuroticism, with positive correlations for both self- and spouse reports. Associations with any of the other Big Five either were negligible in size or did not replicate across data sources.

Conduct-Impulsivity, the Wender–Stein scale most closely linked to the second major ADHD symptom domain of impulsivity, correlated negatively with the Agreeableness dimension for both Big Five self- and spouse reports. Conduct-Impulsivity also showed a secondary positive correlation with Neuroticism in both data sources but not with any of the other Big Five dimensions. Neither Attention Problems nor Conduct-Impulsivity related dependably to Extraversion.

Instead, a third symptom domain, Social Problems, was linked to low levels of Extraversion in both self- and spouse reports. These negative correlations indicate that individuals with more ADHD-related problems reported more withdrawal, loneliness, and isolation, *not* higher levels of sociability, activity, or assertiveness. Unsurprisingly, the ADHD symptom domain of Negative Affect correlated most highly (and positively) with self- and spouse reports of Big Five Neuroticism. However, this Wender–Stein scale showed the least discriminant validity across the Big

Five, with secondary negative correlations observed for three additional Big Five dimensions: Agreeableness and, to a lesser extent, Conscientiousness and Extraversion. Of all the Wender–Stein symptom domains, only Learning Problems did not correlate substantially with the expected Big Five domain, Openness, or with any other of the Big Five.

In summary, the strongest association between the Wender–Stein scales and the Big Five was found for the most central ADHD symptom domain, Attention Problems. In general, the links between symptom domains and Big Five showed an impressive convergent and discriminant pattern for four of the Big Five dimensions. Nonetheless, the Wender–Stein symptom scales are intercorrelated and the sometimes substantial off-diagonal correlations in Table 2 attest to this lack of independence. The symptom scales showed the most notable lack of discriminance vis-à-vis Neuroticism, perhaps indicating the general maladjustment associated with these problem domains.

To what extent did this pattern of findings replicate across our six studies and across gender? Table 3 presents the self-report data separately for men and women for all six samples. It shows that the links between ADHD symptoms and Big Five shown in Table 2 held not only in the adult community and undergraduate student samples but also in the adult clinical sample, thus providing broad generalizability evidence. A meta-analytic comparison between the two student samples, the three parent samples, and the adult ADHD sample showed no systematic differences for these primary associations, although some effects were slightly larger for undergraduate than for parent samples. Analyses of gender differences showed good replication across men and women, despite the somewhat differing composition of the Wender–Stein scales for the two genders. As shown by the sample size weighted mean correlations in Table 3, the effect sizes were similar for the two genders.

#### *Relations Between DSM–IV Childhood Symptoms of ADHD and the Big Five*

Again, we emphasize the overall pattern of findings averaged across samples. Table 4 shows these data for both the self- and spouse-reported Big Five. Predicted correlations are in bold type. Paralleling the pattern found for the Wender–Utah, overall ADHD symptoms were related to low Conscientiousness, low Agreeableness, and Neuroticism, but not to Extraversion or Openness, using both self- and spouse report of the Big Five. Across data source, then, only Conscientiousness, Agreeableness, and Neuroticism had significant and replicable links with overall ADHD.

However, we were most interested in results for the two DSM–IV symptom domains scored separately. Because the Inattention-Disorganization and Hyperactivity-Impulsivity scales were substantially correlated (averaging  $.56$  in our studies), we also created residual symptom scores in which each DSM–IV domain was partialled from the other, to highlight the unique features of the two symptom domains. As shown in Table 4, the inattention residual showed the predicted negative link to Conscientiousness, which replicated in both self-reports ( $r = -.46$ ) and spouse data ( $r = -.37$ ). Moreover, there was a secondary association with Neuroticism, which held in the self-report data for both men and women, but in the spouse data only for women. Correlations with the other Big Five dimensions were either nonsignif-

Table 3  
Correlations of Self-Report Big Five Traits With Wender–Stein ADHD Scales by Sample

Wender subscales by sample	E		A		C		N		O	
	M	W	M	W	M	W	M	W	M	W
<b>Wender Social Problems</b>										
Michigan undergrads	<b>-.44**</b>	<b>-.49**</b>	-.13	.00	<b>-.27**</b>	<b>-.13**</b>	<b>.25**</b>	<b>.23**</b>	<b>.19**</b>	-.03
Denver undergrads	<b>-.22*</b>	<b>-.35**</b>	<b>-.34**</b>	.01	<b>-.33**</b>	.03	<b>.41**</b>	<b>.41**</b>	-.01	.02
Michigan parents	<b>-.41*</b>	<b>-.43**</b>	-.21	.08	-.25	<b>-.38**</b>	.36	<b>.32**</b>	-.12	.02
Denver parents	<b>-.23*</b>	<b>-.36**</b>	-.18	.01	<b>-.34**</b>	-.07	<b>.37**</b>	.10	.11	.01
Bay Area parents	<b>-.33**</b>	<b>-.53**</b>	-.20	-.02	<b>-.27**</b>	<b>-.22**</b>	<b>.23**</b>	<b>.41**</b>	.12	.03
Michigan adult ADHD	<b>-.59**</b>	<b>-.34</b>	-.24	-.15	<b>-.44**</b>	<b>-.31*</b>	.15	<b>.49**</b>	-.13	.15
<i>weighted composite</i>	<b>-.39**</b>	<b>-.44**</b>	<b>-.12**</b>	<b>.08**</b>	<b>-.28**</b>	<b>-.12**</b>	<b>.30**</b>	<b>.30**</b>	<b>.12**</b>	.01
<b>Wender Conduct-Impulsivity</b>										
Michigan undergrads	-.14	.09	<b>-.54**</b>	<b>-.39**</b>	-.13	<b>-.26**</b>	.07	<b>.19**</b>	.10	<b>.15**</b>
Denver undergrads	<b>-.40**</b>	<b>-.18**</b>	<b>-.61**</b>	<b>-.58**</b>	-.07	<b>-.27**</b>	<b>.50**</b>	<b>.16*</b>	.05	.10
Michigan parents	.05	-.07	<b>-.51**</b>	<b>-.18</b>	.09	.04	-.15	.19	-.06	-.25
Denver parents	.07	.02	<b>-.24*</b>	<b>-.36**</b>	-.17	<b>-.38**</b>	.04	<b>.25**</b>	.13	.08
Bay Area parents	.10	.04	<b>-.36**</b>	<b>-.51**</b>	.16	<b>-.23**</b>	-.06	<b>.27**</b>	.07	-.11
Michigan adult ADHD	-.29	.12	<b>-.46*</b>	<b>-.49**</b>	.04	<b>-.45**</b>	.02	<b>.32*</b>	-.14	.11
<i>weighted composite</i>	-.09*	.01	<b>-.46**</b>	<b>-.36**</b>	-.06	<b>-.27**</b>	.10*	<b>.21**</b>	.07	<b>.10**</b>
<b>Wender Attention Problems</b>										
Michigan undergrads	-.06	-.08	-.20	<b>-.20**</b>	<b>-.60**</b>	<b>-.59**</b>	<b>.28**</b>	<b>.29**</b>	<b>.28**</b>	<b>.21**</b>
Denver undergrads	<b>-.27*</b>	<b>-.31**</b>	<b>-.68**</b>	<b>-.46**</b>	<b>-.50**</b>	<b>-.63**</b>	<b>.67**</b>	<b>.38**</b>	.17	.05
Michigan parents	-.14	-.02	-.38	-.21	<b>-.47*</b>	<b>-.46**</b>	.10	.25	-.10	.05
Denver parents	-.04	-.08	-.12	<b>-.24**</b>	<b>-.42**</b>	<b>-.63**</b>	.20*	<b>.32**</b>	.18	.11
Bay Area parents	<b>-.22**</b>	<b>-.16*</b>	.05	-.21*	<b>-.55**</b>	<b>-.54**</b>	<b>.24**</b>	<b>.41**</b>	-.01	.18
Michigan adult ADHD	.16	-.08	-.02	-.26	<b>-.54**</b>	<b>-.78**</b>	.31	<b>.55**</b>	.06	.31
<i>weighted composite</i>	<b>-.12**</b>	<b>-.14**</b>	<b>-.25**</b>	<b>-.26**</b>	<b>-.50**</b>	<b>-.60**</b>	<b>.33**</b>	<b>.35**</b>	<b>.14**</b>	<b>.15**</b>
<b>Wender Negative Affect</b>										
Michigan undergrads	<b>-.26**</b>	<b>-.27**</b>	<b>-.46**</b>	<b>-.33**</b>	-.17*	<b>-.26**</b>	<b>.44**</b>	<b>.43**</b>	-.03	<b>.19**</b>
Denver undergrads	<b>-.45**</b>	<b>-.34**</b>	<b>-.76**</b>	<b>-.41**</b>	<b>-.28**</b>	<b>-.37**</b>	<b>.74**</b>	<b>.61**</b>	.20	-.09
Michigan parents	-.14	-.25	<b>-.44*</b>	-.19	-.07	<b>-.29*</b>	<b>.39*</b>	<b>.40**</b>	<b>-.42*</b>	.01
Denver parents	-.14	<b>-.22**</b>	-.15	-.24	-.15	-.35	<b>.24*</b>	<b>.48**</b>	.15	.04
Bay Area parents	-.07	<b>-.25**</b>	-.00	<b>-.27**</b>	-.07	<b>-.26**</b>	<b>.31**</b>	<b>.60*</b>	.05	<b>.30**</b>
Michigan adult ADHD	-.18	-.22	-.42	<b>-.30*</b>	-.24	<b>-.48**</b>	<b>.49*</b>	<b>.63**</b>	-.21	.15
<i>weighted composite</i>	<b>-.22**</b>	<b>-.27**</b>	<b>-.37**</b>	<b>-.31**</b>	<b>-.16**</b>	<b>-.31**</b>	<b>.43**</b>	<b>.52**</b>	.03	<b>.11**</b>
<b>Wender Learning Problems</b>										
Michigan undergrads	.01	-.07	.04	.00	-.15*	-.08	.09	.11	<b>-.06</b>	<b>-.06</b>
Denver undergrads	.10	-.05	-.17	-.14*	.05	<b>-.26**</b>	-.01	<b>.25**</b>	<b>-.40**</b>	<b>-.12</b>
Michigan parents	<b>-.42*</b>	-.13	<b>-.40*</b>	-.16	-.31	-.17	.38	.20	<b>-.35</b>	<b>-.01</b>
Denver parents	.03	<b>-.20*</b>	<b>-.22*</b>	-.08	-.07	<b>-.22**</b>	.18	.08	<b>-.03</b>	<b>-.03</b>
Bay Area parents	<b>-.23**</b>	-.07	-.11	-.15	-.19*	-.06	<b>.30**</b>	.09	<b>-.30**</b>	<b>-.18*</b>
Michigan adult ADHD	-.07	-.18	.11	.00	<b>-.42*</b>	-.06	.25	<b>.30*</b>	<b>-.19</b>	<b>-.22</b>
<i>weighted composite</i>	-.04	<b>-.09**</b>	<b>-.09*</b>	-.06	<b>-.13**</b>	<b>-.14**</b>	<b>.15**</b>	<b>.15**</b>	<b>-.18**</b>	<b>-.09**</b>

Note. Predicted associations are set in bold. ADHD = attention-deficit/hyperactivity disorder; Wender = Wender–Utah Rating Scale; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience; M = men; W = women; Michigan = Mid-Michigan area; Bay Area = San Francisco Bay Area; undergrads = undergraduates.

\*  $p < .05$ . \*\*  $p < .01$ .

icant or failed to replicate across data sources. In short, findings were very similar to those reported for Attention Problems on the Wender–Utah scale in Table 2. The Hyperactivity-Impulsivity residual correlated with low Agreeableness across both self- and spouse reports on the Big Five. The other Big Five dimensions were not consistently related; a positive correlation with Extraversion held only in the self-reports. However, with regard to possible gender differences, it was noteworthy that for women but not men, the correlation of Hyperactivity with Extraversion was qualitatively larger than with (low) Agreeableness.

Overall, the pattern of correlations yielded a clear discriminant pattern for the two *DSM-IV* ADHD domain residuals. Thus, the

association of the overall *DSM-IV* ADHD score with Conscientiousness, Agreeableness, and Neuroticism may be explained in terms of distinct personality correlates of the two ADHD symptom domains: Attention problems related to low Conscientiousness and Neuroticism, and Hyperactivity-Impulsivity related to low Agreeableness.

With regard to replication of these findings across individual samples, Table 5 shows the self-report correlations separately for the three samples for which *DSM-IV* scales and Big Five scores were available. This table includes both residual and raw-score symptom scales, for completeness. The table shows that the correlations of low Conscientiousness, low Agreeableness, and Neu-

Table 4  
*Self- and Spouse Ratings on the Big Five and DSM-IV Overall ADHD Symptom Score and Residual Symptom Domains: Correlations Combined Across Samples*

DSM-IV domain	E			A			C			N			O		
	M	W	T	M	W	T	M	W	T	M	W	T	M	W	T
Overall ADHD symptoms															
Self-report Big Five	.01	.04	.03	<b>-.26**</b>	<b>-.22**</b>	<b>-.24**</b>	<b>-.39**</b>	<b>-.44**</b>	<b>-.42**</b>	<b>.23**</b>	<b>.24**</b>	.23**	.03	.15**	.10**
Spouse-report Big Five	-.08	-.14	-.10	<b>.31*</b>	<b>-.14</b>	<b>-.24*</b>	<b>-.40**</b>	<b>-.32*</b>	<b>-.36**</b>	<b>.30*</b>	<b>.32*</b>	.31**	-.24	-.22	-.23*
Inattention residual															
Self-report Big Five	-.09	<b>-.28**</b>	<b>-.22**</b>	.04	-.06	-.04	<b>-.44**</b>	<b>-.48**</b>	<b>-.46**</b>	<b>.14*</b>	<b>.29**</b>	.21**	.04	.08	.06
Spouse-report Big Five	-.07	-.23	-.16	.17	-.04	-.11	<b>-.32*</b>	<b>-.42*</b>	<b>-.37*</b>	<b>.08</b>	<b>.30*</b>	.17	.16	.11	-.14
Hyperactivity residual															
Self-report Big Five	.16**	.33**	.24**	<b>-.22**</b>	<b>-.14**</b>	<b>-.19**</b>	-.01	.03	.02	.10	-.03	.01	.03	.07	.04
Spouse-report Big Five	.04	.16	-.01	<b>-.30*</b>	<b>-.12</b>	<b>-.24*</b>	-.25	.22	-.04	<b>.38**</b>	-.05	.17	.20	.10	-.16

Note. Primary predicted associations are set in bold. For self-report,  $n = 734$ ; for spouse report,  $n = 107$ . DSM-IV = Diagnostic and Statistical Manual of Mental Disorders (4th ed., American Psychiatric Association, 1994); ADHD = attention-deficit/hyperactivity disorder; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience; M = men; W = women; T = total; Inattention residual = DSM-IV inattention-disorganization score after the effect of hyperactivity-impulsivity was controlled through regression; Hyperactivity residual = DSM-IV hyperactivity-impulsivity score after the effect of inattention-disorganization was controlled through regression.  
 \*  $p < .05$ . \*\*  $p < .01$ .

roticism with the overall ADHD score generally replicated across samples. The only difference between raw and residualized Inattention scores involved, as expected, Agreeableness: the raw scores had a secondary correlation (mean  $r = -.19$ ), which

disappeared when the effects of Hyperactivity were controlled (i.e., in the residual scores). Similarly, the raw scores on Hyperactivity had a secondary correlation with Conscientiousness (mean  $r = -.21$ ), which disappeared in the residual scores that control

Table 5  
*Correlations of DSM-IV ADHD Symptom Scales and Self-Reported Big Five Domains in Adulthood for Each Sample*

DSM-IV symptom domains by sample	E			A			C			N			O		
	M	W	T	M	W	T	M	W	T	M	W	T	M	W	T
Overall ADHD															
Michigan undergrads	-.02	.07	.04	<b>-.21**</b>	<b>-.19**</b>	<b>-.20**</b>	<b>-.38**</b>	<b>-.38**</b>	<b>-.38**</b>	<b>.20**</b>	<b>.18**</b>	<b>.19**</b>	.12	.15**	.14**
Michigan parents	-.11	-.07	-.09	<b>-.18</b>	<b>-.25*</b>	<b>-.22*</b>	<b>-.39**</b>	<b>-.45**</b>	<b>-.42**</b>	<b>.34**</b>	<b>.25*</b>	<b>.30**</b>	-.26*	.14	-.06
ADHD adults	.37*	.02	.16	<b>-.18</b>	<b>-.29*</b>	<b>-.25*</b>	<b>-.47**</b>	<b>-.74**</b>	<b>-.65**</b>	<b>.19</b>	<b>.50**</b>	<b>.39**</b>	.04	.13	.10
Inattention raw															
Michigan undergrads	-.12	-.13*	-.16**	-.14*	-.15**	-.19**	<b>-.52**</b>	<b>-.49**</b>	<b>-.50**</b>	.23**	.28**	.22**	.12	.14*	.11*
Michigan parents	-.10	-.10	-.13	-.13	-.19	-.20*	<b>-.38**</b>	<b>-.52**</b>	<b>-.46**</b>	.28*	.26*	.23**	-.25	.15	-.08
ADHD adults	.28	-.14	.02	-.02	-.27	-.19	<b>-.60**</b>	<b>-.81**</b>	<b>-.73**</b>	.24	.55**	.41**	.03	.13	.11
Inattention residual															
Michigan undergrads	-.16*	-.29**	-.26**	-.01	-.04	-.05	<b>-.44**</b>	<b>-.41**</b>	<b>-.42**</b>	.15*	.26**	.20**	.06	.06	.05
Michigan parents	-.07	-.12	-.11	-.03	-.10	-.09	<b>-.30*</b>	<b>-.52**</b>	<b>-.43**</b>	.13	.26*	.16	-.19	.14	-.02
ADHD adults	.06	-.32*	-.18	.22	-.19	-.05	<b>-.57**</b>	<b>-.72**</b>	<b>-.67**</b>	.24	.50**	.39**	.01	.11	.09
Hyperactivity raw															
Michigan undergrads	.06	.23**	.12*	<b>-.21**</b>	<b>-.17**</b>	<b>-.22**</b>	-.15*	-.16**	-.15**	.12	.04	.04	.09	.12*	.09*
Michigan parents	-.12	-.00	-.11	<b>-.22</b>	<b>-.28*</b>	<b>-.29**</b>	-.37**	-.21	-.31**	.38**	.18	.25**	-.25	.09	-.13
ADHD adults	.39*	.19	.28*	<b>-.30</b>	<b>-.26</b>	<b>-.30**</b>	-.29	-.54**	-.44**	.12	.36*	.23*	.05	.10	.09
Hyperactivity residual															
Michigan undergrads	.13	.32**	.22**	<b>-.15*</b>	<b>-.11*</b>	<b>-.15**</b>	.11	.09	.10	.02	-.11	-.07	.04	.06	.04
Michigan parents	-.09	.10	-.03	<b>-.25</b>	<b>-.14</b>	<b>-.23**</b>	-.25	.24	-.01	.37**	-.03	.14	-.18	-.04	-.12
ADHD adults	.34	.39*	.36**	<b>-.39*</b>	<b>-.12</b>	<b>-.25*</b>	.01	-.05	-.03	-.01	.03	-.01	.04	.03	.04

Note. Predicted associations are set in bold. Residual scores are scores after the effects of the other factor have been removed through regression (see Table 4 note). DSM-IV = Diagnostic and Statistical Manual of Mental Disorders (4th ed., American Psychiatric Association, 1994); ADHD = attention-deficit/hyperactivity disorder; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience; M = men; W = women; T = total; Michigan = Mid-Michigan area; undergrads = undergraduates; Inattention = DSM-IV inattention-disorganization; Hyperactivity = DSM-IV hyperactivity-impulsivity.  
 \*  $p < .05$ . \*\*  $p < .01$ .

Table 6  
*Achenbach (1997) Current Adult ADHD Symptoms Related to Big Five Dimensions:  
 Partial Correlations from Simultaneous Regression Models for Broadband Summary  
 and Narrowband Symptom Scales*

Adult symptoms	Big Five Domain				
	E	A	C	N	O
Broadband summary scales					
Overall ADHD	.28*	<b>-.44**</b>	<b>-.33**</b>	<b>.37**</b>	-.06
Externalizing	.30**	<b>-.59**</b>	-.20	.30**	-.07
Internalizing	<b>-.33**</b>	-.05	-.02	<b>.66**</b>	.05
Narrowband symptom scales					
Withdrawn	<b>-.51**</b>	-.26*	.18	<b>.40**</b>	.12
Intrusive	<b>.46**</b>	<b>-.37*</b>	-.19	.24*	-.13
Aggressive Behavior	-.01	<b>-.61**</b>	.01	.36**	-.02
Delinquent Behavior	.13	<b>-.36**</b>	<b>-.24*</b>	.00	.01
Attention Problems	.20	-.20	<b>-.57**</b>	<b>.25*</b>	-.06
Anxious/Depressed	<b>-.33**</b>	-.05	-.02	<b>.66**</b>	.05
Somatic Complaints	-.08	-.14	.13	<b>.46**</b>	-.15
Thought Problems	-.03	-.06	-.03	.30**	.26*

*Note.* Predicted associations are set in bold. Adult symptom scales are from the Achenbach (1997) Young Adult Self-Report. ADHD = attention-deficit/hyperactivity disorder; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience; Overall ADHD = sum of attention problems, intrusive behavior, and aggressive behavior; Externalizing = intrusive + aggressive + delinquent; Internalizing = anxious/depressed + withdrawn.

\*  $p < .05$ . \*\*  $p < .01$ .

for Inattention. Otherwise, findings for Hyperactivity resembled the composite shown in Table 4, with similar effect sizes across samples. We found a positive correlation with Extraversion in two samples for self-report data (Table 5), but not for spouse data.

#### *Relations Between Current Adult Symptoms and the Big Five*

For the Michigan clinical sample (see Table 1), participants were diagnosed according to ADHD research-diagnostic criteria based in large part on a detailed clinical interview as described in the *Method* section. Current adult problems in multiple domains were assessed with Achenbach's (1997) symptom scales. Because this sample includes clinically diagnosed individuals and non-ADHD controls, the intercorrelations among the Big Five dimensions (particularly Agreeableness, Conscientiousness, and Neuroticism) are likely to be somewhat biased. To control for these correlations and examine unique links between the Big Five and the symptom scales, we used regression analyses, rather than correlations, for this sample.<sup>2</sup> Table 6 shows the partial correlations derived from multiple regression models. In each model, each Big Five dimension serves as a predictor whereas the other four Big Five dimensions are controlled. The relevant Achenbach scale serves as the outcome variable.

As Table 6 shows, our composite score of adult symptoms demonstrated the same pattern we had seen in the measures of recalled childhood symptoms: low Conscientiousness, low Agreeableness, and high Neuroticism. In addition, there was a positive association with Extraversion. With regard to the specific ADHD-related symptom domain scales, Achenbach Attention Problems were primarily and substantially associated with low Conscientiousness, and secondarily with Neuroticism, closely paralleling

our findings from the childhood symptom data. Achenbach Aggressive Behavior (which best matched Wender–Stein Conduct-Impulsivity) was most associated with low Agreeableness, also as expected. The Intrusive scale (which best matched *DSM-IV* Hyperactivity-Impulsivity) was associated with low Agreeableness and high Extraversion.

Two additional Achenbach scales are of interest to replicate findings for childhood Wender–Stein symptom domain scales. Like the Negative Affect scale, Achenbach's Anxious/Depressed scale was strongly related to Neuroticism. Like the Social Problems scale, Withdrawn behavior was strongly related to low Extraversion. What is most important about all these results, however, is that the adult behavior problems generally replicated the pattern of findings we obtained for the corresponding scales in the childhood symptom data, thus giving us greater confidence in their generalizability.

Table 6 also includes the Big Five associations for Achenbach's other problem scales, because these are likely to be of interest to personality researchers. For example, the negative association between Achenbach Delinquent Behavior and low Agreeableness and Conscientiousness extends to adulthood earlier findings based on children (John et al., 1994) and parallels findings for antisocial personality (Miller & Lynam, in press). It was notable, however, that the relation of Conscientiousness was much larger with attention problems than with delinquency, suggesting that future studies

<sup>2</sup> The simple correlations showed a similar (but, unsurprisingly, somewhat less discriminant) pattern of findings and are available from the authors upon request.

Table 7  
*Adults Diagnosed with ADHD Compared With Non-ADHD Controls: Mean Big Five Scores, ANCOVA Results (Age and Gender Covaried), and Effect-Size Measures*

Big Five domain	Group		$F(1, 56)$	$p$	$d$	ADHD percentile (%)
	ADHD	Control				
Extraversion	32.0 (7.2)	31.3 (4.7)	< 1.0	<i>ns</i>	0.12	55
Agreeableness	<b>29.7</b> (6.0)	33.3 (5.9)	5.1	.03	-0.61	27
Conscientiousness	<b>22.3</b> (7.6)	34.6 (5.2)	45.4	< .001	-1.95	3
Neuroticism	<b>26.4</b> (8.7)	19.2 (7.3)	17.6	< .001	0.90	82
Openness	31.6 (5.8)	30.7 (5.9)	< 1.0	<i>ns</i>	0.15	56

*Note.* ADHD means for predicted differences are set in bold. Standard deviations are shown in parentheses.  $F$  is from an analysis of covariance (ANCOVA) with age and gender covaried;  $d$  = group differences in standard deviation ( $z$  score) units (Cohen & Cohen, 1983); ADHD = attention-deficit/hyperactivity disorder; ADHD percentile = percentile of ADHD group mean in normal ( $z$ ) distribution versus standardization sample.

of delinquency may do well to control for attention problems.<sup>3</sup> Agreeableness, however, was related to both intrusive/aggressive behavior and delinquent behavior.<sup>4</sup> Considering Table 6 overall, it is striking that with one exception (delinquent behavior), all of the problem-behavior domains showed a secondary association with Neuroticism, underscoring the maladjusted negative affect shared by all these symptoms.

Finally, we considered the association of the interview-based clinical diagnosis of adult ADHD with the Big Five self-reports. We compared the participants diagnosed with clinical levels of ADHD (including both combined and inattentive subtypes and omitting those who failed to reach research diagnostic cutoffs) to the non-ADHD control participants. For each Big Five dimension, we conducted an analysis of covariance (ANCOVA), controlling for differences due to gender and age. The results of these ANCOVAs are given in Table 7, along with means, standard deviations, and Cohen's  $d$  (Cohen, 1988) as a measure of the effect size in terms of standard-deviation units. The table also provides the percentile rank of the ADHD group mean for each of the Big Five.

As before, the overall ADHD diagnosis was related to low Conscientiousness, low Agreeableness, and high Neuroticism; it was unrelated to Extraversion or to Openness. These effects were substantial in magnitude (see Table 7). The control participants scored very close to the population means on the Big Five scales (Costa & McCrae, 1992), so the clinical group scores can be evaluated in distributional terms. On Conscientiousness, the ADHD-diagnosed individuals represent a very extreme group, scoring on average two standard deviations below the mean (approximately 34.5 in the norm group; Costa & McCrae, 1992), and thus in the lowest third percentile. Put another way, 73% of the ADHD individuals had Conscientiousness scores below the third percentile, and 54% had scores below even the first percentile. Effects were also large for Agreeableness, on which the ADHD group mean was at the 27th percentile (one standard deviation below the controls), and Neuroticism, on which the ADHD mean was at the 82nd percentile (over half a standard deviation from the controls; see Table 7). Overall, our findings point to ADHD as an extreme group in terms of personality traits.

### Summary

To facilitate a focus on the most replicable results and on the magnitude of effects across all studies, we summarize the major findings in Table 8 at the level of "overall" ADHD symptom totals. ADHD symptoms were consistently and robustly related to three of the Big Five dimensions: low Conscientiousness, low Agreeableness, and high Neuroticism. Effects were generally largest for Conscientiousness. The findings for Extraversion and Openness illustrate the potential danger of relying on only one instrument or one data source. For example, consideration of only the Wender-Utah scale and self-reports of personality would indicate that ADHD is related negatively to Extraversion and positively to Openness. Yet, the correlations for the other instruments and across data sources suggested that there is no reliable association, in either direction, between Extraversion or Openness and ADHD symptoms. Table 8 also includes multiple correlations derived from regressions predicting each ADHD measure from all Big Five dimensions simultaneously. These provide a preliminary answer to the question of whether personality traits can fully explain ADHD symptom reports. The multiple correlations averaged about .55, suggesting substantial links, but far from empirical equivalence, even when imperfect measurement reliability is taken into account. The Big Five accounted for a substantial proportion of the variance in ADHD symptoms in the clinical sample; variance proportions were notably more modest in the samples of parents and students.

<sup>3</sup> With attention problems controlled in a regression model, the association of delinquency with Conscientiousness was nonsignificant (partial  $r = -.12$ ,  $p = ns$ ). When delinquency was controlled, attention problems were still related to Conscientiousness (partial  $r = -.68$ ,  $p < .01$ ).

<sup>4</sup> When the relevant Achenbach scales were entered into a regression to predict Big Five dimensions in an effort to establish specificity of associations, Agreeableness was related to delinquency (partial  $r = -.33$ ,  $p < .01$ ) but not to intrusiveness (partial  $r = -.19$ ,  $p = ns$ ). Extraversion was related to intrusiveness (partial  $r = .25$ ,  $p = .02$ ) but not to delinquency (partial  $r = .02$ ,  $p = ns$ ). Thus, the link of the "second" ADHD dimension with low Agreeableness may be related in part to the overlap of hyperactivity-impulsivity and antisocial behavior. Investigation of the specificity of this link is an important direction for future research.

Table 8  
*Summary of Correlations of Overall ADHD Symptom Scores with the Big Five by ADHD Measures and by Same or Different Data Source for ADHD and Big Five Measurement*

ADHD measure and reporter	Big Five reporter	E	A	C	N	O	Multiple <i>R</i>
Same data source							
Wender-25/self	Self	<b>-.20*</b>	<b>-.41*</b>	<b>-.38*</b>	<b>.47*</b>	.12*	.58
<i>DSM-IV</i> /self	Self	.03	<b>-.24*</b>	<b>-.42*</b>	<b>.23*</b>	.09	.52
Achenbach/self	Self	.04	<b>-.36*</b>	<b>-.54*</b>	<b>.52*</b>	.08	.70
Unweighted <i>M</i>		-.04	-.34*	-.45*	.41*	.10	.60
Different data source							
Wender-25/self	Spouse	-.05	<b>-.21*</b>	<b>-.25*</b>	<b>.33*</b>	.01	.36
<i>DSM-IV</i> /self	Spouse	-.10	<b>-.24*</b>	<b>-.36*</b>	<b>.31*</b>	-.23*	.45
Diagnosis/interview	Self	.05	<b>-.30*</b>	<b>-.66*</b>	<b>.45*</b>	.08	.70
Unweighted <i>M</i>		-.04	-.25*	-.42*	.36*	-.05	.50
Grand <i>M</i>		.03	-.29*	-.44*	.39*	-.02	.55

*Note.* Within the table, correlations of .20 and larger are set in bold. To permit direct comparison, the Achenbach (1997) correlations are zero-order correlations in this table. ADHD = attention-deficit/hyperactivity disorder; E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism; O = Openness to Experience; *DSM-IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., American Psychiatric Association, 1994).

\*  $p < .05$ .

### General Discussion

This research presents the most definitive examination to date of the Big Five in relation to symptoms of ADHD. ADHD is known as a childhood syndrome of major theoretical and social concern, but its link with adult characteristics is not fully understood. Links between personality traits and ADHD symptoms, both concurrent and recalled from childhood, are of interest for several reasons: enabling the knowledge base in personality to be brought to bear on improving our understanding of the underpinnings of ADHD, clarifying the determinants of adult symptom ratings that inform clinical assessment, and informing developmental hypotheses about how early ADHD symptoms partake in the later development of personality. Within the limits of our design, the data suggest several interpretations that should spark further prospective investigations.

#### *Measures of Overall ADHD Symptoms and the Big Five*

As we noted in our *Method* section, the three measurement approaches to assessing ADHD symptom domains yielded respectable convergences that suggest some construct validity for a broad conception of ADHD. This was consistent across child and adult symptom profiles, although there were some differences as well. It should be noted that after we began data collection for this project, additional normative instruments for assessing ADHD in adults have become available (Brown, 1996; Conners, Erhardt, & Sparrow, 1999). Replication of the present findings with those measures will be needed. Nevertheless, the clear pattern of findings linked ADHD symptoms with low Conscientiousness, low Agreeableness, and high Neuroticism. Links with Extraversion, although observed in some self-report measures, were not confirmed when using spouse reports of the Big Five.

It is important to recognize that the clinical sample obtained here may not be representative of all children who grow up to have ADHD symptoms. Our clinical sample was largely composed of

college students; although there is growing concern about the incidence of ADHD in college samples (Wolf, 2001), many children with ADHD do not go on to attend college (Weiss et al., 1999). Thus, studies of other clinical samples will also be of interest and might show even stronger personality correlates than we observed in our relatively high-functioning clinical sample. It is also important to note that the present research relied on self-report symptom ratings and a structured interview (in one study) to assess ADHD symptoms. Although these are commonly used methods in the literature, future research needs to include other data sources in assessing ADHD symptoms, such as parental reports of childhood symptoms (Ward et al., 1993) and spouse or peer reports of current adult symptoms (Downey et al., 1997). Although the literature is limited as to whether recall bias might affect adults' reports of their childhood ADHD symptoms, findings so far suggest that there may be an underreporting bias on the part of individuals who experienced ADHD symptoms in childhood (see Barkley, 1998, for review and discussion). Such a response bias would serve to attenuate the personality-to-ADHD links observed.

A check on results with prospective studies of children or with observer ratings of ADHD symptoms in childhood or adulthood also will be important to tease apart the extent to which the current pattern of findings may be due to the influence of current personality traits on recalled childhood behaviors. It may be that the observed associations would be somewhat more modest in magnitude, especially in view of the long time periods at issue, with a prospective methodology.

Nonetheless, the substantial associations observed suggest important links, but not equivalence, between ADHD symptoms and personality traits. Overall, in considering the summary data provided (see Table 8), 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. Although our data do not directly address

causality, they raise the possibility of at least two different causal processes. One is that extreme standing on early precursors to personality traits (e.g., biological or temperament characteristics) may co-occur with other activating variables in development to contribute to onset and persistence of ADHD symptoms. Because such contextual and ecological factors, including family and school contexts, do play an important role in moderating the development and expression of the ADHD syndrome and its outcomes (Hencker & Whalen, 1999), it would be an oversimplification to view temperament as wholly determinative.

In fact, another possibility is that ADHD symptoms, along with temperament and other experiential factors, contribute to the development of adult personality traits. Indeed, the adult outcomes of ADHD symptoms in childhood, which are only now beginning to be mapped, sometimes include personality disturbance, both in terms of antisocial personality and other Axis II disorders (Tzelepis et al., 1995). If the current results are taken at face value, it may be that one subclinical manifestation of a range of ADHD symptom severity in childhood is to shape personality traits in adulthood. The latter possibility will be an interesting focus in future prospective studies. For example, it would be of value to examine Conscientiousness in adult twins discordant for ADHD.<sup>5</sup> With these considerations in mind, we consider further the results relating specific symptom domains and traits.

### *Two Major ADHD Symptom Domains and the Big Five*

Although the two major symptom domains of ADHD are substantially correlated (about .50), they have different patterns of external correlates. Symptoms of inattention-disorganization are associated with learning problems and with internalizing symptoms, such as anxiety and depression; hyperactive-impulsive symptoms are associated more strongly with aggression, antisocial behavior, peer rejection, and global functional impairment (Lahey et al., 1994; Lahey & Willcutt, 1998; McBurnett et al., 1999; Willcutt, Pennington, Chhabildas, Friedman, & Alexander, 1999). Thus, we both expected and observed a differential pattern of personality correlates for these two domains.

The most consistently defined ADHD symptom domain, attention problems, was uniformly and strongly associated with low Conscientiousness. The Hyperactivity-Impulsivity domain in *DSM-IV* differed somewhat from its closest match in the other approaches. Nonetheless, all were consistently related to low Agreeableness. Achenbach adult intrusiveness (the closest match with *DSM-IV* childhood Hyperactivity-Impulsivity), however, was also related to high Extraversion.

The association with Extraversion may be limited to self-reports, as was true for *DSM-IV* Hyperactivity. The findings using clinical diagnoses supported the association of ADHD with Agreeableness but not Extraversion. However, it was notable that this pattern for the *DSM-IV* symptoms (see Table 4) was not equally clear for men and women. ADHD symptoms in women may be associated more with Extraversion than (low) Agreeableness, whereas the reverse may be true in men, suggesting an intriguing direction for further examination of possible sex differences in expression of ADHD. To clarify the role of Extraversion, future research needs to examine the facet-level scales of the Big Five (Costa & McCrae, 1992), or use other trait models of personality that distinguish between the activity-level, sociability, and

positive-emotion components of Extraversion. ADHD symptoms may be positively associated with some facets of Extraversion, such as excitement seeking, and negatively associated with others, such as warmth.

Cutting across the Attention and Hyperactivity-Impulsivity domains, Neuroticism played a notable secondary role. This secondary effect appeared to be rather consistent for attention problems, but smaller and less consistently observed for hyperactivity-impulsivity. The higher order association established here also needs to be followed up both with regard to facets of Neuroticism (in particular, relatively "internalizing" vs. relatively "externalizing" components) and with regard to ADHD subtypes and comorbidity. In the most general terms, then, our findings for the two major symptom domains suggest the following conclusion: overall ADHD symptoms are related to low Conscientiousness, low Agreeableness, and high Neuroticism. This association is explained by the fact that ADHD has at least two major components: one is related to low Conscientiousness and secondarily to high Neuroticism, whereas the other relates to low Agreeableness and, under some models, to Neuroticism. The primary findings in relation to ADHD each warrant further comment.

*Links with low conscientiousness.* The link of core symptoms of ADHD with low Conscientiousness is interesting for several reasons. From a theoretical developmental viewpoint, it might suggest one route to ADHD development. Early temperament precursors of Conscientiousness, such as the effortful control dimension identified by Rothbart and colleagues (Derryberry & Rothbart, 1997; Rothbart & Ahadi, 1994; Rothbart & Bates, 1998), develop in the toddler years in conjunction with early development of the prefrontal cortex. This temperament dimension has been related to the ability to regulate attention. One implication of our data taken together with the developmental data (Rothbart & Bates, 1998) may be that when this trait develops in the direction of poor control, ADHD symptoms emerge in the inattentive-disorganization domain. In adulthood, the residual effect may be extremely low Conscientiousness, as we observed in our patient sample. Prospective studies of temperament, ADHD, and personality will be of interest to evaluate this possibility further.

This scenario also would be consistent with extensive neuropsychological investigations that associate ADHD symptoms with problems in executive control functions such as behavioral inhibition and working memory (Barkley, 1997; Pennington & Ozonoff, 1996). Conscientiousness thus may be the normal-trait marker for the prefrontally mediated domain of executive functioning described in the neuropsychological literature (Nigg, 2000, 2001). This interpretation is also consistent with findings that Conscientiousness is the only dimension in the Big Five taxonomy that is consistently related to school and work performance (John & Srivastava, 1999). Further neuropsychological executive function studies that incorporate Conscientiousness and ADHD symptoms would test this conjecture.

*Links with low agreeableness.* Second, the *DSM-IV* Hyperactivity-Impulsivity symptoms appeared to have unique associations with low Agreeableness. This association speaks to both the overlap with oppositional behavior of the hyperactivity-impulsivity domain in ADHD, and also to the propensity to antisocial hostile

<sup>5</sup> We are indebted to an anonymous reviewer for this suggestion.

acting out in association with elevated hyperactivity-impulsivity symptoms (Hinshaw, 1987; Lahey, Waldman, & McBurnett, 1999; Robins, 1991). Biological parents of children diagnosed with ADHD plus comorbid oppositional or conduct problems have themselves higher Neuroticism and lower Agreeableness than parents of children diagnosed with pure ADHD (Nigg & Hinshaw, 1998), suggesting that some of this association may be due to the comorbid symptoms that frequently accompany the hyperactivity-impulsivity domain. This finding also highlights, however, the interpersonal nature and consequences of many hyperactivity-impulsivity symptoms. Many of the symptoms measured in the *DSM-IV* list pertain to intrusive or inconsiderate interpersonal behaviors likely to trouble or upset others over the long run.

*Links with high Neuroticism.* A third finding was that high Neuroticism was associated with core inattention-disorganization symptoms, whereas we observed only in some samples and with some measures an association of Neuroticism with hyperactivity-impulsivity. The former association may be due in part to the comorbidity of inattention symptoms with anxiety/depression, and may need to be further elucidated in relation to the ADHD subtypes in *DSM-IV*. Certainly, the possible role of Neuroticism in ADHD is intriguing; although not part of the diagnostic criteria, clinical observations frequently include difficulties with negative affect, anger, dysphoric mood, and anxiety.

#### *Other Links in the Literature*

Considering our findings in a broader context, we noted earlier that antisocial personality disorder is a taxonomic “near neighbor” of ADHD (although it appears on Axis II of *DSM-IV*) and also relates to low Agreeableness and low Conscientiousness (Miller & Lynam, in press). However, in the literature on Big Five and personality disorders, ADHD symptoms have not been considered, making it difficult to know whether these personality links are specific to ADHD or shared with antisocial symptoms. For some preliminary evidence, we can consider the partial correlations we reported in Table 6 (as well as Footnotes 3 and 4). For example, low Conscientiousness was associated primarily with attention problems rather than with aggression and delinquent behavior (which are central to antisocial personality). Conversely, Agreeableness was related more strongly to aggression and delinquent behavior than to attentional problems (which are more central to ADHD). Thus, ADHD and antisocial personality may differ in their relative strength of associations with Conscientiousness and Agreeableness, with attention problems and their link to Conscientiousness an important differentiating characteristic. These are important issues for future research. Another interesting link involves recent work by Big Five personality researchers on the combination of high Agreeableness and high Conscientiousness. These characteristics may be described as socialization (Digman, 1997) or moral character (Paulhus & John, 1998), suggesting that individuals with ADHD (and antisocial personality) lack in socialization and the development of morality. In short, the combination of these two Big Five dimensions is of interest to a number of theoretical perspectives and warrants further research attention. Yet caution is warranted before moving too quickly to a single broadband summary of ADHD (e.g., “externalizing”). The results reported here support the notion that ADHD needs to be understood in multidimensional terms (APA, 2000), perhaps as a con-

fluence of more than one disturbance (see Nigg, 2001). The next step will be to examine the unique relation of personality traits to ADHD symptoms in conjunction with comorbid externalizing and internalizing problems. Along the same lines, we noted that the different ADHD assessment tools used in the field vary in their bandwidth. This highlights the need for further development of appropriate adult-specific criteria for ADHD, an effort to which personality theory may contribute.

#### *Conclusions*

From a process viewpoint, our findings are consistent with the idea that either ADHD occurs at the extremes of normal personality variation through shared precursors in temperament or early neural development (as implied in the preceding discussion) or that ADHD symptoms contribute to the development of personality traits. ADHD is often thought to emerge from atypical development of prefrontal neural systems and their associated neuropsychological executive functions (Barkley, 1997; Pennington & Ozonoff, 1996). Critical personality traits, such as Conscientiousness, can also be linked theoretically with these same neural systems (Nigg, 2000; Rothbart & Bates, 1998). Conscientiousness may represent another level of analysis, distinct from neuropsychological measures, of these neural systems (and a related argument might be made for other traits). When seen in this light, the present findings are in many ways consistent with neuropsychological models of ADHD. However, like neuropsychological measures (Nigg, 2000), personality traits do not fully explain ADHD symptom variation. Thus, these personality characteristics are likely best viewed as one element in larger transactional models needed to fully account for this persistent disorder or to map its adult outcomes.

More specifically, the data here show that the ADHD domain of attention problems is related substantially to low Conscientiousness and more modestly with Neuroticism. The ADHD domain of hyperactivity-impulsivity is related to low Agreeableness. Extraversion, as defined by the Big Five, was not related to ADHD symptoms when different data sources were taken into account. This picture was replicated in multiple samples. These findings enable new linkages to be made with personality theory that can shed light on likely long-term outcomes for children and adults with ADHD symptoms and provide clues to developmental pathways. The findings thus suggest directions for theories of ADHD development as well as for refinements in the assessment of ADHD, and point to the value to ADHD research of incorporating more careful analysis of personality traits in considering both causal mechanisms and adult outcomes.

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Received January 10, 2001

Revision received February 28, 2002

Accepted March 6, 2002 ■