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The Relationship Between Cognitive Distortions and ADHD After Accounting for Depression, Anxiety, and Personality Pathology

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THE RELATIONSHIP BETWEEN COGNITIVE DISTORTIONS

AND ADHD AFTER ACCOUNTING FOR DEPRESSION, ANXIETY, AND

PERSONALITY PATHOLOGY

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Submitted in Partial Fulfilment of the Requirements for the Degree of

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DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by Amelia D. Serine on the 26th day of

September, 2016, in partial fulfillment of the requirements for the degree of Doctor of

Psychology, has been examined and is acceptable in both scholarship and literary quality.

Committee Members' Signatures:

       Chairperson

       Chair, Department of Psychology

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Abstract

Adults with attention-deficit/hyperactivity disorder (ADHD) suffer from numerous

difficulties in daily functioning and, unfortunately, the medications that are typically the

first-line of treatment do not ameliorate many of these issues. Psychosocial treatments,

such as cognitive behavioral therapy, are increasingly demonstrating effectiveness both in

conjunction with medication and as stand-alone treatments for ADHD. It is theorized

that some of the problems associated with adult ADHD result from cognitive distortions.

Previous studies have identified a preliminary relationship between cognitive distortions

and ADHD, but these studies did not measure personality pathology, which might explain

part of the findings, given that personality disorders are highly comorbid with ADHD and

cognitive distortions. The purpose of the current study was to determine the relationship

between cognitive distortions and ADHD after accounting for personality pathology,

depression, and anxiety. Results demonstrated that the previously identified relationship

between cognitive distortions and ADHD disappears once personality pathology,

depression, and anxiety are taken into consideration. As such, it appears that the

relationship between ADHD and cognitive distortions can be explained by the existence

of comorbidities and that cognitive distortions are not inherent to a diagnosis of ADHD

itself. These findings may lend support to the hypothesis that adult ADHD is a disorder

of deficit and not distortion.

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Chapter 1: Introduction

Statement of the Problem

Attention-deficit/hyperactivity disorder (ADHD) is characterized by the presence of pervasive inattentive and/or hyperactive-impulsive symptoms significant enough to interfere with daily functioning (*Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. [*DSM-5*]; American Psychiatric Association [APA], 2013). ADHD begins in childhood and, although it is typically diagnosed in children, is now considered a lifelong disorder that continues into adulthood for many individuals (Young, Toone, & Tyson, 2003). Indeed, some suggest that approximately 46% of children diagnosed with ADHD continue to meet diagnostic criteria as adults (Kessler et al., 2010). Overall, a conservative estimate of the prevalence of ADHD in adults ranges from 2.5% to 4.4% (Faraone & Biederman, 2005; Kessler et al. 2006; Simon, Czobor, Balint, Meszaros, & Bitter, 2009), which represents a slight decline when compared to the prevalence rate of 5% in children (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). It is important to note, however, that this adult prevalence rate is likely attenuated because adults with ADHD tend to underreport the severity of their symptoms (Kooij et al., 2008; Manor et al., 2012).

The individual, social, and societal impact of an ADHD diagnosis is significant and wide-ranging. The negative effect of ADHD on daily life, social relationships, risk-taking behavior, productivity, finances, and mental health has been well documented across numerous countries (Brod, Pohlman, Lasser, & Hodgkins, 2012), suggesting that individuals with ADHD experience similarly significant impairments and difficulties irrespective of cultural background. Across cultures, adults diagnosed with ADHD often

struggle with work performance and attendance (de Graaf et al., 2008), which likely

results in work-related problems, such as unemployment or an inability to maintain

financial stability (Kessler et al., 2006). These difficulties may also lead to business-level

problems, such as a loss of productivity and profit. Adults with ADHD have higher

healthcare costs than those without ADHD (Swensen et al., 2003) and are more likely to

be obese (Cortese et al., 2008), which may further exacerbate health problems and costs,

as well as decrease quality of life and interpersonal satisfaction. Further, there is

evidence demonstrating that adults with ADHD experience greater conflict in their

interpersonal relationships (Kessler et al., 2006). Finally, adults with ADHD have a

higher likelihood of being physically injured and of being involved in a serious motor

vehicle accident (Chang, Lichtenstein, D'Onofrio, Sjolander, & Larsson, 2014; Merrill,

Lyon, Baker, & Gren, 2009), which also leads to increased individual and societal

problems.

In addition to these individual, social, and societal issues, many of those with

ADHD have additional psychiatric diagnoses, which further decrease their quality of life

and contribute to their functioning difficulties. Between 56% and 89% of individuals

with ADHD will have one or more additional psychiatric conditions in their lifetime

(McGough et al., 2005; Sobanski, 2006). Of these comorbid conditions, personality

disorders appear to be the most prevalent, found at a rate of 50.7% to 78.5% (Cumyn,

French, & Hechtman, 2009; Jacob et al., 2007), followed by co-occurring anxiety

disorders, with a prevalence as high as 47.1% (Biederman, Faraone, Spencer, & Wilens,

1993; Kessler et al., 2006; Sobanski, 2006), and co-occurring depressive disorders, with a

prevalence ranging from 38.3% to 50% (Biederman et al., 1993; Kessler et al., 2006).

These conditions are followed closely by substance use disorders, at 15.2% (Kessler et al., 2006). The presence of these comorbidities is problematic because it increases the difficulty of making an accurate diagnosis, developing appropriate treatment strategies, and achieving successful treatment outcomes.

In addition to comorbid diagnoses, adults with ADHD are also reported to perceive events in distorted ways (Abramovitch & Schweiger, 2009), commonly referred to as cognitive distortions (Beck, 1967; Burns, 1980). The presence of cognitive distortions could have a significant negative impact on those with ADHD because being able to perceive events in an undistorted way is an important part of successful functioning and resiliency (Neenan, 2009). There is evidence demonstrating that adults with ADHD engage in a significantly higher rate of cognitive distortions than non-psychiatric controls, and that adults with ADHD plus comorbid depression engage in even more cognitive distortions than those with ADHD alone (Mitchell, Benson, Knouse, Kimbrel, & Anastopoulos, 2013). Nevertheless, the Mitchell et al. (2013) study and others like it (Abramovitch & Schweiger, 2009; Strohmeier, 2013; Torrente et al., 2014) have not examined the impact of personality pathology in relation to ADHD and cognitive distortions. Consequently, failing to control for personality pathology within the relationship between ADHD and cognitive distortions demonstrates a clear limitation, as personality disorders correlate highly with cognitive distortions (Rosenfield, 2004). This omission is especially significant given the high rates of comorbid personality disorders in the ADHD population.

Chapter 2: Literature Review

Adult Attention-Deficit/Hyperactivity Disorder

According to the *DSM-5*, a diagnosis of ADHD is warranted when an individual

presents with a persistent pattern of inattentiveness and/or hyperactivity-impulsivity

across multiple settings (APA, 2013). These symptoms must cause significant distress or

impairment in functioning, and there must be some inattentive or hyperactive-impulsive

symptoms evident before the age of 12 (APA, 2013). ADHD is no longer considered to

be a childhood disorder, because there is significant evidence demonstrating that ADHD

symptoms persist into adulthood with some of the same patterns of psychopathology,

cognitive dysfunction, and maladaptive functioning as children with ADHD (Biederman

et al., 1993). Whereas adults are no longer believed to grow out of this disorder, the

symptom presentation for adults with ADHD changes, in that the hyperactivity-

impulsivity tends to wane over time (with some retaining an inner restlessness) and

inattentiveness becomes a more prominent feature (Kessler et al., 2010). This

pathological inattentiveness can lead to numerous difficulties and dysfunction across

many domains of life.

Functional Impairment

Adults with ADHD often function in ways that cause impairment in important life

domains and reduce overall quality of life (Nigg, Butler, Huang-Pollock, & Henderson,

2002; Weiss et al., 2010). Functional impairments can be ubiquitous for individuals with

ADHD. For example, socially, adults with ADHD tend to have greater difficulties with

affect recognition than those without ADHD (Rapport, Friedman, Tzelepis, & Van

Voorhis, 2002), which may contribute to their relational and occupational difficulties, as

they may miss important social cues and be viewed as insensitive or socially awkward (Kessler et al., 2006). This finding also illuminates another possible reason adults with ADHD experience greater interpersonal conflict (Kessler et al., 2006) and have a 2 times higher divorce rate than those without ADHD (Barkley & Gordon, 2002; Biederman et al., 2006). These difficulties may also partially account for the finding that adults with ADHD are more likely to have been arrested and experience problems with the law (Biederman et al., 2006). In addition, stigma is a concern for those exhibiting symptoms and behaviors of ADHD, which may further hinder their ability to relate to others and increase their distress and dissatisfaction in social, academic, and occupational domains (Biederman et al., 2006; Canu, Newman, Morrow, & Pope, 2008). Additionally, substance abuse is a serious problem for these adults (Kessler et al., 2006), likely further impairing individuals who already struggle in many other aspects of their lives.

Educationally, individuals with ADHD have a significantly lower likelihood of graduating from high school (Barkley, Murphy, & Fischer, 2008; Miller, Nigg, & Faraone, 2007), and approximately 21% fewer people in this population attend college than those without ADHD (Barkley et al., 2008). This reduced educational attainment is likely to have lifelong repercussions, impacting wages, job satisfaction, promotion, and retention at work. In the workplace, disorganization, procrastination, and a pattern of leaving important tasks incomplete can lead to poor performance (Weiss, Murray, & Weiss, 2002), which may cause these individuals to become frustrated (Ramsay, 2002). Because adults with ADHD have difficulty expressing anger in healthy ways (Richards, Deffenbacher, Rosen, Barkley, & Rodricks, 2006), this frustration may cause further interpersonal difficulties both at home and work (Ramsay, 2002), and may contribute to

the finding that they switch jobs more frequently (Weiss et al., 2002) and are less likely to be employed than those without ADHD (Biederman et al., 2006; Kessler et al., 2006). Moreover, ADHD has been associated with a 4% to5 % decrease in job performance, as well as a higher incidence of sick days and workplace accidents or injuries (Kessler, Lane, Stang, & Van Brunt, 2008). In fact, more than 120 million days of work are lost in the United States each year due to ADHD, resulting in a cost of approximately $19.5 billion (Kessler et al., 2005).

Deficits in Executive Functioning

Another issue for adults with ADHD relates to difficulties in executive functioning, which are defined as "self-directed actions of the individual that are being used to self-regulate" and move toward a goal (Barkley, 1997, p. 56). The four executive functions (EFs) originally discussed by Barkley (1997) include working memory; self-regulation of affect, motivation, and arousal; internalization of speech; and reconstitution. The first executive function, working memory, refers to the ability to hold and manipulate events in the mind, as well as hindsight, foresight, and organization of purposeful behavior across time (Baddeley & Hitch, 1994; Barkley, 1997). The second executive function includes the self-regulation of affect, arousal, and motivation or drive, as well as the ability to take an outside perspective. With this executive function in particular, it is easy to see how impactful impairment could be, especially in a workplace setting where self-motivation and emotional regulation are necessary skills for success. The third executive function, internal speech, refers to the ability to reflect, describe, and problem-solve through the use of language. Internalized speech in conjunction with working memory could also lead to moral reasoning (Barkley, 1997). The final executive function

described by Barkley was reconstitution, which includes behavioral analysis and synthesis, verbal and behavioral fluency, and creativity.

According to Barkley's earlier work (1997, 2001), poor behavioral inhibition was the main cause of the executive function deficits seen in ADHD. Behavioral inhibition allows an individual to inhibit a first response to a setting event; stop an ongoing response, which allows for a delay between the event and the response; and prevent other self-directed responses from interfering or disrupting this delay period. He theorized that when behavioral inhibition is compromised, as in ADHD, the areas of executive function that require effective response inhibition to function properly would become similarly compromised. Deficits in the executive functions would then lead to additional problems, such as impaired motor control and goal-directed persistence, which manifests in the form of distractibility or difficulty sustaining attention and difficulty re-engaging in an activity after being disrupted, which are hallmark symptoms of ADHD (Barkley, 1997, 2001). It is important to note that in this early model, behavioral inhibition was not theorized to be directly responsible for adaptive executive function, but simply provided the delay in which these cognitive processes could occur, thus enabling individuals to self-regulate responding and persist toward goals.

Later, Barkley (2006, 2012) redefined the various executive functions in terms of self-directed actions. Thus, nonverbal working memory became self-directed sensing, verbal working memory became self-directed speech, self-regulation of affect/motivation/arousal became self-directed emotion, and reconstitution became self-directed play. In this updated version, self-sensing involves the ability to sense oneself through internally represented images and sounds, as well as perceive oneself through

time. Self-speech enables an individual to have an internal monologue and problem-

solve. Self-directed emotion involves the self-directed experience of feelings, which can

include self-motivation. Self-directed play involves being able to generate novel ideas

through the analysis of old ideas and subsequent synthesis into a new idea or behavior

(Barkley, 2001, 2012). Additionally, Barkley redefined behavioral inhibition as self-

restraint. In doing so, he put significantly less emphasis on behavioral inhibition as the

main contributor to the deficits in executive function in ADHD, and more emphasis on

the role of the executive functions as a whole in self-regulation and goal attainment

(Barkley, 2012). In other words, in his revised conceptualization, behavioral inhibition

(self-restraint) simply was theorized to be one of the many executive functions and was

not theorized to play any particular or fundamental role in proper executive functioning.

He stated that "the underlying psychological difficulties that are giving rise to these

symptoms involve deficits in all of the major EFs, and each of these EFs is a type of self-

regulation—a special form of self-directed action" (Barkley, 2012, p. 3).

　　　　Another model that describes the relationship between impaired executive

functions and ADHD was developed by Brown (1996a, 2001). Brown's theory of

executive functions is similar to Barkley's in many ways (1997, 2012), in that they both

conceptualized executive functions as important for self-regulation (Brown, 2006). They

also agree that deficits in the ability to use executive functions are part of the symptom

picture in ADHD. Where they differ lies chiefly in the premise of their theories and how

they reached their conclusions regarding executive functions in ADHD (Brown, 2006).

Brown painstakingly conducted numerous clinical interviews with individuals with

ADHD and their families to determine the areas in which these people were experiencing

impairment, as compared to similar others without ADHD (Brown, 2006). From these interviews, he developed a set of rating scales (Brown 1996a, 2001), which he used as the basis for his model of executive dysfunction in ADHD. Different versions of these scales, termed the Brown Attention Deficit Disorder Scales (BADDS), have been developed for adults, adolescents, and children, as have forms that can be completed by parents, teachers, and clients (Brown, 2006). In the current study, the BADDS Adult Version will be used to determine a diagnosis of ADHD, as it has excellent psychometric properties and conceptualizes executive function difficulties effectively (Brown & Whiteside, 2003).

From his research and clinical interviews, Brown (2001) asserted that there are six clusters of executive functions that apply to all individuals, whether or not they are diagnosed with ADHD: Activation, Focus, Effort, Emotion, Memory, and Action (Brown, 2006). Activation involves the cognitive abilities of preparation and organization to engage in a task, Focus involves the ability to sustain attention on a task, and Effort involves the ability to remain alert and engage in a task diligently. Emotion is a cognitive function that involves the ability to tolerate frustration and manage emotions, Memory involves the ability to recall things and use working memory, and Action involves the ability to regulate and monitor actions (Brown, 2006). These are clusters of executive functions that are viewed as interacting with one another—typically unconsciously—to self-regulate and complete various tasks. Significant impairments in these executive functions over the course of time are seen as part of an ADHD diagnosis (Brown, 2006). Unlike Barkley's earlier work, Brown's model of executive functions does not posit behavioral inhibition as the primary executive function necessary for the others to occur.

Rather, Brown asserts that behavioral inhibition is but one of many executive functions

necessary to self-regulate behavior, which is consistent with Barkley's (2012) later

assertions. Regardless, both authors acknowledge that deficits in executive function are

inherent to ADHD symptoms (Brown, 2006).

Support for both models has been demonstrated by numerous studies, indicating

that impaired behavioral inhibition is a central characteristic in individuals with ADHD

(Fedele, Hartung, Canu, & Wilkowski, 2010; Frazier, Demaree, & Youngstrom, 2004;

Hervey, Epstein, & Curry, 2004). Additionally, executive function difficulties have been

found to be the best predictors of having ADHD as an adult (Barkley et al., 2008;

Faraone, Biederman, & Spencer, 2010; Kessler et al., 2010), and were better at

distinguishing adults with ADHD from clinical controls than *DSM-IV-TR* criteria

(Barkley et al., 2008; Faraone et al., 2010). Furthermore, executive function impairments

as predictors of adult ADHD share the least overlap with other diagnoses in the *DSM-IV-*

TR, suggesting that executive function impairments are the best measures to differentiate

between ADHD and other psychological diagnoses (Kessler et al., 2010). These findings

highlight the role executive function plays in the development and maintenance of

ADHD, and continue to stress the importance of accurate diagnosis and treatment for

adults with ADHD. With the role of deficits in executive function clearly established, an

intriguing question remains regarding the relative impact and role of cognitive distortions

in this troubling disorder.

Cognitive Behavioral Therapy for ADHD

Given the numerous difficulties in functioning that adults with ADHD experience

in everyday life, it is of paramount importance to have effective treatments available. In

most cases, medications, such as psychostimulants, are the first line of treatment for

adults with ADHD and are effective in the short-term (Prince, Wilens, Spencer, &

Biederman, 2006; Safren, Sprich, Cooper-Vince, Knouse, & Lerner, 2010).

Unfortunately, medications may not be effective and/or entirely ameliorate problematic

symptoms for many people with ADHD (Safren, Sprich, Cooper-Vince, et al., 2010).

Approximately 20% to 50% of these adults do not respond to medication, and of those

who do, symptoms are commonly only reduced by half (Wilens, Spencer, & Biederman,

2001). Overall, it has been suggested that using medications as the only form of

treatment may lead to inadequate treatment for about half of adults with ADHD (Wilens,

Spencer, & Biederman, 2000), likely because medication does not provide individuals

with ways to cope with the functional impairments associated with ADHD (Mitchell et

al., 2013). Due to the limitations of medication use, psychosocial treatments such as

cognitive behavioral therapy (CBT) have recently been examined as treatment options

both in addition to medication use and as stand-alone treatments for adult ADHD.

Modified CBT. Several treatment manuals have taken a cognitive-behavioral

approach to the treatment of adult ADHD, but have adapted the prototypical treatment

strategies to better suit the needs of these adults (Ramsay & Rostain, 2015a; Safren,

Perlman, Sprich, & Otto, 2005; Solanto, 2011). These treatment regimens operate

primarily on the assumption that cognitive restructuring of dysfunctional automatic

thoughts and maladaptive core beliefs is an essential component to successful therapy

with an ADHD population. Given that many core beliefs evinced by adults with ADHD

tend to include overgeneralized themes of inadequacy, failure, and self-mistrust (Ramsay

& Rostain, 2011), the cognitive component to these psychosocial treatments appears to be a vital element for successful treatment.

Numerous CBT-based models have been proposed to treat ADHD. The Safren, Perlman, et al. (2005) model for treatment emphasizes psychoeducation about ADHD, planning and organizational skills, reducing distractibility through stimulus control, and cognitive restructuring to foster adaptive thinking. Information about dealing with procrastination and relapse prevention is also included. The Ramsay and Rostain (2015a) model for adult ADHD treatment emphasizes psychoeducation, cognitive interventions to change core beliefs and cognitive distortions, behavioral interventions, motivational and problem-solving strategies to improve implementation, acceptance and mindfulness, and detailed strategies to help cope with adult ADHD. The Solanto (2011) model is generally intended for group treatment, but can be adapted easily for individuals. This manual stresses the importance of time management in terms of scheduling, time awareness, setting manageable tasks, having rewards for following through with tasks, prioritizing, tackling emotional obstacles, activation, and motivation. This model also emphasizes developing, using, and maintaining a system of organization, as well as the importance of planning and finishing a project.

Effectiveness of CBT for adult ADHD. Overall, many researchers have concluded that CBT, specifically including the cognitive restructuring components, is an effective treatment for adult ADHD (Chandler, 2013; Knouse & Safren, 2010; Solanto et al. 2010; Young & Amarasinghe, 2010). Nevertheless, the effectiveness of CBT may vary depending upon the severity of ADHD (Ramsay & Rostain, 2011), whether CBT is

accompanied by medication use (Antshel et al., 2011), and the comorbidities associated with a diagnosis of ADHD (Barkley, 2006).

CBT plus medication vs. another type of therapy. A randomized controlled trial (RCT) recently showed that CBT was superior to relaxation and educational support in reducing ADHD symptoms in adults on an established medication routine. Notably, these results were maintained for 6 to 12 months (Safren, Sprich, Mimiaga et al., 2010). In the same year, another RCT also demonstrated that CBT was superior to relaxation and educational interventions in adults with ADHD established on medications, but these results were not reassessed at a follow-up (Solanto et al., 2010). As such, it is unclear whether these gains were maintained over time. In a pilot RCT for adults with ADHD, other researchers compared medication alone with two types of therapy administered in addition to medication (Virta et al., 2010). This study included a CBT group, a cognitive therapy group, and a medication-only control group. Researchers concluded that both therapy interventions were more effective than medication alone, but CBT led to greater symptom improvement than cognitive therapy. One important limitation to note, however, is that none of the participants exhibited severe levels of ADHD pathology; rather, only mild to moderate cases were included, which may limit the generalizability of this study (Virta et al., 2010).

CBT plus medication vs. medication alone. One study compared manualized CBT plus medication to a medication-only group in adults with ADHD (Safren, Otto, et al., 2005). These researchers found that the group receiving CBT plus medication experienced significantly greater ADHD, anxiety, and depression symptom reduction than the non-CBT group. A strength of this study is that independent evaluators were

used in addition to self-ratings to determine severity of symptoms. Another study also

found that CBT modified for adults with ADHD plus medication was superior to

medication alone (Rostain & Ramsay, 2006). In this study, 70% of adults in the dual

treatment group had at least moderate symptom improvement in regard to ADHD,

depression, anxiety, and hopelessness.

  CBT plus medication in a group format. In a group and individual format, CBT

was examined in adults with ADHD on stable pharmacotherapy (Emilsson et al., 2011).

CBT was found to have medium to large effectiveness in reducing ADHD severity and

comorbid problems, as well as in decreasing impairment. Treatment gains increased even

further at a three-month follow-up, suggesting that clients continued to use strategies

developed during treatment to engender continued improvement over time (Emilsson et

al., 2011). Given that the presence of comorbid diagnoses leads to greater impairments

for adults with ADHD and can reduce treatment effectiveness (Barkley, 2006), the results

from the Emilsson et al. (2011) study are particularly encouraging. Additionally, a short-

term intensive group CBT plus psychoeducation intervention has been studied in adults

with ADHD on medication (Bramham et al., 2009; Young & Bramham, 2007). This 3-

day intervention was found to induce improved self-efficacy, self-esteem, and knowledge

of ADHD when compared to a waitlist control group (Bramham et al., 2009).

  CBT without medication. Stevenson, Whitmon, Bornholt, Livesey, and

Stevenson (2002) studied 43 men and women, only 11 of whom were on medication, and

found that a cognitive remediation program led to significantly reduced ADHD

symptoms as compared to a wait-list control group. Notably, these results were

maintained for 2 and 12 month follow-ups. Nevertheless, one limitation of this study was

that it exclusively used self-report measures. In a pilot study, Ramsay and Rostain (2011)

examined CBT in five high-functioning adults with ADHD who were not taking

psychotropic medications. They found that these adults experienced reductions in the

severity of ADHD symptoms, anxiety, and depression, and improvements in overall

functioning. These results provide initial support for CBT as a promising stand-alone

treatment option; however, CBT alone may be less appropriate for adults whose ADHD

is quite severe, whose functioning is greatly impaired, who have other comorbidities, or

who have poor social support (Ramsay & Rostain, 2011). Overall, there is evidence that

CBT is an effective treatment for adults with ADHD, and that the cognitive components

are essential because they augment the behavioral components (Ramsay, 2010).

Defining Cognitive Distortions

Considering how conducting CBT for adults with ADHD focuses on changing

maladaptive cognitions and beliefs, it is also useful to understand how cognitive

distortions originated and developed over time. The first individual to describe cognitive

distortions was Beck (1967), who defined five cognitive distortions in his seminal work:

magnification and minimization, selective abstraction, overgeneralization, arbitrary

inference, and inexact labeling. Magnification and minimization occur when an

individual distorts an event in his or her mind in such a way as to make it much more or

much less significant than it truly is. Selective abstraction occurs when an individual

pinpoints one particular negative aspect of a situation on which to focus, which then

causes him or her to lose sight of the larger context. Overgeneralization occurs when

someone makes a global, overarching statement about an event based on one piece of

information about that event. Arbitrary inference occurs when an individual prematurely

makes a conclusion or decision about something without first gathering sufficient

information to support this decision. Inexact labeling occurs when an individual

erroneously labels a situation as grimmer or more calamitous than it is in reality or when

objectively weighing the evidence.

Later, other researchers developed their own terminology to refer to different

types of distorted cognitive phenomena, which may be considered an expansion or

elaboration of Beck's (1967) original five cognitive distortions. For example, one set of

researchers described 12 distinct cognitive distortions based upon their theory that people

have specific absolute ideas about behavior and events, called "must" or "should"

statements (Ellis & Dryden, 1997). These rigid beliefs lead to distortions of thought

when individuals become psychologically distressed. Their list of distortions includes :

(a) all-or-none thinking(e.g., "If I fail at one thing I am a complete failure."), (b) jumping

to conclusions and negative non sequiturs(e.g., "Because they saw me fail, they will see

me as completely incompetent."), (c) fortune-telling (e.g., "Because they are laughing at

me, they will hate me forever."), (d) focusing on the negative (e.g., "One thing went

wrong so nothing good is happening in my entire life."), (e) disqualifying *the positive*

(e.g, "They only complimented me because they are trying to be nice."), (f) allness and

neverness (e.g., "Life will always be awful and I'll never be happy."), (g) minimization

(e.g., "My good work was just luck."), (h) emotional reasoning (e.g., "I feel bad which

proves I am bad."), (i) labeling and overgeneralization (e.g., "Because I made a mistake I

am a complete loser."), (j) personalizing (e.g., "Because they are laughing they must be

laughing at me."), (k) phonyism (e.g., "I don't deserve praise because I will soon show

them how awful I am."), and (l) perfectionism (e.g., "I did well, but I should have done better;" Ellis & Dryden, 1997, p. 15-16).

Another researcher who established his own list of cognitive distortions was Burns (1980), who enumerated a list of distorted thoughts, similar to those mentioned previously, with the goal of making them more accessible to the average person. These distortions include (a) all-or-nothing thinking, (b) overgeneralization, (c) mental filter, (d), discounting the positive, (e) jumping to conclusions, which includes mind reading and fortune-telling, (f) magnification or minimization, (g) emotional reasoning, (h) should statements, (i) labeling, and (j) personalization and blame (Burns, 1980; Burns, 1999). Additionally, other distortions were presented by Gilson and Freeman (1999), who discussed fallacies of thought. These included fallacies of worrying, change, fairness, being right, ignoring, control, attachment, and heaven's reward.

More recently, Yurica (2002) used factor analysis to demonstrate the validity of 11 distinct cognitive distortions, which are similar to previous descriptions, but which are assessed via the empirically validated Inventory of Cognitive Distortions (ICD; Yurica & DiTomasso, 2002). Her 11 validated cognitive distortions include (a) fortune-telling, (b) externalization of self-worth, (c) magnification, (d) labeling, (e) comparison to others, (f) emotional reasoning, (g) perfectionism, (h) arbitrary inference/jumping to conclusions, (i) minimization, (j) mind-reading, and (k) emotional reasoning and decision-making. These cognitive distortions, as measured by the ICD, will be utilized in the current study.

Cognitive Distortions in ADHD

Although there is currently limited research elucidating the relationship between cognitive distortions and adult ADHD explicitly (Mitchell et al., 2013), there is

preliminary evidence suggesting that cognitive distortions are linked to adult ADHD

(Abramovitch & Schweiger, 2009; Strohmeier, 2013). Furthermore, some authors have

suggested that the link between ADHD and cognitive distortions can be explained by

impaired behavioral inhibition, in that it leads not only to poor motor control but also to

poor cognitive control (Abramovitch & Schweiger, 2009). Impaired cognitive control

could then manifest in the form of intrusive thoughts that individuals with ADHD have

difficulty suppressing.

Other researchers have proposed additional ways maladaptive core beliefs and

cognitions could develop in adult ADHD and, notably, these do not necessarily conflict

with the theory proposed by Abramovitch and Schweiger (2009). Specifically, three sets

of researchers set forth a lifespan approach to the development of cognitive distortions in

ADHD (McDermott, 2000; Ramsay & Rostain, 2008; Safren, Sprich, Chulvick, & Otto,

2004). These authors suggest that as ADHD develops over time into adulthood, the

numerous functioning difficulties experienced by these individuals lead to the

development of pervasive negative core beliefs and cognitive distortions. These

cognitive distortions, or ways of misinterpreting life events, in turn, lead to further

impairments. Thus, a vicious cycle is established in which these adults experience failure

and underachievement, which reinforces their maladaptive core beliefs and cognitions

leads to emotional distress and poor coping strategies such as procrastination and

avoidance, and, ultimately, cultivates further underachievement (McDermott, 2000;

Ramsay & Rostain, 2008; Safren et al., 2004). There is support for these ideas; however,

even when researchers find evidence for the connection between ADHD and cognitive

distortions, they conclude that longitudinal studies are needed to test these models further (Weiss et al., 2012).

There is also evidence demonstrating that although cognitive distortions occur in the normal population, they are more frequent in adults with ADHD. One study found that adult males with ADHD have a greater number of intrusive and worrisome thoughts, including cognitive distortions, and also experience more distress from these thoughts than adults without ADHD (Abramovitch & Schweiger, 2009). Other studies also found that adults with ADHD endorse a greater amount of cognitive distortions than non-clinical controls (Mitchell et al., 2013; Torrente et al., 2014). Further, Torrente et al. (2014) demonstrated that the frequency of cognitive distortions contributes to ADHD severity and predicts functional impairment. These findings are significant, given that the frequency of intrusive or distorted thoughts is thought to be a distinguishing factor between clinical and sub-clinical psychological problems (Turner, Beidel, & Stanley, 1992). In fact, frequency of intrusive cognitions has successfully distinguished adults with ADHD from adults without ADHD (Abramovitch & Schweiger, 2009).

Cognitive Distortions in Depression

Cognitive distortions have been extensively correlated with depression in the literature (Mathews & MacLeod, 2005; Yurica, 2002), with individuals experiencing depression endorsing greater dysfunctional beliefs than either non-depressed individuals or individuals whose depression has been treated and/or remitted (Beevers & Miller, 2004; Mathew, Sudhir, & Mariamma, 2014). Interestingly, those experiencing depressive symptoms tend to prefer negative or sad stimuli and avoid positive stimuli (Mathews & MacLeod, 2005), which demonstrates that individuals with depression

engage in attentional biases toward negative or mood-congruent information. These

negative attentional biases are one way individuals with depression cognitively distort

their experiences. Additionally, when researchers have induced non-clinical populations

with negative cognitive biases, they found that symptoms of depression and anxiety

increased (Mathews & Mackintosh, 2000). In fact, one study demonstrated that

individuals with recent suicide attempts were more likely to endorse having cognitive

distortions than psychiatric controls (Jager-Hyman et al., 2014), suggesting that one of

the most severe manifestations of depression is correlated with cognitive distortions.

The most common pattern of distorted cognitions for individuals with depression

is a negative view of the world (e.g., "Life is full of obstacles I cannot overcome."),

themselves (e.g., "I am deficient or inadequate."), and the future (e.g., "My suffering will

continue indefinitely;" Beck & Alford, 2009). People with depression are likely to

misinterpret what others say as being insulting or disparaging, and are also prone to

misinterpret small events as being significant losses (Beck & Alford, 2009). Lastly,

individuals experiencing depression are "particularly sensitive to any impediments to

their goal-directed activity" (Beck & Alford, 2009, p. 227). These cognitive

misinterpretations of life events can have catastrophic effects on an individual, social, and

societal level.

Cognitive Distortions in Anxiety

In addition to depression, extensive research has demonstrated a correlation

between cognitive distortions and anxiety (Mathews & MacLeod, 2005). Individuals

with anxiety tend to experience distortions of thought in the form of showing preferential

attention toward threatening stimuli (Cisler & Koster, 2010; Heinrichs & Hofmann,

2001). In other words, individuals with anxiety perceive the world around them as more

potentially threatening than non-anxious individuals. This may manifest differently

depending on the anxiety disorder. For example, people with social anxiety disorder

perceive social situations to be threatening and, as such, have maladaptive cognitions

about the costs of poor performance in those situations (Smits, Julian, Rosenfield, &

Powers, 2012). Specifically, people with social anxiety disorder believe that poor social

performance has horrible consequences (Hofmann, 2004), believe that they have

insufficient social skills (Gaudiano & Herbert, 2003), and have exorbitantly high

standards for their behavior in social situations (Wong & Moulds, 2011). All of these

maladaptive beliefs represent and are manifested by cognitive distortions.

Cognitive Distortions in ADHD with Comorbidities

Given that cognitive distortions are highly correlated with both anxiety and

depression (Mathews & MacLeod, 2005), and that anxiety and depression are highly

correlated with ADHD (Kessler et al., 2006), it stands to reason that cognitive distortions

will be even higher in individuals who have ADHD as well as a comorbid disorder such

as anxiety or depression. Research has supported this conclusion.

Although the frequency of cognitive distortions in adults with ADHD is higher

than non-clinical controls, preliminary research suggests that when a comorbid diagnosis

exists, the rate of cognitive distortions is found to be even higher. For example, adults

with ADHD and comorbid depression have been found to endorse a greater amount of

cognitive distortions than both non-clinical controls and those with ADHD without

comorbid depression (Mitchell et al., 2013). In an unpublished dissertation, Strohmeier

(2013) examined cognitive distortions in adults with ADHD, anxiety, and depression. He

found that cognitive distortions, particularly perfectionism, were associated with ADHD

symptoms, even after controlling for anxiety and depression. This finding further

suggests that cognitive distortions may be part of the symptom picture of adult ADHD.

Nevertheless, as neither of these studies accounted for the presence of comorbid

personality disorders, which have been shown to be highly correlated with cognitive

distortions (e.g., Rosenfield, 2004), a definitive statement cannot yet be made as to

whether cognitive distortions are linked to a diagnosis of ADHD.

Cognitive Distortions in Personality Disorders

Unfortunately, a thorough literature review of scholarly research databases was

unable to identify any studies that specifically discuss cognitive distortions in the context

of personality disorders or personality pathology in an adult ADHD population. There is,

however, some evidence that cognitive distortions are correlated with indicators of

personality pathology, such as neuroticism, in adults with ADHD (Vasey & MacLeod,

2001). Furthermore, there is ample research in non-ADHD clinical populations

suggesting that cognitive distortions are correlated with a wide range of personality

disorders (Beck, Davis, & Freeman, 2015; Beck, Freeman, & Davis, 2004; Fournier,

DeRubeis, & Beck, 2012; Napolitano & McKay, 2007; Oshio, 2012; Rosenfield, 2004;

Wenzel, Chapman, Newman, Beck, & Brown, 2006). Specifically, all-or-nothing or

dichotomous thinking appears to be a particularly prevalent cognitive distortion in

personality disorder populations, especially in clusters B and C (Beck et al., 2004;

Napolitano & McKay, 2007; Oshio, 2012).

Additionally, one study demonstrated that "the frequency of cognitive distortions

accounts for up to 50% of the variance in the number and severity" of personality

disorders, with the exception of narcissistic, obsessive-compulsive, and histrionic

personality disorders (Rosenfield, 2004, p. 123). This conclusion suggests that

distortions of thought are highly correlated with personality disorders. Moreover, others

discovered that individuals with personality disorders endorse beliefs that theoretically

corresponded with their specific personality disorder (Beck et al., 2001). This study

provides evidence that dysfunctional beliefs can predict the presence of specific

personality disorders. Although this study was performed with psychiatric outpatients

and not with ADHD adults per se, it is thought that the findings are relevant to the current

study.

ADHD and Personality Disorders

Whereas the exact comorbidity of personality disorders within ADHD is unclear

(Jacob et al., 2007), it appears that ADHD is highly correlated with increased rates of

personality disorders in clusters B and C as compared to non-clinical controls (Cumyn et

al., 2009; Miller et al., 2007). For example, rates of antisocial personality disorder range

from 5.7% to 44% (Barkley et al., 2008; Biederman et al., 1993; Jacob et al., 2007; Miller

et al., 2007; Young et al., 2003), as compared to 3.9% in non-clinical controls (Miller et

al., 2007). An effect for gender has also been identified, with males with ADHD having

a higher likelihood of antisocial personality disorder than females with ADHD

(Biederman, Faraone, Mounteaux, Bober, & Cadogen, 2004). Rates of borderline

personality disorder range from 3.4% to 20.3% (Miller et al., 2007; Young et al., 2003),

as compared to 3.9% in non-clinical controls (Miller et al., 2007). Histrionic personality

disorder ranges from 2.3% to 35.2% (Jacob et al., 2007; Miller et al., 2007), as compared

to 2.1% in the general population (Nestadt et al., 1990), and narcissistic personality

disorder rates are approximately 12%, as compared to 3% in non-clinical controls (Miller

et al., 2007). Avoidant personality disorder ranges from 12.5% to 18.3% (Cumyn et al,

2009; Jacob et al, 2007; Miller et al., 2007), as compared to 1% in non-clinical controls

(Miller et al., 2007), and dependent personality disorder ranges from 5% to 6.9% (Miller

et al., 2007; Young et al., 2003), as compared to 0% in non-clinical controls (Miller et al.,

2007). Lastly, obsessive-compulsive personality disorder rates are approximately 14%,

as compared to 4% in non-clinical controls (Miller et al., 2007).

   Some researchers have suggested that ADHD correlates so highly with cluster B

personality disorders because cluster B disorders involve interpersonal difficulties and

deficits in regulating behavior, thoughts, and emotions, all of which are analogous to

many symptoms of ADHD (Miller et al., 2007; Weiss, Hechtman, & Weiss, 1999).

Others have suggested that attention problems lead to "fragmented perceptions of the

environment," which when combined with "deviant social perceptions, may lead to

substantial neurocognitive problems," such as difficulties in self-monitoring (Anckarsater

et al., 2006, p. 1242). Further, because the "neurocognitive skills including attention,

impulse control, empathy, and communication are of general importance in the

development of personality" (Anckarsater et al., 2006, p. 1242), there may be a linear

connection between having ADHD and a concomitant personality disorder. It has also

been suggested that the reason ADHD correlates highly with cluster C personality

disorders may be due to a subset of individuals with ADHD who present with anxious,

fearful, and/or obsessive features, combined with a heightened attentional focus (Miller et

al., 2007). These features are highly characteristic of the cluster C personality disorders

and may help explain the observed connection between ADHD and cluster C disorders.

Given the high rate of comorbid personality disorders in adults with ADHD (Cumyn et al., 2009; Jacob et al., 2007; Miller et al., 2007), examining comorbid personality pathology in conjunction with cognitive distortions in adult ADHD is essential. Additionally, because increased personality pathology is associated with more functional impairments and greater severity of ADHD (Young et al., 2003), this information is even more important. Finding that personality pathology is responsible for the increased rate of cognitive distortions found in ADHD would have a significant impact on the diagnosis and treatment of adult ADHD.

Five Factor Model

To examine personality pathology in the context of ADHD, the present study utilized the Five Factor Model of Personality (FFM; Costa & McCrae, 1985), as measured by the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992). The FFM is based upon the idea that personality can be characterized into five broad domains: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, which are broad dimensions that have been broken down into lower-level traits, or facets (Costa & McCrae, 1992, 2008; Kurylo & Stevenson, 2011; McCrae et al., 2002; Widiger & Costa, 2013).

Openness to Experience has been defined as the active pursuit of and appreciation for new experiences. Individuals high in Openness are imaginative, curious, and feel a wider range of emotions than less open individuals (Widiger & Costa, 2013). Openness facet scales include fantasy, aesthetics, feelings, actions, ideas, and values (Costa & McCrae, 1992). Conscientiousness refers to a need for achievement and work commitment, as well as cautiousness and morality (Costa, McCrae, & Dye, 1991).

Individuals high in Conscientiousness are ambitious, organized, and work earnestly to

achieve their goals (Widiger & Costa, 2013). Conscientiousness facet scales include

competence, order, dutifulness, achievement striving, self-discipline, and deliberation.

Extraversion refers to the amount of social stimulation an individual prefers. Individuals

high in Extraversion are sociable, talkative, affectionate, and require more stimulation

than individuals lower in Extraversion (Widiger & Costa, 2013). Extraversion facet

scales include warmth, gregariousness, assertiveness, activity, excitement seeking, and

positive emotions.

Agreeableness, though similar to Extroversion in that it is a measure of

interpersonal behavior, refers to social interactions ranging "along a continuum from

compassion to antagonism" (Costa & McCrae, 1985, p. 2; Widiger & Costa, 2013).

Individuals high in Agreeableness are trusting, altruistic, and empathic, and believe other

people are as well (Widiger & Costa, 2013). The Agreeableness facet scales are trust,

straightforwardness, altruism, compliance, modesty, and tendermindedness. Neuroticism

refers to the extent to which an individual experiences negative emotions and his or her

level of emotional stability. Individuals high in Neuroticism are apt to experience greater

psychological distress, to have lower frustration tolerance, and to be more vulnerable to

stress than individuals low in Neuroticism (Widiger & Costa, 2013). The Neuroticism

facet scales are anxiety, hostility, depression, self-consciousness, impulsiveness, and

vulnerability to stress (Costa & McCrae, 1992, 2008).

FFM and ADHD. One study examined FFM personality traits in adults with

ADHD. They found that individuals with ADHD tended to score higher in Neuroticism

($M = 116.6$) and lower in Extraversion ($M = 103.2$), Openness to Experience ($M = 114.0$),

and Conscientiousness ($M = 91.3$) than a control group, whose mean scores were 94.8,

113.7, 131.8, and 111.6, respectively (Jacob et al., 2007). Mean scores in Agreeableness

were not significantly different between groups, with the ADHD group scoring 112.0, as

compared to controls who scored 111.8 (Jacob et al., 2007). They also found that

females with ADHD scored higher than males with ADHD in Neuroticism, Extraversion,

and Openness to Experience, which is inconsistent with other research demonstrating that

the relationship between personality features and ADHD symptoms is not significantly

different for males and females (Parker, Majeski, & Collin, 2004). Regardless, Jacob et

al., (2007) asserted that their outcomes added to previous findings indicating that the best

predictor of an ADHD diagnosis is high Neuroticism scores, in addition to information

about difficulty with attention and organization (Rosler et al., 2004). More recent studies

have continued to support a connection between ADHD symptoms and Neuroticism

(Avisar & Shalev, 2011; Bennett, 2015; Michielsen et al., 2014; Valero et al., 2012).

Similar to previous findings, one group of researchers found that high

Neuroticism and low Conscientiousness were significant predictors of the

hyperactivity/impulsivity and inattentiveness seen in ADHD (Parker et al., 2004).

Further, they found that low Extraversion and Agreeableness were good predictors of

hyperactivity/impulsivity, but not of inattentiveness. Notably, this study was performed

with higher functioning adults who were accepted to college, which may make this study

less generalizable to the wider ADHD population. In a population of adolescents and

young adults, another group of researchers found lower Agreeableness and higher

Neuroticism compared to non-ADHD controls and those who previously met for ADHD

but were no longer symptomatic (Miller, Miller, Newcorn, & Halperin, 2008).

Additionally, young adults with ADHD were lower in Conscientiousness than non-ADHD controls, but no difference was found between groups on Openness and Extraversion. The strengths of this study were that it followed these young adults from childhood into young adulthood, making their diagnoses more accurate due to lack of retrospective reports, and giving a unique developmental perspective to examining personality pathology in those with ADHD (Miller et al., 2008).

In six studies of adults with ADHD, Nigg, John, et al. (2002) found that inattentiveness and disorganization were significantly negatively correlated with low Conscientiousness and positively correlated with Neuroticism. They also found that hyperactivity, impulsivity, and oppositionality were inversely correlated with low Agreeableness. A strength of each of these studies was that observer reports were used in addition to self-reports. In a meta-analysis, another group of researchers also examined the FFM in relation to ADHD symptoms, finding that inattentiveness and hyperactivity/impulsivity were both correlated with low Conscientiousness, low Agreeableness, and high Neuroticism (Gomez & Corr, 2014). Given the preponderance of evidence just reviewed, it is clear that there is a connection between ADHD and FFM personality traits. Specifically, high Neuroticism, low Conscientiousness, and low Agreeableness appear to be the best predictors of an ADHD diagnosis.

FFM and personality disorders. The FFM has been tested extensively to support the notion that personality traits have utility in the assessment and conceptualization of personality disorders (Miller, 2012), and that personality disorders are extreme manifestations and maladaptive versions of normal personality functioning, which can be measured using the FFM (Costa & Widiger, 2002; Widiger & Trull, 2007).

Generally, the FFM characterizes people with personality disorders as having high

Neuroticism, and borderline personality disorder seems also to be characterized by low

Conscientiousness and low Agreeableness (Trull, 2005). Regardless of the specific FFM

permutations, there is ample evidence that the FFM has clinical and diagnostic utility in

regard to personality disorders. For example, O'Connor (2002) used factor analysis to

compare the FFM with 28 other personality inventories. He found that "the factor

structures that exist in the scales of many popular inventories can be closely replicated

using data derived solely from the scale associations with the FFM" (O'Connor, 2002, p.

198). Further, another group of researchers used meta- and factor analysis to examine

various inventories of both adaptive and maladaptive personality functioning, which

resulted in a factor structure closely resembling the FFM (Markon, Krueger, & Watson,

2005).

Additionally, a group of researchers applied the FFM to a population of adults

diagnosed with one of four personality disorders (i.e., schizotypal, borderline, avoidant,

and obsessive-compulsive) to determine whether the FFM could distinguish among these

disorders reliably (Morey et al., 2002). Each personality disorder group scored high in

Neuroticism and low in Agreeableness and Conscientiousness, which was significantly

different from a normal control group. They concluded that the FFM was able to

distinguish the four personality disorder groups from a normative group; however, the

measure was unable to distinguish the personality disorder groups from one another

(Morey et al., 2002). Therefore, according to this study, the NEO-PI-R seems to be a

good measure for detecting personality disorder pathology, but may be less able to

distinguish one personality disorder from another.

Other studies have demonstrated the utility of the NEO-PI-R in identifying specific personality disorders. For example, in one large study, the NEO-PI-R was compared to and found to correlate strongly with the Hogan Development Survey (HDS; Hogan & Hogan, 1997, 2009), an extensively used and psychometrically sound measure that purports to assess the personality disorder categories set forth in the *DSM-IV-TR* (Hogan & Hogan, 2001). In another study, the NEO-Five Factor Inventory, a short version of the NEO-PI-R, was compared to the Self Report Standardized Assessment of Personality-Abbreviated Scale (SAPAS-SR; Germans, Van Heck, Moran, & Hodiamont, 2008) to screen for personality disorder diagnoses (Germans, Rath, Van Heck, & Hodiamont, 2013). Although they found that the NEO-FFI was not an adequate personality disorder screener, they discovered that the FFM traits were moderate predictors of each personality disorder examined (Germans et al., 2013).

In psychiatric patients with borderline personality disorder, researchers found that 43% of the variance in borderline symptomatology was accounted for by FFM traits (Bagby, Sellbom, Costa, & Widiger, 2008). This study also found that the FFM added incremental validity to a different personality pathology measure in its ability to account for borderline symptoms. In other words, the FFM was able to accurately characterize borderline personality disorder. In a meta-analysis, one researcher synthesized the convergent validity correlations between *DSM-IV-TR* personality disorder symptoms and FFM personality disorder similarity scores and counts from numerous studies (Miller, 2012). The weighted effect sizes were .41 (paranoid), .43 (schizoid), .32 (schizotypal), .40 (antisocial), .54 (borderline), .33 (histrionic), .44 (narcissistic), .54 (avoidant), .33 (dependent), and .16 (obsessive-compulsive). The author concluded that these results are

important, given that the studies in the meta-analysis used measures that were not

specifically intended for personality disorder diagnoses. These correlations indicate that

the FFM and *DSM* personality disorders are related, and highlight the versatility of the

FFM in conceptualizing personality traits as well as personality disorders.

Expanding on these findings, researchers concluded in two meta-analyses that the

FFM has predictable associations with the diagnostic criteria of each of the personality

disorders (Samuel & Widiger, 2008; Saulsman & Page, 2004). Moreover, after a

literature review, another researcher concluded that "multiple studies provide convincing

evidence that the *DSM* personality disorder diagnoses show a systematic relationship to

the five factors and that all categorical diagnoses of *DSM* can be accommodated within

the five-factor framework" (Livesley, 2001, p. 24). Further evidence for this assertion

has been found, in that the NEO-PI-R has demonstrated good stability in scores over the

course of time for individuals with personality disorders (Wilberg, Karterud, Pedersen,

Urnes, & Costa, 2009). Additionally, because it has been suggested that personality

disorders are, in essence, problematic and extreme variations of "normal" personality

traits, it stands to reason that personality disorders could be measured by the FFM

(Miller, 2012). In fact, Lynam and Widiger (2001) demonstrated that FFM personality

disorder prototypes created by expert raters were significantly positively correlated with

FFM personality disorder conversions derived from the *DSM-IV-TR* ($r = .71$, on average).

It has even been asserted that comparing an individual's FFM profile with the FFM

profile of a prototypical personality disorder can "provide as valid of an assessment of

that personality disorder as a direct, explicit assessment of the respective personality

disorder" (Miller, 2012, p., 1565).

Further evidence for the ability of the FFM to identify personality disorders has

been found in research that tallies scores on *DSM-IV-TR* personality categories based on

scores from relevant FFM traits (Miller, Few, Lynam, & MacKillop, 2015). This type of

research has found that FFM traits are significantly associated with the *DSM* personality

disorders, are consistent with other measures of the *DSM* personality disorders, and add

additional information regarding functioning (Miller et al., 2012; Miller et al., 2015). In

sum, the FFM seems capable of identifying personality disorders in certain contexts. As

such, there appears to be sufficient evidence suggesting that the FFM is not only an

excellent tool to assess personality pathology, but also may be considered a good tool to

identify personality disorders (Widiger & Costa, 2012). To be conservative, however, the

current study will use the NEO-PI-R to identify pathological aspects of personality, as it

is not intended to identify specific personality disorders, per se.

Purpose of the Study

The current study attempted to determine the relationship between cognitive

distortions and ADHD after accounting for personality pathology and other clinical

syndromes, specifically, depression and anxiety. Hopefully, the findings of this

investigation will provide clinicians with valuable information to guide assessment and

treatment of those with ADHD. In summation, the present study was developed to

examine whether there is a relationship between cognitive distortions and "pure" ADHD

or whether the previously identified relationship between cognitive distortions and

ADHD was simply attributable to extraneous factors, namely, comorbidities. More

specifically, this study aimed to ascertain whether the severity of ADHD predicts an

increased frequency of cognition distortions, after accounting for the presence of anxiety, depression, and personality pathology.

Hypotheses

Hypothesis 1: It was hypothesized that the severity of ADHD (as measured by the BADDS total score) would be correlated positively with Neuroticism (as measured by the NEO-PI-R), anxiety (as measured by the PSWQ), and depression (as measured by the Beck Depression Inventory [BDI-II; Beck, Steer, & Brown, 1996), and would be correlated negatively with Agreeableness and Conscientiousness (as measured by the NEO-PI-R).

Hypothesis 2: The severity of ADHD, anxiety, depression, Neuroticism, Conscientious, and Agreeableness would predict an increased frequency of cognitive distortions (as measured by the ICD). Specifically, greater cognitive distortions would be correlated with increased anxiety, depression, and Neuroticism and decreased Agreeableness and Conscientiousness.

Hypothesis 3: The relationship between the severity of ADHD and the frequency of cognitive distortions would remain predictive after accounting for the relative contribution of existing personality pathology (high Neuroticism, low Agreeableness, and low Conscientiousness), depression, and anxiety.

Chapter 3: Method

Research Design

This study used a correlational research design to assess the relationship between

the frequency of cognitive distortions as measured by the ICD total score; the severity of

ADHD as determined by the BADDS total score; personality pathology as determined by

scores of high Neuroticism, low Agreeableness, and low Conscientiousness on the NEO-

PI-R; anxiety as measured by the PSWQ total score; and depression as measured by the

BDI-II total score.

Participants

Data were collected on 112 adult participants from an archival database composed

of adults who received an extensive intake assessment at an outpatient, university-based

clinic specializing in the treatment and research of adult ADHD. This facility is located

in a large urban setting in the northeastern United States. The clinic does not accept

third-party insurance reimbursement and, therefore, only accepts either private payees or

clients with university-based insurance. Participant data were included if the participant

was between the ages of 18 and 85 at the time of the assessment; did not evince

symptoms of active psychosis, intoxication, or active and severe substance use disorders;

presented with symptoms consistent with ADHD or met full criteria for an ADHD

diagnosis; and completed the BADDS, NEO-PI-R, ICD, PSWQ, and BDI-II during a

semi-structured clinical intake interview at the center. Participants were excluded from

the study if they were outside the age criterion, did not complete one of the required

instruments at intake, or presented with an exclusionary mental health diagnosis.

Measures

      Inventory of Cognitive Distortions. The ICD is a 69-item self-report measure

designed to identify the frequency of 11 cognitive distortions (Yurica & DiTomasso,

2002). These 11 distortions are composed of items rated on a scale from 1 (never) to 5

(always), and the measure is scored by adding the responses to create a total score

ranging from 69 to 345. A higher score equates to a greater number and/or frequency of

endorsed cognitive distortions. Psychometric analyses completed by Yurica (2002)

established the reliability and validity of the ICD in an adult clinical sample. The ICD

was found to have excellent internal consistency (Cronbach's $\alpha = .98$) and test-retest

reliability ($r = .998$). The ICD was also found to have excellent construct and content

validity, as per a 100% expert agreement on the descriptions of cognitive distortions used

by the ICD. Additionally, strong concurrent and construct validity were established for

the ICD when it was correlated with other well-established measures of dysfunctional

thinking, anxiety, and depression. Specifically, the ICD had a strong positive correlation

with the Dysfunctional Attitude Scale (DAS; $r = .70$; Weissman & Beck, 1978), the Beck

Anxiety Inventory (BAI; $r = .59$; Beck & Steer, 1990), and the BDI-II ($r = .70$).

      Moreover, the ICD correlated significantly with severity and number of both

clinical syndromes and personality pathologies, as measured by the Millon Clinical

Multiaxial Inventory-III (Millon, Millon, Davis, & Grossman, 2006; see Rosenfield,

2004). The ICD has further proven its utility, given that cognitive distortions, as

measured by the ICD, were found to have a direct positive relationship with ADHD

severity (Strohmeier, 2013). The ICD was also validated in a non-clinical sample

(Roberts, 2015). In this study, the ICD was demonstrated to have high internal

consistency (α= .97) and to highly positively correlate with the DAS and Perceived Stress

Scale (PSS; Cohen, Kamarck, & Mermelstein 1983). The reliability and validity of the

ICD were further validated in an outpatient medical population, in which it was

demonstrated to capably identify distorted thoughts relating to health risk factors, as

measured by the Millon Behavioral Medicine Diagnostic (MBMD; Millon, Antoni,

Millon, Meagher, & Grossman, 2001; Uhl, 2007). Another study examined the ICD in

relation to the Mahan and DiTomasso Anger Scale (MAD-AS; Mahan, 2001),

demonstrating that the ICD had a direct positive correlation with the MAD-AS (Latella-

Zakhireh, 2009). These results support a relationship between individuals who use

cognitive distortions and those who are angry, thus providing further support for the

utility and credibility of the ICD.

Revised NEO Personality Inventory. The NEO-PI-R is a 240-item inventory

designed to measure the five personality domains of the FFM: Openness to Experience,

Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Costa & McCrae,

1992). Items are composed of sentences that are rated on a Likert scale ranging from

"strongly disagree" to "strongly agree." These items are grouped into the five domains

with six facet scales per domain to provide greater detail. Scores are expressed as

standardized T-scores based upon norms for both males and females. T-scores above 65

are considered Very High, T-scores between 55 and 65 are considered High, T-scores

between 45 and 55 are considered Average, T-scores between 35 and 45 are considered

Low, and T-scores below 35 are considered Very Low (Costa & McCrae, 1992).

The validity and reliability of the NEO-PI-R are excellent (Costa & McCrae,

1992), likely due to the large body of research spanning different ages, cultures, and

languages upon which it was developed (Costa et al., 1991). Numerous studies have

supported the psychometric properties of NEO-PI-R scales across cultural context, age,

ethnicity, socioeconomic status, literacy, and gender, among other characteristics (De

Fruyt, De Bolle, McCrae, Terracciano, & Costa, 2009; De Fruyt, Mervielde, Hoekstra, &

Rolland, 2000; McCrae, Kurtz, Yamagata, & Terracciano, 2011; McCrae & Terracciano,

2005; Sutin, Costa, Evans, & Zonderman, 2013). For example, McCrae et al. (2011)

found that the internal consistency and test-retest reliability of the 30 facet scales were

universal across 51 cultures and 28 languages. This has led some to conclude that

"psychometric properties of personality scales are universal—further evidence that traits

function the same way around the world" (Allik, Realo, & McCrae, 2013, p. 67). In a

Russian sample, the NEO-PI-R again produced the traditional FFM structure, and all five

factors achieved factor congruence coefficients of .95 or .96 (Allik et al., 2013).

Additionally, the NEO-PI-R has been examined in the context of ADHD, demonstrating

that the most common personality features of individuals with ADHD tend to be high

Neuroticism, low Agreeableness, and low Conscientiousness (Parker et al., 2004).

     Brown Attention Deficit Disorder Scale-Adult Version. The BADDS is a 40-

item self-report measure designed to determine the presence of symptoms of ADHD in

adults (Brown, 1996a). Each item consists of a scale ranging from 0 (never) to 3 (almost

daily), which individuals use to rate how problematic various ADHD symptoms have

been for them over the past six months. Raw scores range from 0 to 120, which are then

converted into T-scores that are categorized. The recommended cut-off score is 50, with

scores of 50 or above indicative of an ADHD diagnosis, and higher scores suggesting

higher probability of diagnosis. Items on this scale are clustered around five main

domains of ADHD symptoms: (a) ability to sustain attention and concentration, (b)

ability to sustain energy and effort, (c) organization and activation for work, (d)

managing affective interference, and (e) using working memory and accessing recall

(Brown, 1996b; Brown & Whiteside, 2003). A psychometric evaluation of the BADDS

demonstrated excellent internal consistency (Cronbach's α = .96) and sufficient test-retest

reliability (r = .87; Brown & Whiteside, 2003).

Beck Depression Inventory, Second Edition. The BDI-II is a 21-item self-

report measure of the severity of depression (Beck, Steer, & Brown, 1996). Items range

from 0 to 3, and are totaled to create an overall depression score ranging from 0 to 63.

The total score is then labeled either minimal (0-13), mild (14-19), moderate (20-28), or

severe (29-63), with higher scores equating to greater perceived depression. A

psychometric analysis of the BDI-II demonstrated that it has high internal consistency

(Cronbach's α= .91) and test-retest reliability (r = .93; Beck, Steer, Ball, & Ranieri,

1996). Additionally, the BDI-II has sufficient discriminant validity in that it correlated

mildly (r = .47) with the Hamilton Anxiety Rating Scale-Revised (HAM-A; Hamilton,

1959), a well-established measure of anxiety (Beck, Steer, Ball, et al., 1996).

Penn State Worry Questionnaire. The PSWQ is a 16-item self-report measure

used to evaluate the severity and frequency of worry (Meyer, Miller, Metzger, &

Borkovec, 1990). Each item ranges from 1 (not at all typical of me) to 5 (very typical of

me), with possible scores ranging from 16 to 80. Five items require reverse scoring,

which are then tallied with the other 11 items to create an overall worry score. The total

score can then be classified as representing Low (16-39), Moderate (40-59), or High (60-

80) levels of worry, with higher scores indicating greater perceived worry. The PSWQ is

an excellent measure to use in an adult ADHD population, particularly due to findings

that worry, as opposed to state anxiety, is closely related to distractibility (Lapointe et al.,

2013). Furthermore, psychometric evaluations found that the PSWQ demonstrated strong

internal consistency (Cronbach's α= .83-.93) (Brown, Antony, & Barlow, 1992; Molina

& Borkovec, 1994) and test-retest reliability (r = .74-.93; Molina & Borkovec, 1994).

Additionally, the PSWQ successfully discriminated between individuals with generalized

anxiety disorder and those with another type of anxiety disorder (Brown et al., 1992).

Demographics Questionnaire. The demographics questionnaire includes basic

information from participants, such as their age, gender, and ethnicity.

Procedure

Every client evaluated at the ADHD center received a thorough psychodiagnostic

evaluation upon intake. Data collected from each client were stored in an archival data

set. Data used in the present study were extracted from data collected initially between

2014 and2016, and consisted of all clients at the center who met inclusion criteria

described previously. A clinician at the center extracted data from the ICD, NEO-PI-R,

BADDS, BDI-II, and PSWQ and transferred them onto a spreadsheet. To preserve

anonymity and to ensure confidentiality, these data were de-identified on the spreadsheet.

Following IRB approval and after identifying information was removed, the data were

provided to the principal and responsible investigators. The anonymous data were

exported into a Statistical Package for Social Sciences, version 22.0 (SPSS 22.0) file and

analyses were completed to examine the various hypotheses.

Chapter 4: Results

Statistical analyses were computed to examine whether the severity of ADHD

correlated positively with Neuroticism, anxiety, and depression, and correlated negatively

with Agreeableness and Conscientiousness. Additionally, the present study aimed to

determine whether the severity of ADHD was predictive of cognitive distortions when

depression, anxiety, and personality pathology (high Neuroticism, and low Agreeableness

and Conscientiousness) were taken into consideration.

Statistical Analyses

The variables of interest were analyzed through the use of SPSS 22.0. The first

power analysis was for a Pearson product-moment correlation. In this analysis, the effect

size was set at 0.30, which is considered a medium effect size for correlation (Cohen,

1988, 1992), the significance level was set at 0.05, and the power level was set at 0.80, as

per conventional standards (Cohen, 1988, 1992). This analysis determined that 64

participants were needed to perform the following correlation. The second power

analysis was for a multiple regression with six predictors. In this analysis, the effect size

was set at 0.15, which is considered a medium effect size for multiple regression (Cohen,

1988, 1992), the significance level was set at 0.05, and the power level was set at 0.80, as

per conventional standards (Cohen, 1988, 1992). This analysis determined that 110

participants were needed to perform the following multiple regression analysis. The

number of required participants was, therefore, set at the higher value of 110.

Demographic Analysis

Demographically, the sample consisted of 77 males and 35 females, with a mean

age of 32 and an age range of 18 to 60. Participants identified as 75% Caucasian,

followed by 4.5% Hispanic, 3.5% "Other," 2.7% African American, 1.8% Asian

American, and 12.5% with ethnicity unspecified in the database.

Hypothesis I

To examine whether the severity of ADHD (as measured by the BADDS total

score) was significantly positively correlated with Neuroticism (as measured by the

NEO-PI-R), anxiety (as measured by the PSWQ), and depression (as measured by the

BDI-II), and significantly negatively correlated with Agreeableness and

Conscientiousness (as measured by the NEO-PI-R), six Pearson product-moment

correlations were conducted. To control for the increased likelihood of a Type 1 error, a

Bonferroni correction was calculated by dividing the initial alpha of .05 by 6 to obtain a

more stringent alpha level of .008. Results indicated a significant positive relationship

between ADHD and Neuroticism ($r = .295$, $p = .002$) and ADHD and depression ($r =$

$.410$, $p = .000$). Results also indicated a significant negative relationship between ADHD

and Conscientiousness ($r = -.566$, $p = .000$). The relationship between ADHD and

anxiety approached significance ($r = .215$, $p = .023$), but was not significant when using

the more stringent alpha level of .008. There was no significant relationship between

ADHD and Agreeableness ($r = -.111$, $p = .245$). Correlations, means, and standard

deviations can be found in Table 1.

Table 1

Correlations, Means, and Standard Deviations for ADHD, Neuroticism, Anxiety, Depression, Agreeableness, and Conscientiousness

	ADHD	Neuroticism	Anxiety	Depression	Agreeableness	Conscient-iousness	M	SD
ADHD	------	.295*	.215	.410*	-.111	-.566*	76.48	10.37
Neuroticism	.295*	------	.542*	.586*	-.045	.133	59.36	12.81
Anxiety	.215	.542*	------	.439*	-.091	.126	52.45	16.20
Depression	.410*	.586*	.439*	------	-.013	-.074	16.27	10.51
Agreeableness	-.111	-.045	-.091	-.013	------	-.139	48.24	13.66
Conscientiousness	-.566*	.133	.126	-.074	-.139	------	34.95	14.63

*$p < .008$.

Hypothesis II

To identify whether the severity of ADHD, increased anxiety, depression, and Neuroticism, as well as decreased Agreeableness and Conscientiousness significantly predicted an increased frequency of cognitive distortions, a multiple regression was conducted. A multiple linear regression analysis was conducted using ADHD (as measured by the BADDS), anxiety (as measured by the PSWQ), and depression (as measured by the BDI-II), as well as Conscientiousness, Agreeableness, and Neuroticism scores (as measured by the NEO-PI-R) as the predictor variables, and cognitive distortions scores (as measured by the ICD) as the criterion variable. Tests of assumptions and multiple linear regression were met. The Durbin-Watson statistic was equal to 2.082. According to Field (2009), the Durbin-Watson statistic tests for "serial correlations between errors in regression models" (p.785). Specifically, it tests whether

"adjacent residuals are correlated, which is useful in assessing the assumption of independent errors" (p. 785). The Durbin-Watson statistic varies between 0 and 4 with a value of 2, indicating that the residuals are uncorrelated (Field, 2009). This is precisely what was found in the present analysis.

The collinearity diagnostics revealed that for each of the predictor variables, there was no evidence of multicollinearity. According to Field (2009), tolerance statistics "measure multicollinearity and are simply the reciprocal of the variance inflation factor… Values below 0.1 indicate serious problems," but values below 0.2 may also warrant worry (p. 795). None of the tolerance statistics met this criterion, suggesting multicollinearity was not a problem. Additionally, the variance inflation factor is also a measure of multicollinearity (Field, 2009). It measures whether a predictor has a "strong linear relationship with the other predictors" (Field, 2009, p. 796). Field (2009) explained that values of 10 are indicative of problems in this area. These values ranged from 1.092 to 2.117, suggesting there was no difficulty in this area as well.

Further analyses of assumptions were conducted in accordance with Field (2009). A plot of standardized residuals (ZRESID) against standardized predicted values (ZPRED) revealed that the assumptions of linearity and homoscedasticity were met. To test the normality of the residuals, an examination of a histogram and normal probability plot of the residuals were obtained and examined. The histogram reveals that the assumption of normality was met. Likewise, the normal probability plot examining observed cumulative percentages to expected cumulative percentages also supported the assumption of normality.

An examination of the data revealed that there was an outlier of one score, and

this score was removed from the analysis. The results of the multiple linear regression

analysis, as shown in Table 2, revealed a multiple correlation of $R = .720$ with a

coefficient of determination of .519 ($R^2 = .519$), indicating that approximately 51.9% of

the variance observed can be attributed to this combination of predictor variables. The

adjusted coefficient of determination ($AdjR^2 = .491$) suggests that there would be some

shrinkage from sample to population if the population had been evaluated. The overall

regression analysis, as shown in Table 3, revealed a significant regression ($F(6, 110) =$

18.673, $p = .000$), indicating that the combination of these predictors made a significant

contribution to the prediction of cognitive distortions. As shown in Table 4, an

examination of each of the predictor variables revealed that only three of the predictors

made a significant contribution to the prediction of severity of distorted thinking. These

variables, depression, anxiety, and Neuroticism, were positively related to the prediction

of distorted thinking severity.

Table 2

Model 1 Summary of the Predictor Variables (Conscientiousness, Depression, Agreeableness, Anxiety, Neuroticism, and ADHD) to the Dependent Variable (Cognitive Distortions)

Model	R	R^2	Adjusted R^2	Std. Error of Est.	R^2 Change	F Change	df1	df2	Sig. F Change
1	.720	.519	.491	29.927	.519	18.673	6	104	.000

Table 3

Overall Regression Analysis with Predictor Variables (Conscientiousness, Depression, Agreeableness, Anxiety, Neuroticism, and ADHD) to the Dependent Variable (Cognitive Distortions)

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	100348.218	6	16724.703	18.673	.000[a]
Residual	93146.719	104	895.642		
Total	193494.937	110			

[a] = Criterion variable: severity of cognitive distortions.

Table 4

Coefficients of Predictor Variables (Conscientiousness, Depression, Agreeableness, Anxiety, Neuroticism, and ADHD) to the Dependent Variable (Cognitive Distortions)

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (constant)	-.089	38.437		-.002	.998		
ADHD	.519	.401	.129	1.295	.198	.469	2.130
Anxiety	.593	.224	.223	2.646	.009	.653	1.531
Depression	1.336	.335	.335	3.712	.000	.567	1.764
Neuroticism	.720	.311	.221	2.319	.022	.510	1.962
Agreeableness	-.237	.217	-.077	-1.092	.277	.923	1.084
Conscientiousness	.053	.273	.018	.195	.846	.540	1.851

Hypothesis III

A hierarchical multiple regression was conducted to determine whether the severity of ADHD was predictive of an increased frequency of cognitive distortions, after accounting for the relative contribution of existing personality pathology (high Neuroticism, low Agreeableness, and low Conscientiousness), depression, and anxiety.

In this analysis, a hierarchical multiple linear regression was conducted controlling for Neuroticism, Agreeableness, Conscientiousness, BDI-II score, and PSWQ score in the first level and examining the BADDS total T-scores for the second level. Once again, the assumptions of the analysis were met with the Durbin-Watson statistic equal to 1.916. An examination of the tolerance statistics and the variable inflation factors suggested that there was no problem with multicollinearity. Further analyses of assumptions were conducted in accordance with Field (2009). A plot of standardized residuals (ZRESID) against standardized predicted values (ZPRED) revealed that the assumptions of linearity and homoscedasticity were met. To test the normality of the residuals, an examination of a histogram and normal probability plot of the residuals were obtained and examined. The histogram revealed that the assumption of normality was met. Likewise, the normal probability plot examining observed cumulative percentages to expected cumulative percentages also supported the assumption of normality. The probability probability (P-P) scatter plot showed some mild deviation around the line, but, generally, was very consistent with what would be expected in terms of normality.

As shown in Table 5, the Multiple R^2 was found to be .715 with a coefficient of determination of .511 and minimal shrinkage shown with an adjusted coefficient of determination (R^2 = .488). The *F change* was highly significant at the .000 level. In

Model 2, which included only the ADHD severity score after having controlled for the

others, the *F change* was insignificant. The outcome revealed that the combination of

variables lead to a significant prediction, suggesting that the NEO-PI-R Neuroticism

scale, the BDI-II, and the PSWQ made a significant contribution to cognitive distortion

scores on the ICD.

Table 5

Model 1 and Model 2 Summary

Model	R	R^2	Adjusted R^2	Std. Error of Est.	R^2 Change	F Change	df1	df2	Sig. F Change
1	.715[a]	.511	.488	30.024	.511	21.932	5	105	.000
2	.720[b]	.519	.491	29.927	.008	1.676	1	104	.198

[a] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, and depression to the dependent variable (cognitive distortions).
[b] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, depression, and ADHD to the dependent variable (cognitive distortions).

Model 2 was significant, as shown in Table 6. The analysis of the beta

coefficients, as shown in Table 7, revealed that once again it was the NEO Neuroticism,

BDI, and PSWQ that made a significant contribution to the prediction. The severity of

ADHD did not make a significant contribution to the scores. These results revealed that it

was the comorbidities of Neuroticism, depression, and anxiety that significantly

contributed to the severity of cognitive distortions, and not ADHD itself.

Table 6

Overall Regression Analysis

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	98846.764	5	19769.353	21.932	.000[a]
Residual	94648.173	105	901.411		
Total	193494.937	110			
2 Regression	100348.218	6	16724.703	18.673	.000[b]
Residual	93146.719	104	895.642		
Total	193494.937	110			

[a] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, and depression to the dependent variable (cognitive distortions).
[b] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, depression, and ADHD to the dependent variable (cognitive distortions).

Table 7

Coefficients of Predictor Variables to the Dependent Variable from Model 1 and Model 2

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (constant)	43.054	19.220		2.240	.027		
Neuroticism	.810	.304	.249	2.668	.009	.537	1.863
Agreeableness	-.306	.211	-.100	-1.448	.151	.981	1.019
Conscientiousness	-.178	.208	-.060	-.856	.394	.941	1.062
Depression	1.450	.350	.364	4.140	.000	.603	1.659
Anxiety	.608	.224	.228	2.707	.008	.655	1.527
2 (constant)	-.089	38.437		-.002	.998		
Neuroticism	.720	.311	.221	2.319	.022	.510	1.962
Agreeableness	-.237	.217	-.077	-1.092	.277	.923	1.084
Conscientiousness	.053	.273	.018	.195	.846	.540	1.851
Depression	1.336	.360	.335	3.712	.000	.567	1.764
Anxiety	.593	.224	.223	2.646	.009	.653	1.531
ADHD	.519	.401	.129	1.295	.198	.469	2.130

Note. Dependent variable is cognitive distortions.

In a subsequent analysis, another outlier was removed and the analysis revealed virtually the same results. All of the assumptions were met, and the Durbin Watson was equal to 1.891. Collinearity diagnostics, in terms of tolerance and variable inflation factors, were also met. The dependent variable was normally distributed and the P-P plot was in line with what would be predicted. The results of the hierarchical analysis

revealed that, as shown in Table 8, Model 1 was significant, which included the PSWQ

score, NEO Conscientiousness, NEO Agreeableness, NEO Neuroticism, and the BDI-II

score as predictors. In Model 2 (as shown in Table 9), after having controlled for these

predictors, the BADDS total score did not make a significant contribution, as was found

in the previous analysis. As shown in Table 10, examining the coefficients once again, it

was the NEO Neuroticism, BDI-II score, and PSWQ score that made significant

contributions to the criterion of cognitive distortions. After controlling for these

variables, an identical pattern emerged, and the BADDS did not add significantly to the

prediction. These results suggest that, again, it was the combination of the variables

described above—Neuroticism, depression, and anxiety—that predicted cognitive

distortions and not the severity of ADHD once those variables have been controlled.

Table 8

Model 1 and Model 2 Summary After Outlier Removal

Model	R	R^2	Adjusted R^2	Std. Error of Est.	R^2 Change	F Change	df1	df2	Sig. F Change
1	.736[a]	.542	.520	28.677	.542	24.578	5	104	.000
2	.741[b]	.549	.523	28.590	.007	1.635	1	103	.204

[a] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, and depression to the dependent variable (cognitive distortions).
[b] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, depression, and ADHD to the dependent variable (cognitive distortions).

Table 9

Overall Regression Analysis After Outlier Removal

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	101060.419	5	20212.084	24.578	.000[a]
Residual	85525.081	104	822.357		
Total	186585.500	109			
2 Regression	102396.548	6	17066.091	20.879	.000[b]
Residual	84188.952	103	817.368		
Total	186585.500	109			

[a] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, and depression to the dependent variable (cognitive distortions).
[b] Predictor variables of Neuroticism, Conscientiousness, Agreeableness, anxiety, depression, and ADHD to the dependent variable (cognitive distortions).

Table 10

Coefficients of Predictor Variables to the Dependent Variable from Model 1 and Model 2 After Outlier Removal

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (constant)	36.879	18.451		1.999	.048		
Neuroticism	.806	.290	.252	2.779	.006	.538	1.859
Agreeableness	-.243	.203	-.080	-1.196	.234	.978	1.022
Conscientiousness	-.090	.200	-.031	-.452	.652	.939	1.065
Depression	1.503	.335	.384	4.489	.000	.603	1.658
Anxiety	.613	.214	.234	2.860	.005	.656	1.525
(constant)	-3.776	36.735		-.103	.918		
Neuroticism	.721	.297	.225	2.431	.017	.511	1.957
Agreeableness	-.178	.208	-.059	-.855	.394	.921	1.086
Conscientiousness	.127	.262	.043	.483	.630	.544	1.838
Depression	1.396	.344	.356	4.053	.000	.567	1.764
Anxiety	.599	.214	.229	2.799	.006	.654	1.529
ADHD	.490	.383	.123	1.279	.204	.472	2.118

Note: Dependent variable is cognitive distortions.

Chapter **5: Discussion**

This study examined the relationship between the frequency of cognitive distortions and the severity of ADHD, after accounting for anxiety, depression, and personality pathology in adult outpatients. Previous research found a relationship between cognitive distortions and ADHD symptoms in adults (Abramovitch & Schweiger, 2009; Strohmeier, 2013; Torrente et al., 2014); however, many of these studies were limited by the fact that they did not control for the influence of other clinical syndromes and personality pathology, especially those that are known to correlate highly with cognitive distortions, such as disorders of anxiety, mood, and personality (Beck et al., 2015; Fournier et al., 2012; Mathews & MacLeod, 2005; Napolitano & McKay, 2007; Oshio, 2012; Rosenfield, 2004; Wenzel et al., 2006; Yurica, 2002;;). In other words, these previous studies may have measured cognitive distortions arising from comorbidities, rather than such distortions arising solely from or in addition to ADHD.

Although there have been a few studies that controlled for the presence of comorbid depression (e.g., Mitchell et al., 2013) and comorbid depression and anxiety (e.g., Strohmeier, 2013), a literature review failed to find a single study examining the influence of these disorders in addition to comorbid personality pathology. This apparent void represents a significant limitation in the previous research, given that personality disorders are highly comorbid with ADHD (Cumyn et al., 2009; Jacob et al., 2007; Miller et al., 2007). As such, the goal of this study was to determine whether there is a direct relationship between the frequency of cognitive distortions and ADHD symptoms in adults, after controlling for the influence of such comorbidities, known to be highly prevalent – up to 89% lifetime prevalence (Sobanski, 2006) – in this population.

Findings and Clinical Implications

  Severity of ADHD and comorbidities. The current study found that the severity

of ADHD was highly positively correlated with Neuroticism, which is a known to

correlate highly with personality and other pathologies (Widiger & Costa, 2013). The

severity of ADHD was also correlated positively with depression and correlated

negatively with Conscientiousness. The relationship between ADHD severity and

anxiety was not considered to be significant due to concerns about potential alpha

inflation. These results corroborate much of what has been demonstrated previously in

the literature (Jacob et al., 2007; Parker et al., 2004). These findings suggest that when

comorbidities such as anxiety, depression, and personality pathology, exist with high

Neuroticism and low Conscientiousness and are present in adult ADHD, individuals often

present with more severe ADHD symptomatology, and vice versa. As such, clinically, it

is important for clinicians to screen for these comorbidities when treating adults with

ADHD and to modify treatment accordingly.

  The present study found no relationship between the severity of ADHD and

Agreeableness. Although the severity of ADHD has been found to correlate with low

Agreeableness in some studies (Gomez & Corr, 2014; Miller et al., 2008; Parker et al.,

2004), other studies did not find a relationship between ADHD and Agreeableness (Jacob

et al., 2007), or found this relationship only in adults high in hyperactivity/impulsivity but

not high in inattentiveness (Nigg, John, et al., 2002). As such, it is possible that the

current study found no relationship between ADHD and Agreeableness because

Agreeableness is a better predictor of ADHD for adults with primary

hyperactive/impulsive symptoms than of ADHD for adults with primary inattentive

symptoms (Parker et al., 2004). Given that adults with ADHD generally tend to

demonstrate more inattentive symptoms as opposed to hyperactive/impulsive symptoms

(Kessler et al., 2010), it may be that Agreeableness is not as consistent of a correlate to

adult ADHD as Neuroticism and Conscientiousness. Moreover, given that the present

study did not measure ADHD subtypes, a relationship between Agreeableness and the

ADHD subtypes cannot be elucidated here.

      The role of cognitive distortions. Results also demonstrated that the overall

combination of the independent variables (i.e., severity of ADHD; increased anxiety,

depression, and Neuroticism; and decreased Conscientious and Agreeableness)

significantly predicted frequency of cognitive distortions. When examining the

breakdown, however, the three variables that contributed most significantly to the

prediction of cognitive distortions were depression, anxiety, and Neuroticism. Again, this

corroborates much of what has been found in the literature, that depression (Mathews &

MacLeod, 2005; Yurica, 2002), anxiety (Mathews & MacLeod, 2005), and Neuroticism

(Vasey & MacLeod, 2001) are correlated strongly with cognitive distortions in other

clinical populations, in the absence of ADHD.

      From a clinical perspective, the results further underscore the importance of

appropriate assessment when beginning treatment with adults with ADHD. The presence

of anxiety, depression, and/or Neuroticism in adult ADHD is likely to predict frequent

cognitive distortions. This increased frequency of cognitive distortions may exacerbate

many of the functional difficulties already experienced by adults with ADHD, which are

well-documented in the literature (Kessler et al., 2006; Weiss et al., 2010), impact mood,

and further decrease their quality of life. Therefore, it is essential for clinicians to be

aware of the impact comorbid mood and anxiety disorders as well as maladaptive personality features can have on their clients' clinical presentations and real-life difficulties. Clinicians can alter treatment accordingly so that cognitive distortions can be addressed adequately.

CBT is uniquely qualified in this regard. According to Beck (2011), cognitive distortions are the result of a "systematic negative bias [or inaccuracy] in … cognitive processing" (p.179) found in individuals suffering with a wide variety of psychiatric disorders. Underlying maladaptive core beliefs and intermediate beliefs give rise to negative or otherwise distorted automatic thoughts (Beck, 2011). These maladaptive automatic thoughts, which are often distorted, can in turn lead to psychiatric disorders, such as anxiety and depression (Mathews & MacLeod, 2005), as well Neuroticism (Vasey & MacLeod, 2001). Successful CBT involves identification of the cognitive distortions and dysfunctional core beliefs, and "direct modification of their core beliefs as soon as possible" so that clients may begin to view their current and future problems more adaptively (Beck, 2011, p. 35). As such, the ICD may be a particularly advantageous measure to use at the outset of therapy for adults with ADHD, as it identifies cognitive distortions, which may quickly become a focus of treatment when adults with ADHD present with comorbidities.

It should be noted, however, that CBT alone may be insufficient treatment for individuals presenting with more severe ADHD with comorbidities. In some cases, pharmacological treatments may be necessary (Ramsay & Rostain, 2011). Moreover, the presence of high Conscientiousness and/or low Neuroticism may be protective factors for

adults with ADHD, and could possibly be strengths upon which to capitalize during treatment.

ADHD as a disorder of deficit, more than distortion. The current study found that the relationship between ADHD and cognitive distortions was no longer significant after accounting for the relative contribution of existing personality pathology (high Neuroticism, low Agreeableness, and low Conscientiousness), depression, and anxiety. As such, these particular findings seem to suggest that ADHD may be more of a disorder of cognitive deficit, (or more precisely, deficit in executive functioning) rather than a disorder of cognitive distortion.

This concept is one that has been discussed previously in the literature on children and adolescents, where Kendall (1993, 2012) explained the difference between cognitive deficit and cognitive distortion. According to Kendall (1993), children and adolescents with cognitive deficits often do not carefully process information at times when to do so would be advantageous. That is, children and adolescents with cognitive deficits are not thinking, whereas those with cognitive distortions are processing information but do so in a dysfunctional or biased way. This debate between the etiology of dysfunction being more attributable to deficit versus distortion can be extended to adults with ADHD. For instance, adults with ADHD "are often described as acting before they think… it is not that they don't know what to do, but rather that they are so impulsive that they don't use what they know" (Brooks, 2002, p. 128). Although impulsivity is considered to be a broad category that incorporates several different traits (Malloy-Diniz, Fuentes, Leite, Correa, & Bechara, 2007; Whiteside & Lynam, 2001), the essence of impulsivity can be defined as acting without thinking (Kooij et al., 2010).

In addition to cognitive (and, consequently, behavioral) impulsivity, other deficits in executive functioning have been found in adults with ADHD. According to Brown (2006), these adults also have significant impairments in their ability to cognitively prepare to engage in a task, sustain attention on a task, engage meaningfully and with effort on a task, tolerate frustration, use working memory, and monitor the actions they have taken. His rating scales, the BADDS, were developed meticulously based on interviews with individuals suffering from deficits such as these (Brown, 2006). Furthermore, given that the BADDS was developed based on cognitive deficits (i.e., deficits in executive functioning) as opposed to cognitive distortions, and the ICD was developed to measure distorted thinking style as opposed to deficits, it stands to reason that the two scales would not correlate. This is because these scales may be measuring two separate content domains, one of which tends to be highly prevalent in ADHD (deficit) and the other of which tends to be highly prevalent in the comorbidities commonly seen in ADHD (distortion).

There is also considerable support for the theory that executive function impairments are inherent to ADHD, so much so that deficits in executive functioning are considered to be the best way to differentiate ADHD from most other psychological diagnoses (Kessler et al., 2010). If this is the case, then treatment for adults with more "pure" ADHD—ADHD without comorbidities—may require treatment with a greater focus on compensating for deficits in executive functioning, due to the fact that they have significantly fewer cognitive distortions than those identified in adults with ADHD with comorbidities.

Several clinicians have published manualized treatment strategies to help adults with ADHD compensate for their executive functioning deficits (Brown, 2013; Ramsay & Rostain, 2015b; Tuckman, 2011). For example, Ramsay and Rostain (2015b) have developed a "tool kit" to help adults with ADHD "increase the consistent use of effective coping strategies that will improve one's ability to manage his or her daily affairs" (p. xv). Their handbook identifies "take away" points after each section, and stresses the importance of taking incremental steps toward change in developing new coping strategies to be implemented in real time. For instance, if an adult with ADHD is struggling with managing his or her materials and environment, these authors recommend implementing various organizational strategies (i.e., identifying whether the patient needs the materials, finding a place to store the materials, and how to stay organized) as well as stimulus control (Ramsay & Rostain, 2015b).

Another treatment workbook, developed by Tuckman (2011), also aims to help adults with ADHD compensate for deficits in executive functioning. This workbook includes an explanation of what executive functions are, and discusses how clients can optimize their cognitive resources, have realistic motivation, develop response inhibition, fine-tune their working memory and memory in general, improve their sense of time, regulate emotions, and learn to persevere through difficulties (Tuckman, 2011). In addition, Brown (2013) has published a book which discusses myths, causes, and how treatments can improve executive functions and impact brain processes in ADHD. These treatment modalities are likely to be of the most benefit for adults presenting with ADHD with few comorbid conditions or difficulties. Conversely, the vast majority of adult patients with ADHD will present with comorbidities. As such, successful treatment will

require both teaching patients how to cope with cognitive deficits as well as modifying

cognitive distortions.

The current results are consistent with literature indicating that cognitive

behavioral treatments for adults with ADHD are effective in ameliorating cognitive

distortions (and other maladaptive thinking patterns) and helping clients compensate for

deficits in executive functioning (i.e., Ramsay & Rostain, 2015a; Safren, Otto, et al.,

2005; Solanto, 2011). These treatments are based on the idea that restructuring

dysfunctional thoughts and core beliefs is an essential component to successful therapy

with an ADHD population. It may be that cognitive restructuring is vital to successful

treatment in adults with ADHD with comorbidities, occurring in up to 89% of adults with

ADHD (Sobanski, 2006). Current findings also support previous research demonstrating

that the cognitive techniques of CBT are effective for many adults with ADHD (Ramsay,

2010; Rosenfield, Ramsay, & Rostain, 2008). Nevertheless, the present findings

highlight the importance of tailoring treatment to each individual based on the nature of

their cognitive presentation, severity of ADHD, presence of comorbidities, and the

uniqueness of each individual in symptom presentation, treatment goals, and obstacles to

treatment.

Taken together, these results alert clinicians to be aware that the majority of those

presenting with adult ADHD are likely to present with comorbidities, requiring treatment

consisting of learning to compensate for deficits in executive functioning (of ADHD) as

well as modifying cognitive distortions (of co-occurring conditions). Moreover, "pure"

ADHD in adults is more likely to be a disorder of deficit in executive function rather than

a disorder of cognitive distortion.

Limitations

Limitations of the present study should be considered when evaluating the results.

One notable limitation to the current study arises from the use of the NEO-PI-R, which

was not designed to diagnose personality disorders, as opposed to a measure designed to

specifically do so, such as the Structured Clinical Interview for DSM-IV Axis II

Personality Disorders (SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1997).

Despite the finding that different NEO-PI-R profiles are representative of various

personality disorders (Saulsman & Page, 2004), use of the NEO-PI-R as a measure of

personality pathology represents a potential limitation, in that the conclusions of the

current study should be interpreted with caution when generalizing results to adults with

both ADHD and personality disorders.

Another limitation is that the current university-based outpatient treatment sample

consisted of adults with ADHD who tended to be of higher socioeconomic status and

have better overall functioning than the average adult with ADHD. It is possible that

adults with ADHD who are higher functioning and have greater economic and cognitive

resources are less likely to have distorted cognitions and deficits in executive functioning

than those who are lower functioning and have fewer cognitive and financial resources

with which to cope with life stressors. Additionally, it is possible that there is an inherent

bias within the current sample, given that the sample consisted of individuals seeking

help specifically from a university-based ADHD specialty clinic that accepts private pay

or university healthcare only. It is possible that certain types of people are drawn to

being seen at a clinic that specializes in ADHD, as opposed to those who seek help at a

more general outpatient or community mental health clinic. Furthermore, as the sample

consisted primarily of Caucasian males, the findings are somewhat limited when generalizing to minority populations and women.

Another sample characteristic which represents a limitation in this study is that some participants were taking medications for ADHD at the time of the evaluation, whereas others were not. It is possible that those who were taking medication could have presented with fewer cognitive distortions or deficits in executive functioning than those who were not taking medications, or systematically differed in other ways, which may have influenced the findings. This limitation is mitigated by the fact that both people who were and were not using medication were included in this study.

An additional limitation of the present study is that subtypes of ADHD were not examined within the relationship between ADHD and cognitive distortions. It may be that adults diagnosed with a particular subtype of ADHD could be more likely to present with cognitive distortions than those diagnosed with another subtype. Examining subtypes could help explain the discrepancy between the current results and previous findings.

A final limitation relates to the use of self-report measures. Although self-report measures, such as the BADDS, have been found to be psychometrically sound and there is evidence that adults are the best informants of their own symptoms (Kooij et al., 2008), self-report measures in an adult ADHD population tend to underreport ADHD symptoms, as compared to reports of collaterals (Kooij et al., 2008). This under-reporting of symptoms may be due to a demonstrated lack of self-awareness (Manor et al., 2012). Such under-reporting might minimize findings or even exclude some of those with a milder diagnosis of ADHD, resulting in a biased sample. Furthermore, although all

measures are psychometrically sound, the current study only uses one measure per

construct, which could limit the accuracy of the diagnoses and conclusions drawn from

these measures, given that a multimethod approach, such as informant reports, can

provide useful additional information regarding symptomatology and level of functional

impairment in adults with ADHD (Kooij et al., 2008).

Future Directions

Because the current results are in contrast with previous preliminary findings that

ADHD and cognitive distortions are linked (Abramovitch & Schweiger, 2009;

Strohmeier, 2013), it will be especially important for future research to replicate and

expand on the current findings. One particularly useful way to expand on the current

findings would be to examine a different ADHD population. For instance, future

research should replicate this study in a community-based mental health clinic where

there may be a sample more representative of the average adult with ADHD, or where a

more diverse sample could be obtained. Additionally, replicating this study with children

and older adults would be conceptually informative, to discover whether cognitive

distortions in ADHD alone become present over time and to further explicate the

relationship to comorbidities. For example, do the deficits of executive function in

ADHD precede the development of cognitive distortions in anxiety, depression, and

personality pathology as those with ADHD encounter failure, rejection, and difficulties in

academic and social functioning? Another possible way to expand on the current

findings would be to examine the ADHD subtypes to determine whether the relationship

between ADHD and cognitive distortions is mediated or moderated in some way by the

ADHD subtype presentation.

Summary and Conclusions

This study examined the relationship between ADHD and cognitive distortions after accounting for the relative contribution of personality pathology, depression, and anxiety. Results demonstrated that the previously identified relationship between ADHD and cognitive distortions was no longer significant once the aforementioned comorbidities were taken into consideration. This finding suggests that the relationship between ADHD and cognitive distortions could be explained by the existence of comorbidities, and that cognitive distortions may not be inherent to a diagnosis of ADHD itself. Instead, ADHD may be a disorder of cognitive deficit (in executive functioning) rather than a disorder of cognitive distortion. As such, treatment for adults with "pure" ADHD, without comorbidities, may require treatment focusing primarily on compensating for deficits in executive functioning, as they may have fewer cognitive distortions than adults who have ADHD with comorbidities.

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