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Relationships between Executive Functions, Attention Deficit Hyperactivity Disorder (ADHD), Comorbid Disorders, and Familial History in a Nonclinical Population

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Philadelphia College of Osteopathic Medicine
Department of Psychology

THE RELATIONSHIPS BETWEEN EXECUTIVE FUNCTIONS, ATTENTION
DEFICIT HYPERACTIVITY DISORDER (ADHD), COMORBID DISORDERS, AND
FAMILIAL HISTORY IN A NONCLINICAL POPULATION

By Sara M. Sachjog Vélez

Submitted in Partial Fulfillment of the Requirements of the Degree of
Doctor of Psychology

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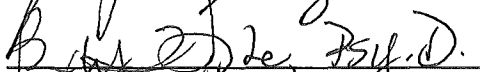
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DEPARTMENT OF PSYCHOLOGY**

Dissertation Approval

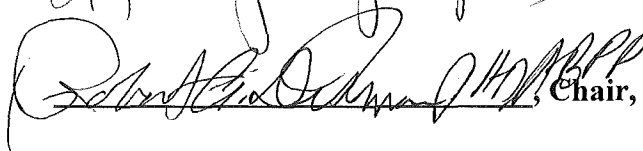
This is to certify that the thesis presented to us by Sara M. Sachjog Vélez
on the 7th day of April, 2009, in partial fulfillment of the requirements for the degree of
Doctor of Psychology, has been examined and is acceptable in both scholarship and
literary quality.

Committee Members' Signatures:

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Abstract

Attention-deficit/hyperactivity disorder (ADHD) is typically characterized by impulsivity, inattention, and hyperactivity and often lasts into adulthood. Depression, anxiety, and bipolar disorder are often diagnosed as comorbid disorders with ADHD. Adults with ADHD may also display executive functioning deficits. The current study sought to identify whether symptoms of executive functioning were related to symptoms of ADHD in adults. It also identified comorbid disorders in the participants.

Questionnaires assessing executive functioning, ADHD, depression, anxiety, and bipolar spectrum disorders were given to participants. Demographics were obtained regarding their own background and comorbid disorders in their first-degree relatives. Results indicated that symptoms of executive functioning and ADHD were significantly related. Both ADHD and executive functioning symptoms were associated with depression and anxiety.

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Act as if what you do makes a difference. It does.

William James

EXECUTIVE FUNCTIONS AND ADHD

Chapter 1

Attention deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder typically characterized by impulsivity, inattention, and hyperactivity that begins in childhood, and for many individuals, persists into adulthood (American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 2000; Barkley, 2006; Hervey, Epstein, & Curry, 2004; McGough & McCracken, 2006; Rostain & Ramsay, 2006; Weisler, 2004; Young & Toone, 2000). There are significant impacts on performance in the academic, social, and vocational realms. These problems are often due to difficulties in social skills, attention, inhibition, working memory, and affect regulation (Barkley, 2006; Hervey et al., 2004; Weisler, 2004). According to the current conceptualization of ADHD, adults with this disorder tend to display executive function deficits and may experience emotions more strongly than those without the disorder (Barkley, 1997a; Barkley, 1997b; Braaten & Rosén, 2000; Hervey et al., 2004; Hesslinger et al., 2002; Pliszka, 2005; Rapport, Friedman, Tzelepis, & Van Voorhis, 2002; Weisler, 2004). Therefore, the current study is primarily designed to clarify how executive functioning is related to the level of presenting ADHD symptoms in adults.

Prevalence, Etiology, and Genetics

ADHD is relatively common, with the overall prevalence averaging approximately 7.4% in the United States population of children and adolescents, according to a study of nearly 6,000 individuals using DSM—IV criteria (Barbarese et al., 2002). The prevalence among adults, however, appears to be a little lower, at 4% to 5% on average (Faraone et al., 2000; Kessler et al., 2005; McGough & McCracken, 2006;

Murphy & Barkley, 1996; Murphy & Gordan, 2006). While this estimate of prevalence is lower than for that of children and adolescents, it is clear that symptoms for many people do not decrease once they reach adulthood, as was once believed (Barkley, 2006; McGough & McCracken, 2006; Rostain & Ramsay, 2006). In fact, this prevalence is likely an underestimation of the adults that suffer from this disability. Attention deficit hyperactivity disorder also has a strong heritable and genetic component (Barkley, 2006; Cornish et al., 2005; McGough & McCracken, 2006; Weisler, 2004), with a number of studies showing much higher rates of the disorder within families as compared to the population base rate (Barkley, 2006).

Typical Characteristics of ADHD

Researchers and clinicians describe a number of problems typically associated with ADHD, since there is a wide array of presenting symptoms. Barkley (2006) suggests that behavioral inhibition is a key area of dysfunction, while research also shows deficits in executive functioning and self-regulation to be factors that lead to some of the problems common to the disorder. Individuals with ADHD also tend to have deficits in social and emotional competence that contribute to the commonly observed social skills problems (Braaten & Rosén, 2000; Friedman et al., 2003; Rapport et al., 2002).

Attention has been one of the most widely discussed cognitive components associated with the disorder. Research has become quite specific in addressing the various aspects of attention as it relates to ADHD in order to better determine what types of problems arise related to each different type of attentional process (Hood, Baird, Rankin, & Isaacs, 2005; Tsal, Shaley, & Mevorach, 2005). However, there are several

areas of neuropsychological functioning that are not as efficient in adults with ADHD as compared to those without the disability (Barkley, 2006; Biederman et al., 2006).

Diagnosis and Comorbidity

What further complicates the treatment of ADHD is its accurate diagnosis. ADHD can be a difficult diagnosis to make because it is often comorbid with other disorders. Some of the disorders and conditions commonly associated with ADHD are the following: depression, anxiety, bipolar disorder, dysthymia, sleep disturbance, conduct disorder, oppositional defiant disorder, antisocial personality disorder, and substance abuse or dependence (Barkley, 2006; Cleland, Magura, Foote, Rosenblum, & Kosanke, 2006; Hesslinger et al., 2002; McGough et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004; Young & Toone, 2000). Many of these comorbid disorders also are associated with deficits in executive functioning (Charney, 2003; Goldapple et al., 2004; Zimmerman, DelBello, Getz, Shear, & Strakowski, 2006). Therefore, it would be important for researchers and clinicians alike to understand as much as possible about the characteristic differences between ADHD and some of its commonly comorbid disorders in order to increase the accuracy and appropriateness of diagnosis and treatment.

Treatment Approaches

Because the type of symptoms is so diverse, a wide variety of approaches need to be taken to successfully treat a person with ADHD. Cognitive and behavioral strategies have been recommended and used for treatment of social skills and behavioral issues related to ADHD symptoms (Barkley, 2006; Pelham et al., 2005; Ramsay & Rostain, 2004; Root & Resnick, 2003; Rostain & Ramsay, 2006; Weisler, 2004). Effective

medication management is also an important component of treatment (Ramsey & Rostain, 2004; Rostain & Ramsay, 2006; Weisler, 2004) and has been recommended to be used either alone or in combination with behavioral methods (Root & Resnick, 2003).

Purpose of the Current Study

Individuals with ADHD exhibit executive function deficits. They may have poor frustration tolerance, planning, organizing, judgment, emotional expression, and inhibition and may even exhibit aggression (Barkley, 2006; Hinshaw & Melnick, 1995; McGough & McCracken, 2006; Melnick & Hinshaw, 2000; Rostain & Ramsay, 2006; Walcott & Landau, 2004). Many studies of ADHD have been designed with children and adolescents, while this disorder frequently continues into adulthood. If neuropsychological deficits, such as executive functioning, could be more clearly defined in symptomatic adults, then it may be possible to better tailor treatment to deal with specific aspects of the disorder (McGough & McCracken, 2006).

Therefore, the aim of the current study was to determine whether executive functioning in adults predicts their performance on a commonly used measure of ADHD. Participants were screened for comorbid symptoms of anxiety, depression, and hypomania/mania. They were asked to indicate the presence and suspected presence of any of these disorders in first-degree relatives. Finally, the study suggested some treatment techniques that may be useful for adults with executive functioning problems.

The following chapter will review the nature of ADHD and its historical development, estimated prevalence, and gender differences. It will then go on to describe the etiology and characteristics of ADHD. Finally, the next chapter will review frequently comorbid disorders, heritability factors, and typical treatments for ADHD.

Chapter 2

As previously described, ADHD is a neurodevelopmental disorder that begins in childhood and often will continue through adolescence and into adulthood (APA, 2000; Barkley, 2006; Hervey et al., 2004; McGough & McCracken, 2006; Rostain & Ramsay, 2006; Weisler, 2004). It is considered to be one of the most heritable disorders and likely results from a combination of genetic susceptibility and environmental factors (Cornish et al., 2005; McGough & McCracken, 2006). Research has shown there to be both structural and functional deficits in the brains of ADHD patients, and medications used to treat these deficits in children also tend to be just as effective in adults (McGough & McCracken, 2006).

In terms of diagnosing adults with attention deficit hyperactivity disorder, there are a number of problems with the current Diagnostic and Statistical Manual of Mental Disorders (*DSM—IV—TR*) (APA, 2000). One of these problems is that *DSM* field trials for ADHD were done on children, so it cannot be assumed that the symptom expression will be the same for adults with the disorder (McGough & McCracken, 2006). An additional tool that may help determine symptom presentation in the adult population would be an assessment of their vocational, social, and family situations in order to obtain a broader conceptualization of impairments than the current criteria provide (Young & Toone, 2000).

It also cannot be assumed that the current *DSM* criteria are developmentally appropriate for adults or that those adults who do not meet criteria according to these guidelines are not clinically impaired. Many adults who are experiencing clinical impairment in their daily lives may not be appropriately treated because of these

problems with the current symptom criteria in the *DSM* (McGough & McCracken, 2006). One possible explanation for the failure to develop different criteria for this disorder in adults could simply be the enormous time and expense that it takes to conduct longitudinal research. This tendency towards cross-sectional research could possibly have contributed to the paucity of data on this segment of the population (Murphy & Gordan, 2006).

Historical Development of Attention Deficit Hyperactivity Disorder

Historically, the symptoms commonly associated with ADHD have been categorized in various ways and have appeared within the context of a number of different clinical disorders (Barkley, 2006; McGough & McCracken, 2006). According to Barkley (2006), the history of this disorder dates back to at least the 1800s, when physicians began describing hyperactivity, as well as problems with sustained attention and inhibition, in their patients. Scientists began to notice similarities to the behavior of individuals with brain damage and began to conceptualize ADHD as a minimal brain dysfunction or MBD (Barkley, 2006). Stimulant medications began to be used for this problem, even while conceptualization of these deficits went through changes. The criteria for this disorder became more specific and began to be differentiated from other related disorders, such as Tourette's syndrome (Barkley, 2006).

More recently, there has been abundant neuropsychological research that has provided considerable evidence of deficits in specific areas of the brain and with certain neurotransmitters. For example, there are typically deficits noticeable in the frontal lobes, and there is often underactivity of dopamine and norepinephrine (Barkley, 2006; McGough & McCracken, 2006). Furthermore, there is strong evidence in the literature of

a genetic component to this disorder (Barkley, 2006; Cornish, et al., 2005; McGough & McCracken, 2006; Stevenson, 1994; Weisler, 2004).

Estimated Prevalence and Gender Differences

The prevalence of ADHD appears to be on average from 4% to 5% (Faraone et al., 2000; Kessler et al., 2005; McGough & McCracken, 2006; Murphy & Barkley, 1996; Murphy & Gordon, 2006). Symptoms for as many as 50% to 80% of children who had been diagnosed with ADHD continue to cause impairment once they reach adulthood (Murphy & Gordon, 2006). Since the *DSM* criteria for ADHD were based on childhood symptoms, they will not as accurately reflect adult symptoms, which would give the appearance of a lower prevalence for adults than children (McGough & McCracken, 2006). Instead, their symptoms typically change with them as they age, while continuing to cause clinically significant impairment (Rostain & Ramsay, 2006). For example, as a child ages, she or he may exhibit fewer movement-related symptoms, such as climbing on desks and or running into the street. Instead, the adult may manifest more cognitive features of the disorder, such as poor planning, being disorganized, poor time management, and problems with self-regulation (Murphy & Gordon, 2006). Additionally, adults may exhibit avoidance and procrastination behaviors due to schemas related to defectiveness, failure, and self-doubt that have developed through their life experiences (Ramsay & Rostain, 2004).

Gender differences have typically been noted in the ADHD population, with more males being diagnosed with the disorder, according to a number of studies (Barkley, 2006). In fact, there may be a bias in the way that ADHD patients are referred for treatment because boys tend to exhibit more outwardly aggressive behavior, which is a

more noticeable problem (Gaub & Carlson, 1997). However, by the time children arrive at the clinic, boys and girls tend to exhibit the same level of aggression (Barkley, 2006). Therefore, some of this evidence could suggest that there has been under-identification or a different manifestation of the disorder in ADHD females, rather than a purely gender-related difference in prevalence (Barkley, 2006). One meta-analysis showed differences in certain aspects of ADHD, while there were no apparent differences for other symptoms. Furthermore, these results depended in part upon the type of sample. For example, when the population was clinical, as opposed to a community sample, differences were virtually nonexistent between genders (Gaub & Carlson, 1997, as cited in Barkley, 2006).

Another study addressed the issue that many of the past ADHD studies have been conducted solely on male patients, which clearly does not allow for adequate generalization to female subjects (Biederman et al., 2005). Therefore, the alleged gender differences seen in research may be due to unknown factors or a bias in the way individuals are referred for treatment, rather than an actual difference in ADHD prevalence. As previously mentioned, boys may exhibit more externalizing behaviors than girls and therefore may have the tendency to be seen as problem children (Biederman et al., 2005).

Due to the public health concern that may arise if girls are underidentified as suffering from this disorder, Biederman and his colleagues (2005) sought to determine whether there were differences in the gender ratio and manifestation of the disorder in a nonreferred sample of subjects with and without the disorder. They were able to show that there were no significant gender differences in presentation of the disorder and its

related impairments (Biederman et al., 2005). The area where gender differences were noticed was in male children's greater referrals for treatment due to disruptive behavior disorders. On the other hand, adults tend to be self-referred and the difference in ratio then becomes much smaller (Biederman et al., 2005).

Etiology and Characteristics of ADHD

Biological and Psychosocial Factors

Attention deficit hyperactivity disorder has a strong genetic and heritable component (Barkley, 2006; Biederman et al., 1995, as cited in Barkley, 2006; Cornish et al., 2005; McGough & McCracken, 2006; Stevenson, 1994; Weisler, 2004). Stevenson (1994) noted an overall heritability rate of approximately .80, or 80%, as cited in Barkley (2006). Children of adults with ADHD have a 57% risk of developing the disorder, according to one study (Biederman et al., 1995, as cited in Barkley, 2006). Twin studies have found a 70% heritability rate in phenotype expression (Weisler, 2004).

Cornish and colleagues (2005) reported an approximate heritability rate that ranges from 0.7 to 0.9, consistent with the literature in this area. These authors also stress the importance of acknowledging that ADHD is quite possibly caused by multiple factors, some of which may be environmental and some of which may be genetically based (Cornish et al., 2005; McGough & McCracken, 2006).

Cornish and colleagues (2005) went further than just attempting to produce general rates of heritability or speculating what the multiple causes for ADHD may be. They have noted that there seems to be a strong relationship between the dopaminergic system and symptoms of ADHD (Cornish et al., 2005). Therefore, they chose to specifically look at the dopamine transporter DAT 1 10/10-repeat genotype to determine

its distinct phenotypic expression of ADHD symptoms in the general population. The variance that seems to exist within the dopaminergic system of people with ADHD could contribute to the presence of executive function deficits. These cognitive deficits may include problems with working memory, sustained and selective attention, and response inhibition. Therefore, Cornish and colleagues assessed the possible connection between a particular genotype, the 10/10 DAT 1, and some neurocognitive markers more common to individuals with ADHD. Their expectations were that they would find the 10/10 DAT 1 genotype connected in conjunction with ADHD symptoms and neurocognitive impairments in the areas of working memory and response inhibition (Cornish, et al., 2005).

The investigators did find significantly more ADHD symptoms associated with the DAT 1 10/10 genotype, including more deficits in response inhibition and selective attention (Cornish et al., 2005). Sustained attention deficits and the central executive aspect of working memory were more generally predicted by high ADHD scores, but not this specific genotype. According to their results, response inhibition does seem to be a phenotypic expression of ADHD through the DAT 1 genotype; however, it is important to note that there may be a large degree of genetic specificity for certain cognitive functions associated with ADHD, such as working memory (Cornish et al., 2005).

Some maternal behaviors during pregnancy have also been shown to have an effect on the risk of the child developing ADHD. For example, exposure to certain toxins through the use of alcohol or tobacco, or through lead exposure can put the fetus at greater risk of developing this neurodevelopmental disorder (Barkley, 2006). Pregnancy complications such as low birth weight, brain hemorrhaging, and possibly even stress

may also result in increased risk for the disorder (Barkley, 2006). Therefore, it is important to provide education to pregnant women about these added risks for ADHD in the interest of prevention.

While psychosocial factors have been investigated as a potential cause of ADHD, few if any of these factors have been narrowed down specifically enough to constitute a particular risk factor for ADHD (Barkley, 2006). Moreover, even though behavioral symptoms of ADHD take place within a social context and some behaviors can be said to be learned, the significant genetic likelihood of one's parent also having ADHD does not allow for a clear distinction to be made between those psychosocial and genetic influences. Evidence for psychosocial causes of this disorder is unconvincing at this point and has likely been overemphasized by the media (Barkley, 2006).

Behavioral Aspects of ADHD

Individuals with ADHD also have a host of externalizing problems, such as behavioral deficits, that have been a noted difficulty in dealing with both children and adults. For example, adults with the disorder are also more likely to be involved in criminal acts, violence, and other antisocial behavior as compared to those without the disorder (Young & Toone, 2000). Therefore, behavioral problems would be important to understand since they can impact upon social, vocational, and academic functioning, just as cognitive deficits do.

Fabiano and Pelham (2003) conducted a case study in the classroom setting of a child whose teacher continued to have significant behavioral problems with him, even with their current behavioral modification program in place. The authors argued that the behavior modification programs set up in many school settings may not be intense

enough to make meaningful changes in children's behavior, and therefore appear to be ineffective. Because of this common problem, in their study they decided to alter this child's intervention in a systematic way until his observed behavior had changed and was consistent with the rest of the classroom, and the teacher was satisfied with the changes made (Fabiano & Pelham, 2003).

Fabiano and Pelham (2003) hypothesized that if this child had more opportunities to earn immediate (daily) rewards and that his behavioral targets were more specific, then he would begin to conduct himself in a much more effective manner. Their behavioral intervention did turn out to be successful in making the child's behavior comparable to his peers in the classroom, which suggests that tailoring existing behavioral modification programs to a child's specific needs would be a more effective means of coping with ADHD symptoms in the classroom (Fabiano & Pelham, 2003). This research could be extended to the therapeutic setting, in which it would be seen as important to tailor treatment to the specific abilities of the individual.

Involvement of parents in the home is another important part of treatment for children with ADHD. Hinshaw and his colleagues (2000) proposed that family processes, including the parents' own behavior and relationship with their child, would be an integral part of treatment for children with ADHD. Therefore, they designed a study to compare treatments for children with ADHD-combined type. The comparison groups included a medication only group, a behavior therapy group, a combined medication and behavior therapy group, and a community comparison group. The assignment to the community comparison group allowed parents to choose standard interventions typically available in the community (Hinshaw et al., 2000).

These investigators were specifically interested in the processes through which changes in parental behavior may have affected children's social skills, level of disruptive behavior, and internalizing symptoms (Hinshaw et al., 2000). Results showed that children in the combined group exhibited a significant increase in social skills and a decrease in disruptive behavior. This change was attributed to the parents' self-reported use of less negative or ineffective discipline in the home. These results speak to the interrelationship between biological mechanisms and the behavioral components of treatment (Hinshaw et al., 2000). Knowledge gained from this research could be extended to treatment of adults with ADHD who are living with a spouse, partner, or children as a family unit. These same types of principles could be used in collaboration with the family of an adult with ADHD.

Socioemotional aspects of ADHD

Affect recognition and experience of emotions. Interpersonal problems are commonly associated with ADHD, although few studies have looked at this particular aspect of the lives of adults living with this disability. For example, they may have difficulty with marital and family relationships due to behavior management problems or communication skills deficits (Weisler, 2004). In an adult's life, interpersonal problems can cause difficulties in vocational functioning as well as in a socioemotional capacity (Rapport et al., 2002). Therefore, Rapport and her colleagues were interested in assessing whether adults with ADHD continue to have the interpersonal problems that children with ADHD have, due to the effects of these problems on the social, emotional, and occupational functioning of adults. More specifically, adults with ADHD can have difficulty with social conduct, thinking about consequences of their actions, self-control,

future-directedness, solving problems, and being able to think creatively (Rapport et al., 2002).

In terms of their interpersonal skills, individuals with ADHD seem to have difficulties with emotional regulation and competence in social situations, apparently due to deficits in behavioral inhibition. What this means is that they may have difficulty delaying or inhibiting their response to a situation, leading them to act in an impulsive manner (Rapport et al., 2002). This deficit in response delay leads to increased emotional arousal, lower tolerance of frustration, and difficulty thinking about and choosing socially appropriate behaviors. Overall, experienced emotion and the way it is expressed seem to be some of the underlying problems with these social skills (Rapport et al., 2002).

Poor interpersonal skills can also be accounted for by attentional problems when the person misses social cues, and thus responds inappropriately (Rapport et al., 2002). There could also be visuoperceptual problems that lead to deficits in perceiving social cues. For example, abnormal structure and function have been shown in certain areas of the brain, such as the cortical-striatal loop in the frontal areas, corpus callosum, parietal lobes, and occipital lobes (Rapport et al., 2002). These abnormalities lend credence to both ideas, that there are both attentional and visuoperceptual problems that could lead to behavioral deficits. Therefore, these individuals would have difficulty interpreting the emotional content and affect expressed in a given social situation (Rapport et al., 2002).

Rapport and her colleagues were interested in comparing experienced emotion and recognition of affect in ADHD and non-ADHD adults in order to determine whether or not the ADHD adults would have a more intense emotional experience and also be less accurate at correctly interpreting others' expressed affect (Rapport et al., 2002). They

compared 28 adults with ADHD hyperactive or combined types with adults who did not have a diagnosis of ADHD on measures related to affect intensity and recognition of nonverbal emotional expressions. Results indicated that the adults with ADHD did have an increased experience of emotions and a deficit in the accurate interpretation of other people's affect (Rapport et al., 2002). On the other hand, when the non-ADHD individuals had an increase in emotional response, they were also better able to understand the emotions of others. Therefore, it appears that in general, when there is an increase in emotional response, one is better able to understand the feelings of another person. However, a person with ADHD may have such an intense emotional response that their ability to understand someone else's emotions is impaired at that time (Rapport et al., 2002).

Additionally, the ADHD participants in this study ranked themselves as being just as confident in their interpretations of the situation as the non-ADHD participants, even when they were actually less accurate in their interpretation. They were also not really able to determine which situations they were judging accurately or inaccurately (Rapport et al., 2002). Therefore, it appears that people with ADHD can be so overwhelmed by their heightened emotional state that their attention is focused inward. This increased focus on their own experience may account for poor judgment in social situations and behavior that at times seems insensitive to the needs of others (Rapport et al., 2002).

Social and emotional competence. It has been made clear that individuals with ADHD have problems in the socioemotional domain; however, it is important to understand whether or not they are themselves aware of those deficits. Therefore, Friedman and her colleagues (2003) looked at social and emotional competencies in

individuals with ADHD, since their interpersonal relationships are known to be a significant area of dysfunction. Emotional competency refers specifically to the ability to correctly identify emotions, have effective affect regulation, and be able to express one's emotions in a way that is appropriate to the situation (Friedman et al., 2003). The degree to which the person is aware of his or her symptoms aids in determining how socially competent they are, and it may even indicate what strategies they are using to compensate for those symptoms (Crosson et al., 1989; Friedman et al., 2003).

Friedman and her colleagues (2003) specifically assessed ADHD adults' self-perception of social and emotional competence and their ability to identify and express emotions. Results indicated that the adults with ADHD were less attentive to emotional stimuli in a given situation and that when describing an emotional situation, they used more words, but fewer emotion-related words, as compared to adults without the disorder. It was also reported the researchers believed that the ADHD participants tended to experience more symptoms of alexithymia than those without the disorder (Friedman et al., 2003). Adults with ADHD in this study did not see themselves as having problems communicating about emotions or recognizing other people's emotions. However, it appears that they do actually have more difficulty with these types of tasks and are not aware of their tendency to misinterpret emotional content and others' affective expression (Friedman et al., 2003).

Affect regulation, empathy, and frustration. Affect regulation has been another common socioemotional problem associated with attention deficit hyperactivity disorder. Poor regulation of emotions includes difficulty expressing empathy, high emotional responsivity, high levels of negative emotions, difficulty dealing with frustration, and

trouble predicting emotional responses that may occur in the future (Barkley, 1997a; Barkley, 1997b; Barkley, 2006; Braaten & Rosén, 2000; Melnick & Hinshaw, 2000; Walcott & Landau, 2004). These individuals also exhibit inappropriate expressions of anger, low motivation, and poor time management (Barkley, 2006), which are all likely to negatively affect vocational performance and interpersonal relationships at times. Additionally, because they differ in their ability to self-regulate emotions, these individuals tend to be more irritable, hostile, and emotionally hypersensitive than those without the disorder (Barkley, 2006).

Braaten and Rosén (2000) were interested in determining whether there were any differences in affect regulation between individuals with and without ADHD. More specifically, they were interested in empathy responses, intensity of emotional experiences, and behavioral manifestations of emotions in the participants. Their sample consisted of boys who were between the ages of 6 and 12 and who were diagnosed with the hyperactive or combined type of ADHD. The inattentive type was excluded because it almost presents as a different disorder than the other two types (Braaten & Rosén, 2000).

In order to assess these factors, Braaten and Rosén (2000) administered a behavioral assessment, obtained a developmental history, identified ADHD symptoms, and determined each child's receptive vocabulary. They then performed an empathy task, which involved reading stories to them in a neutral manner. The boys then rated feelings they had afterward in relation to the story, which were each designed to elicit certain emotions from them (Braaten & Rosén, 2000). They were also rated by their parents on an emotional behavior scale and completed a self-report measure that assessed their level of emotional intensity. The authors expected to find that ADHD boys would show lower

levels of empathy and less ability to match the emotion that they had with the emotion of the person in the fictitious story. They also thought that ADHD boys would have a more intense emotional response, both behaviorally and internally, and would not respond as intensely to perceived negative consequences (Braaten & Rosén, 2000).

Results of this study indicated that the ADHD boys showed less empathy and also expressed more negative affect. ADHD children had less empathy in that they were less successful at matching their emotion to the emotion of the character in the story and did not give as many interpretations of the story that focused on the character's emotional experience (Braaten & Rosén, 2000). Since the boys only exhibited increased behaviors related to negative emotions, it is possible that the ADHD children did not have difficulty with regulation of their positive emotions, but only with the negative. They also did not provide self-report of less empathy, more emotional intensity, or significant reactions to possible negative consequences (Braaten & Rosén, 2000).

Implications of these results could include if someone is not able to experience empathy and appropriately express it to their peers, then they may tend to engage in less prosocial behavior (Braaten & Rosén, 2000). If they engage in less prosocial behavior, then this may account for more experienced social rejection. Therefore, the authors suggest that teaching children how to experience empathy and to express it appropriately through social skills training would likely benefit their socioemotional well-being (Braaten & Rosén, 2000).

Because this study was conducted on 6- to 12-year-olds, it clearly cannot be assumed to generalize to adult behavior (Braaten & Rosén, 2000), and it is also unclear how well individuals learn these skills on their own as they move into adulthood. It

would be beneficial to assess these issues in adults and to incorporate tasks into treatment that would improve these skills when there is a deficit.

Other research has shown that children with ADHD tend to experience more anger, aggression, and depression than those without the disorder (Kitchens, Rosén, & Braaten, 1999). However, these children were not as able to accurately assess their own level of aggression as compared to others' evaluation of their level of aggression. In other words, they tended to rate themselves as being as aggressive as children without the disorder, while parents rated higher levels of aggression in the children with ADHD (Kitchens et al., 1999). Therefore, this research may suggest that the children with ADHD were not as aware of their own affective expression as others who were observing their behavior. If their self-awareness is actually less than those without the disorder, these individuals may experience more social rejection, as indicated previously in relation to prosocial behavior.

Affect regulation can be affected by the experience of frustration and can be more difficult to maintain by people who suffer from ADHD. Some research has been done with children to explore this issue and to compare the differences between individuals with and without the disorder in this domain. For example, Walcott and Landau (2004) looked at 49 boys between the ages of 6 and 11 years old who either had or did not have ADHD. They measured the boys' ability to effectively regulate their affect through behavioral inhibition when engaged in a frustrating task. Parents in this study were asked to withhold ADHD medications for 24 hours prior to participation in the study. Both groups of boys in the Walcott and Landau study were asked to either try to hide or not try to hide their emotions when they were engaging in the frustration task and were coded on

their verbal and nonverbal behavior during the task (e.g., facial expressions, noises made, or slamming their fists).

Results indicated that the boys with ADHD had more difficulty with emotion regulation than non-ADHD boys in general when they were undergoing the frustration task. In other words, they were not able to successfully control the emotional display during the task, whereas the boys who did not have ADHD were able to control their emotional display when asked to do so, indicating that they had better affect regulation during the frustration task (Walcott & Landau, 2004). This study did not use adults with ADHD, so it would be important to determine the effects of frustration in adults with ADHD, as the effects of frustration on affect regulation may be different for someone who has had much more life experience. This study also did not use females, so it would be important to include female participants in the study for better generalization across genders, even though there is some evidence for gender differences in ADHD presentation (Walcott & Landau, 2004).

Cognitive Aspects of ADHD

Patients with ADHD are often known for having problems in certain areas of cognitive functioning that can affect performance in social, academic, and vocational arenas. Hood and colleagues (2005) addressed particular constituents of attention in order to directly assess children's cognitive functioning on a performance task immediately after receiving methylphenidate. Their aim was to determine the effects of this stimulant medication on different attention skills that they would need to use to complete the task. Attention tasks were differentiated between types, including selective, sustained, switching, and dual attention, in order to provide a more detailed examination of

attentional processes. These neuropsychological tests would allow them to measure very specific aspects of cognitive functioning after the use of methylphenidate as compared to performance without the medication (Hood et al., 2005).

Participants with ADHD performed significantly worse than the control group on attentional processes prior to administration of the medication, especially on tasks involving divided attention, response inhibition, and visual searching (Hood et al., 2005). After receiving the medication, however, the ADHD group improved such that their attentional skills were at a relatively normal level. While there were practice effects for the groups, the participants with ADHD improved significantly more than could be accounted for by those practice effects (Hood et al., 2005). The authors of this study suggested that problems ADHD children have in school may not be simply related to the behavioral expression of ADHD, but may in fact have to do with their impaired attentional processes. An improvement in school performance may be explained in part by the improvement in attentional processes that occurs with medication management, as opposed to the frequent notion that it is solely due to improved behavior in the classroom setting (Hood et al., 2005).

Others researchers have also been interested in investigating specific types of attention that may serve to help pinpoint the nature of attention problems. For example, Tsal, Shaley, and Mevorach (2005) also measured specific types of attention deficits that may be present people with ADHD, including selective attention, sustained attention, executive attention, and orienting of attention. They noted that people with ADHD and people with learning disabilities had problems with the ability to attend to relevant stimuli, particularly in visual fields, which they considered to be a problem with selective

attention. They also noted more difficulty in the ability to redirect attention and sustain it for a period of time, possibly due to deficits in the attentional networks of the frontal lobes (Tsal et al., 2005). Through examination of the research, the authors found that attentional processes were typically viewed as a unitary process in regards to ADHD, when there is much evidence to suggest a more complex nature of attention that would include several different types of cognitive processes related to the task of attention. Therefore, their goal was to provide a clearer picture of the role of specific attention deficits in ADHD children by testing for different types of possible deficits (Tsal et al., 2005).

Tsal, Shaley, and Mevorach (2005) found that problems with sustained attention were the most frequently experienced type of attention deficit in their participants. Over half the children also had varying levels of deficits in selective attention, executive attention, and orienting of attention. Furthermore, all participants with ADHD had a deficit in at least one area, but most had deficits in two to three specific types of attentional processes (Tsal et al., 2005).

Much of the research purports that individuals with ADHD have a problem with executive attention, while the research of Tsal and colleagues (2005) shows sustained attention to be the most prevalent attention deficit. It appears that the current conceptualization of ADHD as primarily a problem with executive attention may not be entirely correct, since there is evidence to suggest that the current results are consistent with other research in this area (Tsal et al., 2005). Therefore, it seems that with continued research evidence to support sustained attention as the primary type of attention deficit, a

reconceptualization of attention deficits in ADHD patients may be necessary to most accurately describe this condition.

Neuropsychological Aspects of ADHD

Neuropsychological problems, such as executive functioning deficits, are an aspect of ADHD that continues to be problematic into adulthood for many people (Barkley, 2006; Biederman et al., 2006; Nigg et al., 2005). For example, adults with ADHD tend to have weaknesses in areas such as attention, motor speed, self-regulation, verbal fluency, verbal learning, processing speed, and memory (Barkley, 2006; Hervey et al., 2004; Roth et al., 2004). At the same time, participants with ADHD perform better on tasks that have a visual rather than verbal presentation, due to their difficulties with processing verbal information (Hervey et al., 2004). Furthermore, there is additional variability in the presentation of executive functioning deficits due to the individual's personal traits and the type of ADHD that they have developed (Nigg et al., 2005).

Research has shown problems with dopaminergic and noradrenergic pathways in people with attention deficit hyperactivity disorder. Prefrontal dopaminergic hypoactivity is prevalent in both children and adults, which causes deficits in executive functioning, response inhibition, working memory and verbal learning (Hervey et al., 2004; Hesslinger et al., 2002; Pliszka, 2005; Weisler, 2004). Research has also shown deficits in the anterior cingulate cortex, parietal lobes, occipital lobes, and caudate nuclei, as well as the cortical-striatal loop (Hervey et al., 2004; Hesslinger et al., 2002; Pliszka, 2005; Rapport et al., 2002; Weisler, 2004). These neurocognitive deficits typically lead to behavioral problems in adults such as poor organization and planning, feelings of restlessness, distractibility, impulsivity, procrastination, and difficulty with task

completion (Hesslinger et al., 2002; Ramsey & Rostain, 2004; Weisler, 2004).

Additionally, evidence for difficulty processing verbal information serves to substantiate the behavioral observation that someone with ADHD may not appear to be listening when someone is speaking to them directly (Hervey et al., 2004).

Stimulant medications, such as methylphenidate, are believed to work by regulating dopamine levels more effectively. Because dopamine is related to reward and motivational processes, better regulation may allow for improved attentional skills to be exhibited (Hood et al., 2005). Research indicates that attention is not a single process and that different neural networks allow for different types of attentional processes to occur (Hood et al., 2005).

Comorbidity

Several disorders tend to co-occur with ADHD. In fact, nearly 75% of adult patients with ADHD can be diagnosed with a comorbid disorder (Rostain & Ramsay, 2006). Comorbid disorders associated with ADHD tend to fall into the categories of mood disorders, substance abuse, disruptive behavior, and at times personality disorders. Among those mentioned were depression, anxiety, posttraumatic stress disorder (PTSD), bipolar disorder, sleep disturbance, conduct disorder, oppositional defiant disorder, antisocial personality disorder, and substance abuse disorders (Barkley, 2006; Cleland, Magura, Foote, Rosenblum, & Kosanke, 2006; Hesslinger et al., 2002; McGough et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004). When treating a patient with ADHD, it is important for the clinician to determine which diagnosis will take precedence in the treatment of that particular individual and to make sure that she or he has not overlooked any other important issues during the initial assessment (Weisler, 2004).

One study done on Icelandic children showed a significant association between incident unprovoked seizures in epileptic children and diagnoses of ADHD-inattentive type (Barkley, 2006; Hesdorffer et al., 2004). To be clear, an incident unprovoked seizure is considered to be one in which there was no specific event such as a trauma or infection of the central nervous system to induce the seizure. In this study, investigators found magnetic resonance imaging (MRI) abnormalities in approximately 10% of participants and electroencephalographic (EEG) abnormalities in approximately 64% of participants (Hesdorffer et al., 2004). The epileptic participants exhibited a lifetime prevalence of ADHD-inattentive type of 6.4%, whereas the rate for control subjects was only 1.8%. ADHD-inattentive type was shown to be a risk factor for incident unprovoked seizures. Furthermore, it was suggested that epilepsy and ADHD-inattentive type (ADHD-I) may be considered comorbid conditions, due to the greater likelihood of having incident unprovoked seizures and a history of ADHD-I than control participants (Hesdorffer et al., 2004).

Research results are complicated to interpret at times because so many different types of disorders can be comorbid with ADHD. For example, there are a number of studies that chose to include participants with comorbid disorders. Therefore, it can be difficult to determine whether the results should be attributed to ADHD alone, a comorbid disorder, or a combination of disorders. On the other hand, considering the high rate of comorbidity, if patients who only have a diagnosis of ADHD are utilized, then the research may not generalize well to others and exclude a large percentage of people from participating (Barkley, 2006; Rostain & Ramsay, 2006).

Neuropsychological Aspects of Comorbid Disorders

Overlapping cognitive, emotional, and behavioral symptoms are likely due to similar neuropsychological components of these disorders that manifest themselves in these ways. Studies of individuals with bipolar disorder have implicated executive function deficits in the anterior cingulate cortex, which may have effects on affect regulation and emotional processing (Zimmerman et al., 2006). Other research has shown decreased activity of the ventromedial prefrontal cortex in those with bipolar disorder who completed a selective attention task called the Stroop as compared to controls without the disorder (Kronhaus et al., 2006).

The medial and orbital sections of the prefrontal cortex, as well as the anterior cingulate cortex, have been shown to be related to fear, anxiety, and emotional behavior (Charney, 2003). Individuals with depression have shown changes in the frontal and limbic regions of the brain after treatment of depression with either cognitive behavioral therapy or paroxetine (Goldapple et al., 2004). Some research has also shown a decreased volume of neurons in the paraventricular nucleus of the hypothalamus in those with histories of bipolar or unipolar depression. Since the hypothalamus assists in affect regulation, social behavior, sleep cycles, and cognitive functioning, a person with either of these disorders may exhibit some similar symptoms or behaviors to that of someone with ADHD (Manaye et al., 2005). It is clear that distinction between the neuropsychological functioning seen in each of these disorders can be difficult to make, especially if using solely behavioral indicators of dysfunction. Increased use of neuroimaging and genetic information may help to clarify some of the specific phenotypes of these disorders in the future (Charney, 2003).

Family Contributions

ADHD and other comorbid disorders are often found in family members of identified ADHD patients. Therefore, McGough and colleagues (2005) looked at the presence of comorbid disorders in a sample of ADHD participants, their siblings, and parents in families with several children with ADHD. Their aim was to obtain rates of comorbid psychopathology as well as the ages at which those disorders were diagnosed over a lifetime in families with high rates of ADHD. It was found that a large percentage of the parents had high lifetime comorbidity rates for some other type of psychopathology, reaching 87% for one other disorder over a lifetime and 56% for at least two other disorders over their lifetime. Of the non-ADHD participants, 64% reported having one psychiatric illness over their lifetime, and just 27% had more than one.

Several comorbid anxiety disorders were present, as well as depressive disorders, conduct disorder, oppositional defiant disorder, and substance abuse (McGough et al., 2005). The type of comorbidity in part depended on the subtype of ADHD with which subjects were diagnosed. The hyperactive/impulsive or combined type of ADHD patients exhibited more oppositional defiant disorder, conduct disorder, and substance abuse than those with the inattentive type. Patients diagnosed with the inattentive type of ADHD exhibited more internalized types of disorders. ADHD and bipolar disorder were also shown to be associated among cases of more persistent and severe ADHD at a rate higher than the general population (McGough et al., 2005).

Hence, it appears that both current and lifetime comorbidity are concerning issues that need to be addressed in the assessment and treatment of ADHD patients and their

families. These types of families may be more dysfunctional and the parents may exhibit more problematic parenting styles due to their own risk of psychopathology (McGough et al., 2005).

Treatments for ADHD

Medication management of ADHD

Medication management is an essential component to the treatment of ADHD, which research indicates is a highly biological and genetic disorder. Medications have been shown to be effective in both children and adults. There are several different types of stimulant medications, as well as some nonstimulant medications, that are useful in the treatment of ADHD (Hervey et al., 2004; Pelham et al., 2005; Ramsay & Rostain, 2004; Weisler, 2004). Medications, especially stimulants, typically work by affecting levels of dopamine, norepinephrine, and serotonin, resulting in very effective treatment of the disorder (Barkley, 2006).

According to a number of research studies conducted, stimulants appear to be the most effective medical treatment, as the nonstimulants do not decrease the symptoms as much (Pelham et al., 2005; Weisler, 2004). Stimulant medications help to regulate neurotransmitters that tend to be dysfunctional in ADHD patients, such as norepinephrine and dopamine, which may account for their effectiveness. Commonly used nonstimulants, such as Strattera® (atomoxetine) work solely to inhibit reuptake of norepinephrine. The single effect on norepinephrine may account for the lesser effectiveness shown in studies (Weisler, 2004). For adults who tend to be forgetful and disorganized, a once daily stimulant seems to be the best type of medication (Weisler, 2004). Extended release medications are also beneficial for children who are in school all

day and need medications to last long enough to get them through that time period (Pelham et al., 2005). Effective medication management can help to improve academic, social, and vocational problems that the individual may be having due to social-cognitive and behavioral ways in which they exhibit this disorder (Weisler, 2004).

Cognitive and Behavioral Therapy

ADHD's high rate of comorbidity can at times lead to symptoms that mimic certain personality disorders, causing possible confusion about diagnosis and treatment. For example, Hesslinger and colleagues (2002) noted some similarities of ADHD to borderline personality disorder, such as affect regulation and impulse control problems. Patients with these disorders also tend to have low self-esteem, substance abuse and dependence, and problematic interpersonal relationships.

Due to these similarities, Hesslinger and colleagues (2002) developed an alternative form of dialectical behavior therapy (DBT), which is commonly used to treat borderline personality disorder. The changes to the treatment protocol were made to accommodate diagnosis and treatment of adults with ADHD. Once they made the changes, they conducted a pilot study in this modified DBT format for psychoeducation about the disorder, as well as to teach needed skills to this population (Hesslinger et al., 2002). The researchers also met with the patient's spouse or partner and their families for psychoeducation about the disorder. During this meeting, family members were able to discuss any specific concerns they had about the identified patient (Hesslinger et al., 2002).

Participants improved in the study and reported it to have been very helpful and specific to their needs. They reported they knew more about the diagnosis and were better

able to cope with it after completion of the group. The authors hope that their ideas will generate future research in this area, as the participants seemed to be very positive about what they had gained from participation (Hesslinger et al., 2002). Since those with ADHD frequently have deficits in multiple areas of life, a skill-based group such as this one seems highly applicable and useful for this population.

Adults with ADHD may also be affected by the way they come to know, understand, and interact with the world. In this way, ADHD works to shape their schemas according to their interpretation of that experience. According to Ramsay and Rostain (2004), certain types of schemas tend to occur in ADHD patients as a result of living with this disorder. They suggest ways in which cognitive therapy can help the person to cope with and change maladaptive schemas that have developed subsequent to their ADHD diagnosis (Ramsay & Rostain, 2004).

Due to problematic social interactions, as well as academic and vocational difficulties, individuals with ADHD tend to form beliefs about themselves and the world that reflect ideas of defectiveness, failure, and self-doubt. These types of schemas affect how the person feels about himself or herself, so they may develop avoidance and procrastination behaviors due to overgeneralization of those self-defeating beliefs (Ramsay & Rostain, 2004).

Unfortunately, these schemas can then cause problems with someone's mood and level of functioning (Ramsay & Rostain, 2004). Therefore, it would clearly be beneficial to use cognitive therapy techniques to address these issues as they present for each person specifically. Not only could the therapist work to help change dysfunctional or unproductive schemas, but she or he could help the individual to identify their own

strengths, areas of competency, and coping abilities (Ramsay & Rostain, 2004). While cognitive behavioral therapy has shown some success with this population, many studies have shown these types of psychosocial treatments to be only partially effective without the added use of stimulant medications (Barkley, 2006).

Combination Treatments

Medication and behavioral treatments. Many investigators in the area of ADHD treatment have sought to combine strategies in an attempt to maximize treatment outcome. Pelham and his colleagues (2005) assessed medication, behavioral and combination treatments for the management of ADHD in children, since these treatment regimens had not been adequately addressed in the literature. They compared a group of children that used a methylphenidate patch to a behavioral modification group and to a combination group that used both the medication and behavioral modification. Both the medication and behavioral modification groups showed significant improvement. For example, in the medication only group, children were able to complete more academic tasks and even rated their own behavior more favorably on days when they were medicated. Children were much more likely to complete their academic and adaptive goals on days when behavior modification was implemented as compared to days it was not. Furthermore, the changes seen were similar to those seen when children took a moderate dose of the stimulant medication. All that being said, the combination group that received both stimulant medication and behavior modification did better than the groups where each treatment was given alone. Results showed effectiveness across settings, in a variety of domains of functioning, and with ratings by different types of individuals involved in the study. This research supports the notion that the needs of the

ADHD population would most effectively be addressed through an interdisciplinary approach that combines treatment strategies in order to obtain the most optimal outcome (Pelham et al., 2005).

Psychosocial treatments. Psychosocial treatment of ADHD is a useful component to be used in combination with standard medication management, so that issues related to coping skills and daily frustrations can be addressed directly (Murphy, 2006; Pelham & Gnagy, 1999; Rostain & Ramsay, 2006; Weisler, 2004). These treatments may involve individual, family, couples, or group therapy. Additionally, it may include behavioral coaching, advocacy, and vocational advice (Murphy, 2006). Individuals with ADHD can be taught cognitive and behavioral strategies to cope with their symptoms, improve organizational skills, and enhance communication skills. They can also be informed of access to accommodations that are allowed in educational and vocational settings (Weisler, 2004). Behavioral interventions, such as contingency management, have been useful in certain settings, such as the classroom, which would apply mostly to children (Pelham & Gnagy, 1999). However, this technique could arguably be modified to use with adults in the home for task completion in this setting.

Cognitive behavioral therapy for the ADHD population can be helpful in addressing any issues of depression or anxiety that have become a problem. CBT can also be used to teach patients how to effectively manage time, complete tasks, use problem-solving skills in relationships or at work, manage life transitions, and become more aware of how the disorder affects their lives (Murphy, 2006; Rostain & Ramsay, 2006; Safren, Sprich, Perlman, & Otto, 2005; Weisler, 2004). Safren and his colleagues (2005) developed a workbook to be used by adults with ADHD that teaches them self-

monitoring, organizational and planning skills, problem-solving, and awareness of their own attention span and distractibility. They review common cognitive distortions, how to think more adaptively, and how to maintain changes in behavior and their ways of assessing situations. Clearly, there are a number of highly practical applications for the implementation of cognitive behavioral strategies tailored to adults with the disorder.

Rostain and Ramsay (2006) have also utilized CBT as a psychosocial treatment in combination with medication management in an attempt to maximize functioning for adults with ADHD, since each treatment given alone has been shown to be insufficient. Cognitive behavioral therapy can be helpful to adults who are trying to cope with negative beliefs about themselves that have developed as a result of living with ADHD symptoms. This type of therapy can also be used to treat comorbid problems, such as depression or anxiety, or to address inadequate time management (Rostain & Ramsay, 2006). The goal of these investigators was to determine if the combination of cognitive behavioral therapy and pharmacotherapy would decrease symptoms of ADHD and comorbid disorders while improving the general functioning of adults with this diagnosis (Rostain & Ramsay, 2006).

Eighty-one percent of participants showed at least mild improvement of ADHD symptoms, while 70% did achieve moderate to significant improvement of those same symptoms as measured on the Brown Attention Deficit Disorder Scale (BADDS) (Brown, 1996; Rostain & Ramsay, 2006). Clinician ratings also showed much or very much improvement in symptoms, suggesting that there seems to be congruence between the more objective measure and their own ratings of improvement. Stimulant medications used in this study worked to improve the patients' executive functioning, while cognitive

behavioral therapy seemed to help change people's negative beliefs that had developed due to their difficulty living with ADHD. CBT may also have served to enhance coping skills and to change behaviors. Thus, when they were able to effectively cope with and manage their ADHD, these patients could then experience a decrease in comorbid symptoms of anxiety and depression and an increase in overall functioning (Rostain & Ramsay, 2006).

Solanto and colleagues developed a manualized group treatment for adults with ADHD who needed to improve skill deficits (Solanto, Marks, Mitchell, Wasserstein, & Kofman, 2008). Their group addressed several metacognitive skills that needed to be enhanced, such as attention and memory, organization, planning, and time management. Simpler skills were learned prior to higher order skills. Aside from the skill-based component, they were able to gain support from each other, address personal goals, and identify potential barriers to treatment. Improvements were significant on both the Conners Adults ADHD Rating Scale (CAARS) and BADDIS scales, including some that decreased to subclinical levels after treatment (Solanto et al., 2008). Psychosocial treatments are fast becoming an important aspect of treatment of ADHD in the adult population with increasing support for their efficacy.

CHAPTER 3

Hypotheses

1. Executive function deficits will be significantly correlated with symptoms of ADHD.

People with ADHD have been known to have problems with executive functions, including attention, memory, response inhibition, self-regulation, and planning, to mention a few (Barkley, 2006; Biederman et al., 2006; Hervey et al., 2004; Walcott & Landau, 2004). They also have a tendency to have difficulty dealing with frustrating circumstances and may act impulsively in these situations. Therefore, they may have more difficulty self-regulating and exhibit more problems of behavioral disinhibition. However, much of the research has been conducted on children (Walcott & Landau, 2004). For the present study, this research could serve to provide evidence that executive functioning deficits are a salient enough aspect of ADHD in adults that they may be able to predict levels of dysfunction on a commonly used measure of ADHD.

2. Higher ADHD scores will be correlated with increased rates of comorbid symptoms of bipolar disorder, anxiety or depression.

Approximately 75% of adult patients with ADHD can be diagnosed with a comorbid disorder (Rostain & Ramsay, 2006), which may make its accurate diagnosis difficult. Comorbid disorders associated with ADHD tend to fall into the categories of mood disorders, substance abuse, disruptive behavior, and at times personality disorders. Among those commonly seen are depression, anxiety, bipolar disorder, posttraumatic stress disorder (PTSD), sleep disturbance, conduct disorder, oppositional defiant disorder, antisocial personality disorder, and substance abuse disorders (Barkley, 2006; Cleland et

al., 2006; Hesslinger et al., 2002; McGough, et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004; Young & Toone, 2000).

Many of these comorbid disorders also show deficits in executive functioning. Depression, anxiety, and bipolar disorder, for example, each have differential patterns of brain activation (Charney, 2003; Goldapple et al., 2004; Zimmerman et al., 2006). Distinction between the neuropsychological functioning seen in each of these disorders could be difficult to make. Therefore, in case that the neuropsychological profile varies significantly between individuals, it would be important to determine the presence of anxiety, depression, or bipolar disorder in the population sampled for the present study.

3. Higher executive functioning deficits will be correlated with increased rates of comorbid symptoms of bipolar disorder, anxiety or depression.

Similar neuropsychological components among these disorders lead to cognitive, emotional, and behavioral symptoms that present in various ways through each of these disorders. Executive functioning in the anterior cingulate cortex is shown to be impaired for individuals with bipolar disorder, which can change an individual's ability to regulate and process their emotions (Zimmerman, DelBello, Getz, Shear & Strakowski, 2006). Areas of the prefrontal cortex and the anterior cingulate circuit have been shown to be related to fear, anxiety, and emotional behavior (Charney, 2003). Frontal and limbic regions of the brain have shown evidence of change after treatment of individuals with depression who have engaged in either cognitive behavioral therapy or paroxetine (Goldapple et al., 2004). Research has also shown that patients with bipolar or unipolar depression have a decreased volume in certain areas of the hypothalamus. Being that the hypothalamus assists in affect regulation, social behavior, sleep cycles, and cognitive

functioning, the individual may exhibit symptoms or behaviors similar to that of someone with ADHD (Manaye et al., 2005). Areas of the brain that manage executive functioning are clearly affected in depression, anxiety, and bipolar disorder. Therefore, it appears logical to predict that those with larger deficits in executive functioning are more likely to exhibit signs of ADHD's common comorbid disorders.

CHAPTER 4

Method

The current study consists of a correlational design in which adults were tested on a self-report measure of behavioral signs of executive functioning and were screened for symptoms of ADHD, mania/hypomania, depression, and anxiety. Additionally, information was obtained that determined the reported presence of ADHD or these comorbid disorders in first-degree relatives of participants.

Participants

The sample consisted of a community sample of 70 male and female participants who were able to speak, read, and understand English. Participants were adults who ranged in age from 18 to 60 years old. This age range was selected so that participants would be old enough to complete adult versions of measures and young enough that there would be little risk of age-related cognitive decline. Participants were recruited from the general community. They were obtained within the United States through educational institutions, e-mail, religious affiliations, the investigator's workplace, and other contacts by word of mouth. Participants were obtained from the local Philadelphia area, as well as other parts of the country where the investigator had contacts. An announcement was made to the Association for Behavioral and Cognitive Therapies list-serve to determine whether anyone was interested in participating, as many others have done.

Measures

A demographic questionnaire was administered to screen for exclusion criteria. Exclusion criteria were as follows: under age 18 or over age 60; schizophrenia or schizoaffective disorder; traumatic brain injury; and stroke, seizure disorder, brain tumor, or other neurological disorder. Participants were asked to complete a Behavior Rating Inventory of Executive Function—Adult version (Roth, Isquith, & Gioia, 2005). Levels of ADHD symptomatology were determined through a self-report screening tool called the CAARS—Self-Report: Short Version (CAARS—S:S; Conners, Erhardt, & Sparrow, 1999). Participants were also asked to complete the Mood Disorder Questionnaire (Hirschfield et al., 2000) and the Brief Symptom Inventory 18 (BSI—18; Derogatis, 2000). Completion of these measures concluded the data collection. Each participant was identified by number only, as their responses remained anonymous. If they provided a mailing address on a separate enclosed form, then they were entered into a drawing for a \$35 gift card that was raffled at the end of the data collection period. The individual who won the gift card had it sent to the address provided. The addresses, for the sole purpose of the raffle, were maintained separately from the study data.

Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A). The BRIEF—A is a standardized measure of executive functioning and self-regulation that was validated in both male and female adults, ages 18 to 90 years old. It contains 75 items that are grouped into two different categories: behavioral regulation and metacognition. The overall score that includes both indexes is called the global executive composite. There are also three validity scales included to measure infrequency, negativity, and inconsistency. The BRIEF—A questionnaire takes approximately 10 to 15

minutes to complete and approximately the same time to score. It is designed to measure executive functions such as inhibition, self-monitoring, planning, initiation, task monitoring, emotional control, organization, shifting, and working memory. These cognitive processes are categorized within nine separate domains, four of which load on the Behavioral Regulation Index and five of which load on the Metacognitive Index (Rabin et al., 2006; Roth, Isquith, & Gioia, 2005).

The internal consistency of the self-report form in a sample of clinical and healthy adults ranges from .80 to .94 on the clinical scales and .96 to .98 on the indexes and the global executive composite scores. This scale has been validated for use in a variety of populations, including males and females, different racial and ethnic backgrounds, geographic locations, and educational histories (Roth, Isquith, & Gioia, 2005).

Isquith and Gioia (2000) noted that the Working Memory scale of the children's version of the Behavior Rating Inventory of Executive Functioning (BRIEF) has been particularly useful in distinguishing between children with ADHD who had either ADHD-inattentive or ADHD-combined types. The scale that measured inhibition was particularly helpful in distinguishing among ADHD types. For example, this part of the scale was able to distinguish between children who did not have ADHD, those who had the combined type of ADHD, and those who were diagnosed with the inattentive type. They noted that this scale could be used to differentiate between a number of different executive functions that could be problematic areas for the individual, and suggested that this scale would be a useful test to use in a battery of tests used for ADHD assessment (Isquith & Gioia, 2000).

Rabin and her associates (2006) were interested in executive functioning deficits in a population of adults over the age of 60 who either had mild cognitive impairment or cognitive complaints without deficits upon formal assessment and healthy demographically matched controls. They used both the self- and informant report forms of the BRIEF—A to conduct the assessment and compared these results to that of standard performance-based neuropsychological assessment on each of the groups. Results indicated that the mild cognitive impairment and cognitive complaints groups failed to exhibit clinically significant deficits upon assessment with standard neuropsychological measures, while they did exhibit deficits in several areas as measured by the BRIEF—A (Rabin et al., 2006). These results suggest that the BRIEF—A may be able to detect subtle changes in neurocognitive functioning that may be bothersome to the individual and that may have an impact on their daily level of functioning. Each type of assessment seemed to provide its own unique contribution to the description of executive functioning in participants. Therefore, it may be useful to use both performance- and behavior-based measures in order to more thoroughly assess an individual's functional abilities (Rabin et al., 2006).

For the purpose of the present study, the BRIEF—A provides a highly reliable and valid measure of executive functioning. The measure takes only 10 to 15 minutes to complete, making it unlikely to produce fatigue. The BRIEF—A has been normed and tested on a variety of different individuals within a wide age range, which makes it an appealing tool to be used for the community sample in this study.

CAARS—Self-Report: Short Version (CAARS—S:S). The CAARS-S:S is a standardized measure of the main components of ADHD, such as inattention,

hyperactivity, and impulsivity. It also addresses memory issues, emotional lability, self-concept, and restlessness (Conners et al., 1999). This version of the Conners test also includes an ADHD index and an inconsistency index to determine whether the person responded in a way that was arbitrary or hasty. The CAARS—S:S is a 26-item questionnaire that takes about 10 minutes to complete and is hand scored. It has been normed on a population from both Canada and the United States and can be administered to adults ages 18 and older, including those who have been incarcerated (Conners et al., 1999; Macey, 2003). Internal consistency of the measure was moderate to high, and it has been able to distinguish between groups of adults in clinical and nonclinical settings. However, it would be advisable to interpret scores cautiously with regards to racial and ethnic backgrounds, since those were not described in the normative sample (Macey, 2003). Overall, the CAARS has been rated as one of the best instruments to detect adults with ADHD when compared to other commonly used instruments (Kooij et al., 2008).

Cleland, Magura, Foote, Rosenblum, and Kosanke (2006) utilized the short version of the CAARS as an assessment tool in a population of individuals with substance abuse disorders. Substance abuse can be a comorbid problem for those with ADHD, and these researchers found a significantly elevated level of symptoms across subscales as compared to the normal population. They suggested that specific norms be developed for the substance abuse disorder population, since the prevalence was so much higher (Cleland et al., 2006).

Magruder and colleagues (2005) compared the Psychiatric Diagnostic Screening Questionnaire (PDSQ) and the CAARS to the Structured Clinical Interview for the DSM—IV (SCID—IV) in order to assess whether they were comparative assessment

tools in a substance use disorder population. They noted that the CAARS performed well in comparison to use of the SCID—IV for screening of ADHD in this population (Magruder, Sonne, Brady, Quello, & Martin, 2005).

The brief administration time and the use of this measure in a variety of settings makes it an appealing assessment tool for screening of ADHD in this study's community population. There are certainly some concerns about the use of a self-report measure, since adults with ADHD tend to be poor reporters of internalized symptoms like attention as compared to externalized symptoms like social behavior. It is not surprising to see that adults with ADHD tend to underreport their symptoms as compared to the assessment of the study clinician (Kooij et al., 2008). Even though they tend to underreport their symptoms, they seem to be the most accurate about their own experiences, especially as compared to the report of an informant. The informants tend to be less accurate than the patient, so their report would not likely be beneficial for dispute over symptoms (Kooij et al., 2008). Taking this into consideration, use of the short form of the CAARS (CAARS-S:S) has been shown to be an appropriate tool for research studies that are attempting to assess core ADHD characteristics (Macey, 2003). Therefore, the self-report version of the Conners' Adult ADHD Rating Scale (CAARS—S:S) was used in the current study as a tool to determine the level of ADHD symptomatology and whether each participant would be likely to meet criteria for a diagnosis.

Mood Disorder Questionnaire (MDQ). Bipolar disorder tends to be overlooked by clinicians who typically assess a patient experiencing depressive symptoms of this mood disorder (Das et al., 2005). In fact, oftentimes symptoms of hypomania are not seen as a problem by family members or professionals with whom the individual interacts. Yet if

the possibility of a bipolar spectrum disorder is overlooked, it may lead to poor treatment, inaccurate medicating of the condition, and a worse outcome for the individual (Dunner, 2003). Since bipolar disorder has been shown to be frequently comorbid with ADHD, it would be advantageous to screen for the disorder in case there has been a misdiagnosis or both conditions require treatment (Hirschfeld, Cass, Holt, & Carlson, 2005).

The Mood Disorder Questionnaire (MDQ) is a 15-item questionnaire that can be administered quite easily in a primary care setting if desired. It is a paper and pencil measure that is easily scored and represents symptoms of mania or hypomania taken from criteria in the *DSM-IV*, as well as from relevant clinical experience (Hirschfeld et al., 2000). Hirschfeld and his colleagues (2000) determined the sensitivity and specificity of the index as compared to a clinical diagnosis using the Structured Clinical Interview for the DSM—IV (SCID). They were able to achieve a level of 0.73 for sensitivity and a level of 0.90 for specificity of the measure in determining whether or not an individual was likely to have had a history of mania or hypomania. These levels of sensitivity and specificity are comparable to other questionnaires that screen for mood and other disorders, indicating that this measure is a reasonable choice for screening of bipolar disorder (Hirschfeld, 2000).

Udachina and Mansell (2007) sought to determine whether the Mood Disorder Questionnaire, the Hypomanic Personality Scale, and the Internal State Scale were measuring essentially the same constructs. Each of the scales on their own had been validated for measurement of mania and hypomania, but they had not yet been compared to each other. This research showed that there was a relatively high degree of similarity

between the measures, suggesting that while they are different measures, they did each seem to be measuring symptoms of mania and hypomania (Udachina & Mansell, 2007).

Use of the Mood Disorder Questionnaire has frequently taken place within a primary care setting, where there is a much higher rate of bipolar disorder than in the community population (Das et al., 2005; Hirschfeld et al., 2005). One study used the MDQ to determine how often patients with bipolar disorder were being treated for unipolar depression in a primary care setting (Hirschfeld et al., 2005). The population was relatively diverse, including both men and women and a variety of ethnic backgrounds. Results indicated that over 20% of patients who were taking antidepressants for depression were positive for a history of mania or hypomania according to the MDQ screening; antidepressants may actually serve to exacerbate symptoms of mania/hypomania. More than two thirds of those patients had not been diagnosed with bipolar disorder in the past. However, the investigators caution that the MDQ is not a diagnostic tool and that patients would benefit from further investigation of these symptoms (Hirschfeld et al., 2005). In fact, Hirschfeld and his colleagues note the similarity between some bipolar symptoms and ADHD or anxiety disorders. Therefore, it would be advisable to use measures that assess for those possible comorbid disorders when trying to make a differential diagnosis.

Das and colleagues also used the MDQ to screen for a history of bipolar disorder in a primary care setting. Participants included both women and men who were primarily low income and either Hispanic or African American (Das et al., 2005). Of the participants who had a positive screen for bipolar disorder on the MDQ, nearly half were taking some type of psychotropic medication. However, fewer than 7 % of those

medications were mood stabilizers, which would be most appropriate for someone with this diagnosis (Das et al., 2005). In essence, results of this study were similar to those found by Hirschfeld and his colleagues (2005), in that there is not enough screening for bipolar depression and that this oversight can result in inappropriate medication management of the individual (Das et al., 2005; Hirschfeld et al., 2005). With the ease of administration of the MDQ in this setting, it would be a beneficial addition to the typical screening procedures.

The MDQ would especially be useful in a clinical setting because it could be followed up with an interview if bipolar disorder was suspected by the clinician, based on this screening tool (Hirschfeld et al., 2005; Kemp et al., 2007; Udachina & Mansell, 2007). It would also be important to use caution when making differential diagnoses between bipolar disorder and other disorders with similar characteristics, such as anxiety or ADHD (Hirschfeld et al., 2005). This measure would be appropriate for use as a screening tool in the community sample used for the present study, since it is not intended for diagnosis.

Brief Symptom Inventory 18 (BSI—18). The BSI—18 (Derogatis, 2000) is an 18-item questionnaire derived from the BSI (Derogatis, 1993), which was derived from the Symptom Checklist—90—Revised (SCL—90—R; Derogatis, 1994). This questionnaire is designed to measure the domains of anxiety, depression, and somatization, as well as to provide a global score of psychological distress (Asner-Self, Schreiber, & Marotta, 2006; Derogatis, 2000; Recklitis et al., 2006; Recklitis & Rodriguez, 2007). The BSI—18 correlates highly with the SCL—90—R, which was normed on a community-based sample. It takes about 4 minutes to complete and is written at a reading level of the sixth

grade. The population norms have been derived from both community and adult oncology populations (Derogatis, 2000). This tool can be used as a screening instrument for adults, which makes it an appealing choice for use in research such as the present study.

There have been questions about the accuracy of the factor structure of the BSI—18, which is a three-factor model including anxiety, depression, and somatization. Recklitis and his colleagues (2006) addressed this issue, as well as whether or not the measure could be applied to a population of childhood cancer survivors. They found the measure to uphold this three-factor model in their population of adults and noted that the internal consistency was adequate to apply to this population. While there had been some speculation about whether there were actually four factors, as some research had proposed (Zabora et al., 2001), evidence for this possibility is weak. In the study by Zabora and colleagues, they separated anxiety into panic versus general anxiety, but were not able to make a strong case for this separation of types of anxiety, according to Recklitis and his colleagues. Therefore, the three-factor model has continued to receive support in the literature as being the most practical interpretation of the measure (Recklitis et al., 2007).

In a later study, Recklitis and Rodriguez (2007) used the BSI—18 in another sample of adult childhood cancer survivors and compared its validity to that of the Symptom Checklist 90-Revised (SCL—90—R). Again, the BSI—18 had high internal consistency and correlated well with the SCL—90—R. Results showed that the BSI—18 would be an effective screening tool within the cancer survivor population and can be

used in place of the longer SCL—90—R without loss of sensitivity. (Recklitis & Rodriguez, 2007).

Asner-Self, Schreiber, and Marotta (2006) had concerns about the use of the BSI—18 in a population of Central American immigrants, since this is such a diverse population of individuals and there have not been many studies addressing them specifically. They discussed the ways that Latinos/Latinas are often clumped into a large group, while they actually contain a wide variety of backgrounds and cultural practices. Aside from their concerns about use of the measure in this population, they were interested in whether or not the scale adhered to the three-factor model on which it was based. Results indicated high internal consistency with their population of Central American immigrants. They found strongest support for use of the Global Severity Index to describe overall levels of distress in this population, citing some of the differential ways that these men and women experienced symptoms in each of the domains. For example, as a group they experienced higher levels of general distress than the community sample norms, women had more somatic symptoms than the men or the norm group, and men experienced much more depression than the norm group (Asner-Self et al., 2006). For the purpose of the present study, these findings indicate caution when interpreting scores for participants who may be in this population.

In light of the cultural issues raised, it would also be important to recall that the BSI—18 will only be used as a screening tool and not for the purpose of diagnosis. Overall, the BSI—18 has high internal consistency, can be used reliably in a variety of populations, and should be an easy measure for most anyone to complete in a brief

period. Taken together, the BSI—18 is a highly useful tool to screen for both anxiety and depression in the present study.

Procedure

In the current study, participants were located within the United States, as previously described, and were identified by number only. Participants were handed a packet in person to complete, received one in the mail from the contact list, received one in person from a colleague who may know an interested individual, or were directed to the website through an e-mail, where the demographic portion of the study was completed. If they wished to obtain a complete packet by mail, they could also indicate this in the e-mail reply. Participants were told on the enclosed flier that the research was investigating how information processing relates to thoughts, feelings, and behaviors.

If the participant chose to complete the demographic page via the Survey Monkey web site, he or she entered a mailing address where the remaining questionnaires could be sent. Upon receipt of the demographic page by Survey Monkey, an identification number was assigned and they received a packet with the corresponding numbered questionnaires. Alternatively, participants were handed a packet that included all the study materials when they were seen in person. They completed the questionnaires and mailed them back in a postage paid envelope to the investigator or returned them in person, if applicable. Exclusion criteria were clarified prior to acceptance of the data into the study. Upon receipt and completion of an acceptable questionnaire packet as well as provision of an address, their address was saved in a separate file and the participant was entered into a raffle to win a \$35 gift card to be sent to the mailing address provided. The

questionnaires were scored and entered into an SPSS database in order to test the two hypotheses.

CHAPTER 5

Results

Participants in this study included 70 adults between the ages of 18 and 60 (53 females and 17 males). The mean age for the group was 35.69 ($SD = 11.54$). The racial and ethnic makeup of the group, as displayed in Table 1 was primarily White (78.6%), followed by Asian origin/Asian American/Pacific Islander (11.4%), Latina/o (7.1%), African origin/African American (1.4%), and other (1.4%).

Table 1

Ethnic and racial background of participants

	Number of participants
White	55
Asian origin/Asian American/Pacific Islander	8
Latinos	5
African origin/African American	1
Other	1

The group was well educated, with 81.5% of the sample achieving a bachelor's degree or higher (see Table 2 for educational breakdown). The return rate for questionnaires was 55.6%. There were 16 people who completed the demographic portion online, but did not complete the study by returning the remaining questionnaires. Nearly one third of the questionnaires that were not completed beyond the demographic form were for individuals who reported a diagnosis of ADHD (31.25%).

Table 2

Education level

	Number of participants
High school	3
Associate's/Some college	10
Bachelor's	27
Masters's	20
Doctoral	10

Analyses were conducted to determine whether there were relationships between education level and symptoms of ADHD, executive functioning, depression, and anxiety. There was no significant relationship between education level and any of these variables. Gender did not significantly predict ADHD, executive functioning, depression, or anxiety in this sample, either. Racial and ethnic background was not used as a predictor, as this sample population was primarily White and would not be expected to display much difference in outcome. The only significant finding was a negative correlation between age and anxiety indicating that as the individual got older, she or he presented less anxiety ($r = -.332, p < .01$, two-tailed). However, these results were essentially unrelated to the main variables addressed in this study.

Participants reported being diagnosed with several clinical conditions, including attention deficit hyperactivity disorder (5.7%, $n = 4$), learning disability (2.9%, $n = 2$), depression (17.1%, $n = 12$), anxiety (8.6%, $n = 6$), and substance use disorders (2.9%, $n = 2$) (Table 3). They did not report the presence of oppositional defiant disorder, conduct

disorder, mental retardation, bipolar disorder, schizophrenia, traumatic brain injury, and other neurological disorders (e.g., seizure disorder). Nearly one fifth of the participants reported that they took medications for their diagnosed disorder(s) (18.6%, $n = 13$). The rate of ADHD in the present study population was slightly higher than the population rate in adults, commonly estimated to be from 4 % to 5 % of individuals (Faraone et al., 2000; Kessler et al. 2005; McGough & McCracken, 2006; Murphy & Barkley, 1996; Murphy & Gordon, 2006).

Table 3

Participant diagnoses endorsed on the demographic form

	Number of participants
ADHD	4
Learning disability	2
Depression	12
Anxiety	6
Substance use disorders	2

Participants were asked to report the presence of ADHD, bipolar disorder, depression, and anxiety in their first-degree relatives. One tenth of participants reported the presence of ADHD in these relatives (10%, $n = 7$). There were few individuals who reported the presence of bipolar disorder among these individuals (4.3%, $n = 3$). The most prevalent disorder reported was depression (24.3%, $n = 17$), followed by anxiety (14.3%, $n = 10$).

Table 4

Known and suspected disorders in first-degree relatives

	Number of participants
Known ADHD	7
Known bipolar	3
Known depression	17
Known anxiety	10
Suspected ADHD	13
Suspected bipolar	10
Suspected depression	32
Suspected anxiety	26

Additionally, participants were asked to report the suspected presence of ADHD, bipolar disorder, depression, and anxiety in their first-degree relatives. This analysis resulted in higher numbers as compared to the known diagnosis of these disorders. ADHD was reported to be suspected in 18.6% ($n = 13$) of first-degree relatives. Bipolar disorder was suspected to be present in 14.3% ($n = 10$). Depression was suspected in 45.7% ($n=32$) of cases, while anxiety was suspected in 37.1% ($n = 26$) of this population (Table 4).

The present study assessed the presence of bipolar spectrum disorders, depression, and anxiety in participants, as they are frequently comorbid with ADHD. Bipolar spectrum disorders were infrequent (2.9%). Depression was more common (11.4%), while anxiety was the most commonly experienced disorder (12.9%).

Executive functioning was measured by using the T-scores of the Global Executive Composite score on the BRIEF—A, which includes measurement by all the subscales and provides an overall picture of executive functioning (Roth et al., 2005). The T-scores of the ADHD Index on the CAARS were used to assess level of ADHD symptomatology, since this scale would best allow the examiner to determine whether it would be likely that the individual would have a diagnosis of ADHD (Conners et al., 1999). The population sample was relatively normal, with a slight positive skew ($M_{\text{BRIEF-A}} = 49.1$, $SD = 9.38$; $M_{\text{CAARS}} = 45.8$, $SD = 9.39$). The skewness of this sample was not of great concern because the participants were from a nonclinical sample, so it would be expected that the level of symptoms would be on the lower end of the scale.

Pearson correlations were performed for each of the analyses in the present study. The correlation of the CAARS and BRIEF—A data as described showed that symptoms of ADHD and executive functioning were significantly related ($r = +.829$, $p < .01$, two-tailed).

The ADHD index of the CAARS was compared to symptoms of depression and anxiety as measured by T-scores on the Brief Symptom Inventory 18 (BSI—18) subscales for depression and anxiety. Correlation of the data showed that symptoms of ADHD and depression were significantly related ($r = +.509$, $p < .01$, two-tailed). ADHD and anxiety were also significantly related ($r = +.478$, $p < .01$, two-tailed).

The Global Executive Composite T-scores of the BRIEF—A were compared to symptoms of depression and anxiety and measured by T-scores on the Brief Symptom Inventory 18 (BSI-18) subscales of Depression and Anxiety. A correlation between the data showed that problems with executive functioning were significantly related to

depression ($r = +.472, p < .01$, two-tailed). Problems with executive functioning were also significantly related to anxiety ($r = +.496, p < .01$, two-tailed). Bipolar disorder was not assessed in comparison to either the ADHD measure or the measure of executive functioning, due to the low frequency of which the disorder was identified in this population.

Table 5

Significant correlations between measures

	BRIEF—A	CAARS	BSI—DEP	BSI—ANX
BRIEF-A	—			
CAARS	.829	—		
BSI-DEP	.472	.509	—	
BSI-ANX	.496	.478		—

Note. Correlations are significant at $p < .01$.

Further analysis of the BRIEF—A and CAARS through the use of an analysis of variance (ANOVA) revealed that T-scores on these measures predicted the level of depression based on the T-scores of the BSI—18 depression subscale, $F(2,67) = 12.22, p < .01, \eta^2 = .245$. More specifically, the CAARS alone was able to predict the presence of depression, $p = .048$. A separate analysis of variance determined that T-scores on these measures also predicted the presence of anxiety based on the T-scores of the BSI—18 anxiety subscale, $F(2,67) = 11.79, p < .01, \eta^2 = .238$. All analyses were performed through the use of the Statistical Package for the Social Sciences.

CHAPTER 6

Discussion

The community sample of adults who participated in this study was primarily made up of individuals in their mid-30s who were White and female. Most of them were well educated, achieving at least a bachelor's degree. The sample was relatively normally distributed, with a slightly positive skew. Demographic variables did not play a significant role in the outcome of the present study with this population sample. Perhaps this would be indicative of a sample that was too uniform in terms of these variables to find a difference, or perhaps it would be indicative of a more universal set of variables that were assessed in the present study. However, it would be impossible to confirm these speculations with the available data.

A large percentage of individuals who started but did not complete the rest of the study questionnaires were self-identified as having been diagnosed with ADHD. While their responses would have been helpful, it is not a surprising phenomenon, considering the tendency of individuals with ADHD to fail at task completion.

The frequency of ADHD reported by this sample was slightly higher than the average adult population, likely due to some of the targeted recruitment within this population. Participants endorsed some common psychological disorders aside from ADHD, such as depression, anxiety, substance use disorders, and learning disability. Many of these individuals also reported taking medication to treat these disorders.

Participants were then asked to consider their first-degree relatives and to report whether there was a diagnosis of ADHD, bipolar disorder, depression, or anxiety.

Depression was the most commonly identified disorder, followed by anxiety, ADHD, and

bipolar disorder, respectively. The numbers were even higher when participants were asked to consider whether they had ever suspected any of these disorders among their first-degree relatives. Depression was suspected in nearly half of participants' first-degree relatives. Anxiety, ADHD, and bipolar disorder again followed in this order, at higher rates than the known diagnosis for each condition. Therefore, it seems that among those who chose to participate in the study, there were a large number of people who had experienced these specific mental illnesses within their immediate family. The numbers may have been even higher had more disorders been considered, but that would have been outside the scope of the present study.

Participants were screened with self-report measures for the presence of bipolar disorder, anxiety, and depression, since they are often comorbid with ADHD. Anxiety was the most common, followed by depression and bipolar disorder, respectively. Very few people actually screened positive for bipolar disorder. However, no one that completed the study endorsed being diagnosed with bipolar disorder. Therefore, there were individuals who screened positive who had denied being diagnosed, but may have had the disorder or may have been unaware of their symptoms. Fewer people screened positive for depression than those who endorsed the diagnosis on the demographic form. At the same time, more people screened positive for anxiety symptoms than those who endorsed the diagnosis on the demographic form. Perhaps these discrepancies reflect a lack of awareness of their symptoms, which may lead to differences in treatment-seeking behavior. However, confirmation of this speculation is beyond the scope of this study.

A strong positive correlation was identified between the global measure of executive functioning and the ADHD index on the ADHD assessment tool in support of

the first hypothesis. The first hypothesis indicated that executive functioning symptoms would positively correlate with ADHD symptoms. These results revealed that participants' identified problem areas affected perceived functioning in a very similar way on each of the measures. Therefore, it would seem that executive functioning is a significant aspect of ADHD functioning when assessed through the use of self-report measures. These findings are consistent with the literature that addresses the various neuropsychological processes that lead to behavioral issues for individuals with ADHD (Barkley, 2006; Biederman et al., 2006; Hervey et al., 2004; Hesslinger et al., 2002; Nigg et al., 2005; Pliszka, 2005; Ramsey & Rostain, 2004; Rapport et al., 2002; Weisler, 2004). In fact, research from the current study goes beyond some of the previous research indicating executive functioning as a relevant issue for ADHD patients by showing a strong correlation between these two factors on the self-report measures used in this study.

ADHD and depression were significantly related, which supported the second hypothesis. Hypothesis 2 stated that higher symptoms of ADHD scores would be correlated with increased rates of comorbid symptoms of bipolar disorder, anxiety, or depression. The correlation with depression was not surprising, considering the reported prevalence of this disorder among the ADHD population. Individuals who exhibit behavioral problems associated with the disorder often have difficulty with friendships and may experience rejection on a more regular basis. They also tend to have difficulty succeeding in school or on the job due to their deficits. Therefore, it does not seem unusual for an individual to experience some level of depression when they are also experiencing symptoms of ADHD.

ADHD and anxiety were also significantly related, likely due to similar reasons that lead to the experience of depression. These findings also supported hypothesis 2. Perhaps these individuals receive more pressure from others about their behavior or task performance at home or on the job. Perhaps they struggle to complete work in a timely fashion, impairing their academic or vocational goals. These individuals also tend to get into more trouble with the law and have discord in their interpersonal relationships, which could certainly lead to an increase in anxiety symptoms. The findings related to depression and anxiety are both consistent with literature that identifies these disorders as commonly comorbid to ADHD, providing further evidence for this assertion (Barkley, 2006; Cleland et al., 2006; Hesslinger et al., 2002; McGough et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004; Young & Toone, 2000).

Executive functioning and depression were significantly related, which provided partial support for the third hypothesis. Hypothesis 3 stated that higher symptoms of executive functioning deficits would be correlated with increased rates of symptoms of bipolar disorder, anxiety, or depression. Executive functioning and anxiety were also significantly related, which provided more support for hypothesis 3. In fact, the CAARS and the BRIEF—A together were able to predict the presence of both depression and anxiety. More specifically, the CAARS alone was able to predict signs of depression. Therefore, it seems that difficulty with ADHD symptoms as well as executive functioning deficits contribute to the experience of psychological distress in the form of both anxiety and depression in this community-based sample. These results are consistent with literature that identifies commonalities between the neuropsychological components

of these disorders (Charney, 2003; Goldapple et al., 2004; Manaye et al., 2005; Zimmerman et al., 2006).

Symptoms of bipolar disorder were not compared to ADHD symptoms nor executive functioning symptoms because only 2 of the 70 participants screened positive for a bipolar spectrum disorder on the Mood Disorder Questionnaire. Therefore, these results did not support hypotheses 2 or 3. Since some of the symptom presentation of bipolar disorder can be similar to ADHD, perhaps these results indicated a sufficient difference that bipolar disorder is not likely to present as a comorbid disorder. This finding differs in comparison with some research showing bipolar disorder as a comorbid diagnosis (Barkley, 2006; Cleland et al., 2006; Hesslinger et al., 2002; McGough et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004; Young & Toone, 2000). Perhaps bipolar spectrum disorders could be more likely to be differentially diagnosed in comparison with ADHD, rather than diagnosed as a comorbid condition. However, it is not possible to confirm this speculation with data from the present study. Finally, it would be important to note that the current sample is a nonclinical population, making the likelihood of positive bipolar disorder screenings less likely to occur as compared to a clinical sample, some of whom may also be experiencing symptoms similar to ADHD.

Implications for Diagnosis and Treatment

The level of education was relatively high for this group of participants, largely due to the recruitment method and available sample. It would be important to repeat the study with a less educated group, as there may be a difference in the level of executive functioning. Well-educated participants with ADHD symptoms may have been able to remediate their executive functioning and ADHD symptoms in order to succeed, whereas

a sample with less education may indicate that they were hindered by their symptom presentation. With this knowledge, it would be easier to identify common weak areas in executive functioning and to develop tailored treatments for those specific dysfunctions.

The fact that participants did not report the presence of oppositional defiant disorder or conduct disorder was somewhat unusual, since these disorders have often been diagnosed together in children with ADHD (Barkley, 2006; Cleland et al., 2006; Hesslinger et al., 2002; McGough et al., 2005; Rostain & Ramsay, 2006; Weisler, 2004). However, participants in the current study would probably be less likely to be diagnosed with these disorders, considering the high education level of many of the participants. Therefore, perhaps those who had these diagnoses chose not to participate or may not have been within the sampling population. Only a small percentage of the population in this study was actually in the clinical range of ADHD symptoms; therefore, it would be useful to obtain a sample with more ADHD patients in order to see if the level of comorbidity with these disorders would be similar to what has commonly been cited.

Familial Background

ADHD is reported to have a strong genetic and heritable component (Barkley, 2006; Biederman et al., 1995, as cited in Barkley, 2006; Cornish, et al., 2005; McGough & McCracken, 2006; Stevenson, 1994; Weisler, 2004). Therefore, it would be useful to gather more evidence of the heritability of ADHD. Some research has addressed the prevalence of a broad range of family members' comorbid disorders (McGough et al., 2005), while this study looked more specifically at a few commonly comorbid disorders in a preliminary way through participant report of diagnosis and suspected diagnosis in first-degree relatives. The rates reported of known diagnoses in first-degree relatives

seemed high, while the suspected diagnosis of any of these disorders was even higher. The suspected diagnosis rate may have been high due to either an underdiagnosis of these disorders or a misinterpretation of the signs and symptoms of these disorders. It is likely that both reasons contributed in part to this representation of pathology. It should be noted that due to the wording of the questions about first-degree relatives, it was unclear whether the participants were thinking about the same relative as when they answered the question about the known versus suspected diagnoses. In other words, they may have reported they knew of a diagnosis of ADHD and also that they suspected this diagnosis while referring to the same individual. They may also have been referring to different individuals. It was impossible to differentiate this individually, but the overall report did show higher rates of suspected diagnoses than known diagnoses.

Perhaps this research will serve to highlight the importance of addressing familial pathology that is often present in those with ADHD while treating that individual patient. Familial pathology may cause an exacerbation in symptoms and fail to teach effective ways of coping with deficits. It may also serve to reinforce some of the negative beliefs the individual may have developed as a result of their own disorder. The problems of the individual can be quickly compounded by family members with their own pathology that influences their lives and must be addressed within the therapeutic setting in order to achieve the most efficacious treatment.

Comorbid Mood Disorders

A number of participants in this study screened positive for anxiety and depression, while there were only two who screened positive for bipolar disorder. Perhaps this prevalence speaks to the importance of screening patients within the clinical

setting rather than opting to assess the person solely by his or her description of the problem. There is no accounting for an individual's awareness of the way that his or her experience fits within a clinical profile. Therefore, baseline screening would be important as a preventive measure, especially when working with someone who already presents with signs of ADHD.

In light of the prevalence of depression and anxiety within the current study population, the results showing significant relationships between both the CAARS and the BRIEF—A with depression and anxiety become quite relevant. Both ADHD symptoms and executive functioning deficits were associated with the experience of depression and anxiety symptoms. These results suggested that the effect of an individual's cognitive functioning appeared to impact their affective state in more ways than one. The CAARS was able to predict the presence of depression among this population, suggesting a more direct relationship between ADHD symptoms and depression in this specific population. ADHD is a more specific set of cognitive processes, although diverse, whereas executive functioning deficits are more general and could be accounted for by a number of different things, such as traumatic brain injury, mental retardation, or a seizure disorder. It appears that this less specific profile is not as accurate in predicting the presence of specific emotional distress in the forms of depression or anxiety, while a high ADHD profile would be more likely to do so. Therefore, it would be especially important to seek to identify comorbid symptoms of distress that may be present in individuals with ADHD so that comprehensive treatment is more likely to be achieved.

Executive Functioning and ADHD

The strong correlation between the global measure of executive functioning and the ADHD index is significant in that it provides support for the idea that executive functioning is an aspect of ADHD that deserves attention. It may help to think about the disorder differently and perhaps to provide support for change of the criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM—IV—TR; APA, 2000). The current diagnostic criteria for ADHD are problematic not only because they do not address adult symptoms of the disorder but because they do not address the executive functioning component that is becoming more of an apparent part of the symptom presentation. Inclusion of executive functioning deficits as diagnostic criteria could serve to reframe the conceptualization of ADHD, and therefore may affect its treatment.

Treatment Recommendations

Research has strongly supported the use of medication management for ADHD, with the stimulant medications being the most effective type of treatment (Hervey et al., 2004; Pelham et al., 2005; Ramsay & Rostain, 2004; Weisler, 2004). This treatment is most effective when complemented by the use of cognitive-behavioral strategies to treat the symptoms of ADHD and its comorbid disorders (Barkley, 2006; Hesslinger et al., 2002; Ramsay & Rostain, 2004). The current study in no way detracts from that evidence, but adds yet another important treatment component to be considered and utilized for those affected by this disorder.

In addition to medication and cognitive-behavioral therapy, the treatment of ADHD might include management of the individual's executive functioning deficits. Solanto and colleagues addressed several of these issues in their treatment manual for the

metacognitive skills needed to improve deficits in adults with ADHD (Solanto et al., 2008). The current study supports this approach and suggests that the individual may benefit through the application of traditional techniques of cognitive remediation that are frequently used within the field of rehabilitation psychology. For example, the clinician could introduce the use of external memory aids, such as a planner in which the individual would keep scheduled appointments and daily to-do lists. The clinician could then determine what the person would prefer and whether they would be able to afford the solution, such as the purchase of a planner in paper or electronic format. Additionally, it would be important to collaborate with the support persons in the individual's life when making any kind of behavioral change (Sohlberg & Mateer, 2001). They may be able to assist in maintaining any positive changes made by the individual in treatment. In conclusion, it is clear that medication management and cognitive behavioral therapy would continue to be a recommended form of treatment, with the addition of cognitive remediation techniques to improve relevant areas of executive dysfunction in adult patients with ADHD.

Limitations and Future Directions

Limitations include the use of a nonclinical community sample of educated adults, most of whom did not have a diagnosis of ADHD. Therefore, it could be difficult to definitively generalize these findings to an ADHD-only sample of adults. The use of a community sample allowed for easier recruitment and access to a population that allowed a reasonable examination of the measures for this study.

The use of self-report measures without corroboration can lead to a bias in the report of symptoms. People are not always aware of the areas in which they struggle, and

for a purely ADHD sample, it would be especially important to have others report on symptoms, as well. An approach that involved participation other than the anonymous individual who decided to complete the study did not seem practical for the design of this study.

Testing of first-degree relatives of the participants was not able to be done, and the information obtained was only descriptive in nature. Therefore, it would be important to have future research that more closely investigates the nature of mental illness within first-degree relatives of patients with ADHD, perhaps through screening of those relatives. That information may contribute more significantly to support for the genetic components to the disorder.

Bipolar disorder was not associated with ADHD and executive functioning deficits in this study. However, some of the symptoms can appear similar, such as poor affect regulation (Manaye et al., 2005). Previous research has shown that patients with bipolar disorder clearly have neuropsychological components to the disorder, such as attentional issues and executive functioning deficits (Kronhaus et al., 2006; Zimmerman et al., 2006).

Future research could go on to evaluate ADHD in a clinical sample using more direct neuropsychological measures along with the self-report measures in order to gain a clearer picture of their level of functioning. Such measures would be better able to determine specific neuropsychological issues related to executive functioning and the behavioral manifestations of ADHD. Furthermore, direct assessment of first-degree relatives would be important. It would also be important for future research to more clearly identify the ways in which components of bipolar disorder are similar or

dissimilar to ADHD. With that clarification, perhaps individuals would obtain more accurate diagnoses. Bipolar disorder may be less likely to be seen as a comorbid disorder but as one with which to differentially diagnose the individual. Future research could expand upon commonly seen comorbid disorders and perhaps seek to develop treatment methods that would be able to adequately address both ADHD and its comorbid symptom presentation.

Perhaps the relationship between executive functioning and ADHD could contribute to research that would help to more accurately define the diagnostic criteria for this disorder. Finally, future research could seek to implement new treatment methods, such as cognitive remediation, that may help to improve the individual's level of executive functioning.

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Appendix A

Demographic Questionnaire

1. Gender Female Male
2. Age _____ {Must be 18-60-numbers outside range are exclusionary}
3. I am able to speak and read English. Yes No {Exclusionary}
4. Race/Ethnicity:
_____ Latina/o, Hispanic, or Chicana/o
_____ African-American or African descent
_____ European-American or European descent
_____ Asian-American, Asian descent, or Pacific Islander
_____ Multi-racial or biracial
_____ Other _____ {Fill-in-the-blank}
5. Highest level of education completed:
 High School
 Associates Degree/Some college
 Bachelors degree
 Masters degree
 Doctoral degree (e.g. D.O., M.D., Psy.D., Ph.D.)
6. Please check if you have ever been diagnosed with any of the following:
 Attention deficit/hyperactivity disorder (ADHD or ADD)
 Oppositional defiant disorder
 Conduct disorder
 Learning disability
 Mental retardation
 Bipolar disorder
 Depression
 Anxiety
 Substance abuse or dependence

- Schizophrenia or Schizoaffective disorder {Exclusionary}
- Traumatic Brain Injury (TBI) {Exclusionary}
- Stroke, seizure disorder, brain tumor or other neurological disorder {Exclusionary}

7. Please indicate whether you currently take medication(s) for one of the diagnosed disorder(s) mentioned on the last question:

- Yes No

8. For which diagnosis/diagnoses do you take medication(s)?
{None/Checklist} _____

A FIRST DEGREE RELATIVE IS SOMEONE WHO IS BIOLOGICALLY RELATED TO YOU WITH ONLY ONE DEGREE OF SEPARATION, SUCH AS A MOTHER, FATHER, SISTER, BROTHER, OR CHILD.

9. Do you have any first degree relatives diagnosed with attention deficit hyperactivity disorder (ADHD/ADD)?

- Yes No

10. Do you have any first degree relatives diagnosed with bipolar disorder?

- Yes No

11. Do you have any first degree relatives diagnosed with depression?

- Yes No

12. Do you have any first degree relatives diagnosed with anxiety?

- Yes No

13. Have you ever suspected a first degree relative would have been diagnosed with attention deficit hyperactivity disorder (ADHD/ADD)?

- Yes No

14. Have you ever suspected a first degree relative would have been diagnosed with bipolar disorder?

Yes No

15. Have you ever suspected a first degree relative would have been diagnosed with depression?

Yes No

16. Have you ever suspected a first degree relative would have been diagnosed with anxiety?

Yes No

Appendix B

Promotional Flier

What does INFORMATION PROCESSING have to do with THOUGHTS, FEELINGS AND BEHAVIOR??? Your local Clinical Psychology Doctoral Student wants to figure it out! If you are 18-60 years old and you can read and write in English, please fill out a few brief questionnaires, and mail them back to me. YOU CAN HELP contribute to knowledge in this area. Responses will be kept ANONYMOUS. Provide a mailing address, and you will be entered into a RAFFLE for a \$35 GIFT CARD! If you win, the gift card will be mailed to that address. It's as easy as that! Good luck and thanks in advance!

Appendix C

Address form for enclosure with packet

Initials/Code name (Optional) _____

Street _____

City/State/Zip _____

-ENCLOSE WITH QUESTIONNAIRE PACKET TO ENTER RAFFLE-

Appendix D

Sample E-mail

What does INFORMATION PROCESSING have to do with THOUGHTS, FEELINGS AND BEHAVIOR??? Your local Clinical Psychology Doctoral Student wants to figure it out! If you are 18-60 years old and you can read and write in English, please fill out a few brief questionnaires, and mail them back to me. YOU CAN HELP contribute to knowledge in this area. Reply to this email (sara.oneal@khalsa.com) with a mailing address to send a packet or follow this link to begin the study: {WEBSITE ADDRESS}. Responses will be kept ANONYMOUS. Provide a mailing address, and you will be entered into a RAFFLE for a \$35 GIFT CARD! If you win, the gift card will be mailed to that address. It's as easy as that! Good luck and thanks in advance!