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Attention deficit hyperactivity disorder (ADHD) and gender differences

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Attention Deficit Hyperactivity Disorder (ADHD) and Gender Differences

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Abstract

Few studies investigate gender differences concerning Attention Deficit Hyperactivity Disorder (ADHD) (Hinshaw, 2002). Further, studies that examine self-report ratings of ADHD in females are lacking. Self-reports are crucial to identifying ADHD in females who have been found to have more internalizing symptoms of ADHD (Quinn, 2005). Current models suggest that executive function, rather than attention, is the core deficit of ADHD and that it may serve as a neurobehavioral domain that differentiates individuals with ADHD based on subtype and gender (Wodka et al., 2008). This study examined gender differences on the Behavior Rating Inventory of Executive Functioning- Adult Version (BRIEF-A) between fifty two undergraduate college students who self-reported to have ADHD. Analysis of variance (One way ANOVA) were conducted to determine significant differences between male and female self report ratings on the BRIEF-A. Results indicated that there were no significant differences between males and females on the BRIEF-A. These results were similar to previous literature which indicates that the presentation of ADHD in females is more similar than different from the presentation of ADHD in males (Rucklidge, 2008).

CHAPTER ONE

Introduction

Gender differences in psychopathology has been an area that has been neglected by researchers. Many studies have excluded females from their samples or have not examined gender differences within the samples (Mash & Dozois, 2003). For example, Attention Deficit Hyperactivity Disorder (ADHD) is a neurobiological disorder that has been thought to effect far more males than females, however most studies that have studied ADHD have not included females in their samples (Hinshaw, 2002). Nonetheless, experts argue that ADHD is underdiagnosed in females (National Institute of Mental Health, 2006).

It has been generally found that ADHD manifests itself similar in both males and females. The research has convincingly shown that males and females with ADHD are more similar than different and struggle with similar rates of academic, cognitive, psychosocial, and psychiatric impairment (Rucklidge, 2008). In addition, research has found that females with ADHD are less likely to be diagnosed with ADHD and more likely than males to have the Inattentive Type of ADHD (Biederman, 2002; Rucklidge, 2008). The inattentive type of ADHD is difficult to observe and identify in that the symptoms are less overt than the disruptive behaviors typically seen among males (Quinn, 2005). Further, the limited research available consistently shows that when females are identified as having ADHD they are as impaired as or more impaired than their male counterparts (Biederman et al. 2005, Carlson, Tamm, & Gaub, 1999, Dalsgaard et al., 2005; Dupaul et al. 2006; Reimherr et al., 2008, Rucklidge & Tannock, 2001).

Current models of executive function suggest that executive dysfunction is the core deficit of ADHD and that it may serve as a neurobehavioral domain that differentiates between different groups of individuals with ADHD based on subtype and gender (Wodka et al. 2008).

There is a lack of studies that examine gender differences in executive functioning (Seidman, 2006). Moreover, most of the studies have focused on executive functioning utilizing neuropsychological tests rather than self-reports which may be limited in their utility (Gioia et al., 2002). Given that females have more internalizing symptoms of ADHD their self reports and perceptions are critical to successful diagnosis (Quinn, 2005). The Behavior Rating Inventory of Executive Function (BRIEF) is a self-report rating scale designed to measure the neuropsychological construct of executive functioning and its various components (Gioia, Isquith, Retzlaff, & Espy, 2002). The BRIEF scales have been successful in identifying individuals with ADHD and differentiating between subtypes. (Mahone et al., 2000; McCandless & O'Laughlin, 2007; Pratt, 2000).

One way to examine gender differences in executive functioning is to examine gender differences of self reports on the BRIEF-A. These findings may be helpful in detecting differences that are unlikely to be seen on neuropsychological tests, clinical interviews, or observations. They may also help the field better understand the nature and extent of ADHD and be more successful in detecting ADHD in female samples.

The purpose of this study was to examine gender differences between males and females who have ADHD on self-reports of the BRIEF-A. The sample included fifty two hearing participants who self-reported to have ADHD. Thirty nine (75%) of these participants were male and twelve (23%) were female. All of these participants completed the Brief Rating Inventory of Executive Function- Adult Version (BRIEF-A).

Research Question

It is hypothesized that self report gender differences will be detected on the BRIEF-A between females and males with ADHD.

Definition of Terms

Attention Deficit Hyperactivity Disorder is a neurobiological disorder that is characterized by chronic symptoms of inattention, distractibility, impulsivity, and hyperactivity. Symptoms must have been present before the age of 7, occur in at least two settings, and interfere with social, occupational, or academic functioning (American Psychiatric Association, 2000).

Executive Function is a neuropsychological construct that refers to a multidimensional set of abilities ranging from planning to self-monitoring to working memory, and involving cognitive and emotional components as well as overt behaviors (Donders, 2002).

The Behavior Rating Inventory of Executive Functioning-Adult (BRIEF-A) is a 75-item standardized self-report rating scale used to measure everyday behavioral manifestations of an individual's executive functioning (Gioia et al. 2002)

CHAPTER TWO

Attention Deficit Hyperactivity Disorder (ADHD) and Gender Differences

Gender differences in psychopathology is an important area of interest that often has been neglected by researchers. Gender differences in the form of psychopathology have been formally recognized since Freud presented his views at the beginning of the 20th century; however, psychopathology in girls has received far less research attention than psychopathology in boys (Mash & Dozois, 2003). In the past, many studies have excluded girls from their samples or did not examine girls separately. In addition, until recently there have only been a few studies on disruptive behavior disorders in girls (Mash & Dozois, 2003). Attention Deficit Hyperactivity Disorder (ADHD) is one behavioral disorder that is commonly studied, diagnosed, and treated in predominantly male populations. Many experts argue that there is evidence that ADHD is underdiagnosed in females (National Institute of Mental Health, 2006).

Differential sex prevalence has been found when diagnosing several mental disorders. It has generally been found that males are more likely to have Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Conduct Disorder, Mental Retardation, learning disabilities, language disorders, Autism, and Aspergers Disorder (Hartung & Widiger, 1998). Specifically, males with a diagnosis of an externalizing behavior disorder have thought to outnumber females by ratios of 2-5:1 (Handwreck et al. 2006; Hartung & Widiger, 1998). It is also been found that females are more likely to have a comorbid anxiety disorder, mood disorder, and eating disorder (Barlow, 2002; Hartung & Widiger, 1998). Generally, there has been consensus in the field that males are more likely to have an externalizing disorder (ie. Attention Deficit Hyperactivity Disorder, Conduct Disorder) where girls are more likely to have an internalizing disorder (ie. Generalized Anxiety Disorder, Major Depressive Disorder). While

these gender differences have been well established, their meaning has not been well understood (Mash & Dozois, 2003).

Attention Deficit Hyperactivity Disorder (ADHD) is a neurobiological disorder that has been thought to effect far more males than females. Only recently have gender differences of this disorder received a considerable amount of attention. ADHD is generally characterized by symptoms of inattention, distractibility, impulsivity, and hyperactivity (American Psychiatric Association, 2000). ADHD is categorized into three subtypes; behavior marked by hyperactivity and impulsivity but not inattentiveness (ADHD predominantly hyperactive type), behavior marked by inattentiveness, but not hyperactivity and impulsivity (ADHD predominantly inattentive type), and behavior marked by a combination of hyperactivity and impulsivity and inattentiveness (ADHD combined type).

Females with ADHD especially those who are adolescents and adults have been largely neglected in the research. Since few researchers have considered female profiles of ADHD, little is known about gender differences (Rucklidge, 2008). Small number of female subjects in the ADHD literature hinders the knowledge of this disorder in women. Several important samples that compromise a large percentage of published data in the field are exclusively male and most studies with mixed-sex samples included too few girls for data analysis of female manifestations and mechanisms (Hinshaw, 2002). The two studies that compromise the two largest female samples are recent but both have issues regarding external validity therefore findings cannot fully be generalized (Hinshaw, 2002). There has been a slow growing body of research that has clearly shifted the conceptualization of ADHD and suggests that ADHD is not a predominantly male disorder despite prevalence rates. In addition, recent research suggests that ADHD in

males and females are more similar than different. More studies with larger samples and equal representations across gender are greatly needed. (Rucklidge, 2008).

Overview

Women with ADHD appear to present with significant, chronic problems across several domains of functioning. A five year longitudinal study that assessed psychiatric disorders using blinded structured diagnostic interviews showed that adolescent females with ADHD are at a high risk for elevated lifetime and one year prevalence of antisocial, addictive, mood, and anxiety disorders. The high comorbidity associated with ADHD in females supports the importance of early recognition of the disorder for prevention and early intervention strategies of females with ADHD (Biederman et al., 2006). There is indication from the research done with children and adolescents that females are often as impaired as or even more impaired than males with the disorder (Rucklidge et al. 2007). Further, the few studies that examined sex differences in adults found that psychiatric functioning in adults was similar to that identified in child samples (Rucklidge et al. 2007). Studies have now proved that ADHD females are significantly impaired when compared to non-ADHD girl across all domains of functioning including cognitive, psychiatric, psychosocial, and academic and struggle with similar rates of these problems as their male counterparts (Rucklidge, 2008).

It is well known that ADHD exists in girls and causes considerable impairment in female samples (Rucklidge, 2008). However, information regarding the course of ADHD in females is lacking (Hinshaw, 2006). Most of what is known about ADHD in females is based on clinical experiences and observations rather than scientific findings. Historically, girls may have been understudied because investigators were mainly focusing on the classic symptoms of hyperactivity and impulsivity. The official definition of ADHD has slowly evolved. In 1994, the

DSM IV introduced a subgroup of ADHD that didn't include the classic symptoms of hyperactivity and impulsivity but solely included inattentive symptoms (ADHD predominantly inattentive). Research has shown that girls with ADHD are more likely than boys to be diagnosed with the predominantly inattentive type of ADHD (Biederman, 2002). The inattentive type is more difficult to identify than the hyperactive and combined types. Lack of diagnosis of ADHD in female children can be partly explained because females manifest symptoms that are considerably less overt than the disruptive behaviors typically seen among males (Quinn, 2005). It can also be explained because the behaviors that were used to define the symptomatology of ADHD in the DSM-IV were identified by a sample that was predominantly male and uses cutoffs that didn't account for gender (Reid et al. 2000).

Check lists commonly used by schools, pediatricians, and psychologists to identify children with ADHD continue to emphasize hyperactive/impulsive behavior patterns that are more typical of boys (Nadeau, Littman & Quinn, 1999). Considering theses limitations, there has been an increasing awareness to use separate standards and norms for males and females when rating ADHD behaviors. There has also been a call to develop gender appropriate diagnostic criteria and diagnostic tools. It has been suggested that female-sensitive items for ADHD be included in these tools such as "giggles or takes excessively," "writes or passes notes instead of completing homework," and "changes friends impulsively or without thinking" (Rucklidge, 2008).

Several hypotheses that rely on biological or child-rearing differences by gender have been offered to explain the disproportion of ADHD in males when compared to females but have failed to resolve this issue (Reid et al. 2000). The literature offers no clear explanation to what causes or contributes to the differences in gender prevalence rates of those diagnosed with

ADHD. Hypotheses that have tried to account for the differences in prevalence rates across the genders have been grouped into two categories: (a) bias hypotheses and (b) true differences hypotheses (Hartung et al. 2006). Bias hypotheses suggest that both males and females manifest equal amounts of the same behavior but are rated differently (Hartung et al. 2006). Oppositely, true difference hypotheses suggest that there are true behavioral differences between males and females that account for the differential gender prevalence rate (Hartung et al. 2006).

Rater bias by teachers and parents has been thought to be one of the contributing factors to the under-identification of ADHD in girls (Rucklidge, 2008). As part of the diagnostic process of ADHD, teachers are often asked to complete behavior rating scales to obtain their perceptions of the child's behavior. Research has shown that a gender bias in teacher perceptions of children's behavior may result in a referral bias. Males with ADHD tend to present with higher rates of distress and annoyance to teachers. This may be due to males presenting with more overt and easier to identify symptoms than girls, which are observable and easy to identify.

Results of a metanalysis indicate ADHD females were rated as less attentive and displayed fewer externalizing problems than males according to teachers only and that teachers rate ADHD males as significantly more impaired than ADHD females in comparison to parent reports (Gershon, 2002). In contrast, Hartung et al. (2006) did not find gender differences in ratings when a large sample of college students rated boys and girls exhibiting disruptive behavior. The literature has also consistently showed that boys with ADHD tend to be more disruptive, engage in more rule breaking behavior, and more likely to have a comorbid disruptive behavior disorder than girls. Further, those with disruptive behavior disorders are more likely to have severe ADHD (Rucklidge, 2008).

Scuitto, Nolfi, and Bluhn (2004) investigated the effects of child gender and ADHD symptom type on 199 elementary school teachers' referral decisions by having the teacher read a profile of a fictional child's academic record and then rate on a likert scale the likelihood of referring the child for evaluation. Results showed that when presented with the same symptom profile, teachers were far more likely to refer a boy than a girl for psychological evaluation, regardless of symptom type, and especially when the child exhibited hyperactivity without inattention or aggression (Scuitto et al. 2004). Rater bias by teachers and parents has been thought to be one of the contributing factors to the under-identification of ADHD in girls (Rucklidge, 2008).

Another explanation for gender differences in ADHD is biased assessment. Behavior rating scales are commonly used to assess ADHD yet most of these scales do not clearly specify what normative base should be used when completing ratings on a particular child. This may cause informants to compare the target to both boys and girls, whereas other informants compare the child to same sexed peers (Waschbush & King, 2006).

Symptomatology

Although the criteria used to define ADHD was based largely on a sample of boys, girls are shown to meet diagnostic criteria for ADHD. Girls have also been found to manifest similar symptoms as males. However, when females have ADHD they are more often likely than males to have the predominantly inattentive type (Rucklidge, 2008). Social isolation has been reported more in girls with the inattentive type (Hinshaw, 2002). Further, the National Institute of Mental Health stated that older girls with ADHD tend to have social problems due to withdrawal and internalized emotions, showing symptoms of anxiety and depression (NIMH, 2006).

Female subjects that were assessed with structured diagnostic interviews by self-report, for children 12 and older or parental report, for children under 12 were more likely than males to have the predominantly inattentive type of ADHD (Biederman, 2002). Consistent with these findings, the National Institute of Mental Health stated that girls with ADHD are often inattentive but not hyperactive or impulsive. Contradictory findings based on parental diagnostic interviews have shown that girls are not more likely to have the inattentive type (Bauermeister et al. 2007). Findings from direct observations, questionnaire ratings, and meta analytic review have shown that girls with ADHD exhibit fewer comorbid conduct problems but more internalizing symptoms than boys with ADHD (Abikoff et al. 2002; Gaub & Carlson, 1997; Gershon, 2002; Levy, Hay, Bennett, & McStephen, 2005).

The NIMH Collaborative Multisite Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder (MTA) provided an exceptional opportunity to investigate the nature of core ADHD symptoms as function of gender utilizing a large sample size of children. Results indicated that both parents and teachers rated girls as less symptomatic than boys on the Swanson, Nolan, and Pelham rating scales. Performances on the continuous performance test (CPT) also indicate that girls were less impulsive than boys and girls who had ADHD and comorbid anxiety were less impulsive than girls with ADHD-only (Newcorn et al. 2001). A meta-analysis that examined gender differences showed that ADHD females had lower ratings of hyperactivity, inattention, impulsivity, and externalizing problems and had more internalizing problems than did ADHD boys (Gershon, 2002).

Biederman et al. (2005) examined a large study of non referred subjects and found that that there were no differences between the genders in age of onset of ADHD, duration of the disorder, and individual ADHD symptoms on based upon reports of indirect structured

diagnostic interviews. Further, Biederman et al. (2005) found that both males and females did not differ in subtypes of ADHD with the combined type of ADHD being most prevalent across the genders.

Cognitive and Academic Functioning

Rucklidge and Tannock (2007) found that female adolescents with ADHD obtained higher scores on Processing Speed (particularly Coding) and had lower vocabulary scores than their male counterparts. Further, similar findings of two meta analyses indicate that girls with ADHD have higher rates of speech and language disorders and delays, and may also have more compromised cognitive and intellectual abilities than boys with ADHD (Carlson, Tamm, & Gaub 1997; Gershon, 2002). Gershon (2002) found that females with ADHD obtained a lower Full Scale IQ and lower Verbal IQ than males while no gender differences were found for Performance IQ.

Yang et al. (2004) studied a Taiwanese sample and found that ADHD girls and ADHD boys performed similar on all measures of cognitive functioning except girls performed more poorly on Block Design, a test of visual spatial and perceptual thinking. Biederman et al. (2002) found that girls with ADHD obtained statistically significant, but not clinically meaningful, lower scores on Full Scale IQ and on the Block Design subtest.

There have been mixed results in regards to academic functioning in females with ADHD. Rucklidge and Tannock (2001) found that there were no differences on any achievement tests between males and females with ADHD. Hinshaw (2002) examined a diverse sample that included girls who were carefully diagnosed either ADHD-Inattentive Type of ADHD-Combined Type and found that each ADHD group scored significantly lower on cognitive and

achievement tests than did comparison girls, with effect sizes from medium to large; with girls across the ADHD subgroups performing relatively the same.

Social-emotional Functioning.

Females with ADHD are likely to have psychosocial impairments making it difficult for them to manage the demands of everyday life (Rucklidge, 2008). It has generally been found that individuals with ADHD, regardless of gender, have great difficulties in the area of social and emotional functioning. Biederman et. al (2005) utilized semistructured interviews and found that male and female ADHD subjects reported similar impairments in emotional, school, family, and interpersonal functioning. It was also found that ADHD in both genders was associated with high levels of psychoeducational impairments (Biederman et al., 2005).

Rucklidge and Tannock (2001) examined the behavior ratings of 107 adolescents and their parents and teachers from Southern Ontario completing the Revised Ontario Child Health Study Scales (OCHSS) and the Connor Rating Scales-Revised and several other rating scales found that females were more impaired than males in terms of psychosocial functioning. Females reported more overall distress, anxiety, and depression; a more external locus of control; and more cognitive, and hyperactivity problems. In addition, both parents and teachers rated the females with ADHD as having more difficulties in attention, hyperactivity, oppositional behaviors, conduct problems, social difficulties, anxiety, and depression than their ADHD male counterparts. On the Childhood Depression Inventory (CDI), the females in this study also reported more depressive symptoms, anhedonia, ineffectiveness, and negative self esteem than both female controls and males with ADHD. The girls with ADHD also reported that negative events had a greater impact on them than both female controls and males with ADHD. (Rucklidge & Tannock, 2001) In comparison, Rucklidge et al. (2007) examined psychosocial

functioning in adults with ADHD by having participants complete self- report rating scales. Both genders reported similar psychosocial difficulties which included low self-esteem, mild to moderate levels of depression and anxiety, and a more external locus of control. The overall gender effects that emerged showed that males reported a lower self-esteem and a more external locus of control. In addition, during a semistrucutred interview, males reported more dissatisfaction in childhood than females (Rucklidge et al. 2007.)

It has found that boys with ADHD are more likely to have school problems that warrant disciplinarian action than girls with ADHD. Bauermeiser et al. (2007) studied the parental reports on various rating scales regarding children ages 4 to 17 in a community sample in Puerto Rico. Parental reports indicated that the risks and sequela were systematically similar in males and females, with one exception in school suspension which was far more common in boys (Bauremister et al. 2007). In addition, results on the Brief Impairment School Scale indicated that both boys and girls experience significant difficulties in school settings with boys experiencing more difficulty (Bauermeister et al. 2007).

Biederman et al. (2002) examined the results of parental structured interviews regarding children referred to a psychiatric clinic and found that girls with ADHD had fewer school problems and participated in more spare-time activities than boys with ADHD (Biederman et. al 2002). Additional findings based upon indirect structured interviews of caregivers of non referred subjects indicate that reports of school dysfunction were higher among ADHD subjects regardless of gender. There were also no differences in educational functioning between ADHD males and females (Biederman et al. 2005).

Although the literature shows that the girls with ADHD are less likely to be physically aggressive than the boys with ADHD, they often engage in verbally aggressive behaviors.

Observational studies in a classroom found that girls with ADHD were more likely to be teasing, taunting, and name calling their peers compared with their female counterparts (Abikoff, Jensen, Arnold et al. 2002)

DuPaul and colleagues (2006) examined gender differences in school functioning by having teachers complete the Behavior Assessment System for Children and the Connors Teacher Rating Scale, Academic Competency Evaluation Scale, and the Social Skills Rating Scale. In addition, they examined direct observations of classroom behavior and standardized achievement tests. Results indicated that although girls were less likely to have ADHD, when they did have the disorder, their impairments were as or possibly more severe than boys in relative to non-ADHD peers of the same gender. Further, on teacher ratings of social and behavioral functioning, girls obtained higher scores for externalizing problems, internalizing problems, and school problems. Ratings also indicated that boys had better developed adaptive skills than girls. In addition, based on observations of classroom behavior and teacher ratings of social skills, no gender differences were found (DuPaul et. al. 2006).

Girls with ADHD are likely to have problems with interpersonal relationships and everyday functioning (Rucklidge, 2008). Females with ADHD have exhibited a host of problems concerning relationships in both the school and home. For example, Hinshaw (2002) who studied age and sample of girls with ADHD found that when peers who nominated who they most liked and disliked by selecting pictures from a picture board composed of head-and-shoulder photographs of all classmates, females with ADHD were universally rated more negatively by their peers. Further, Hinshaw found that girls who had the Inattentive type were less rejected but more socially isolated (Hinshaw, 2002). In addition, to having problems with their peers, females with ADHD have found to have problems with authority figures in school.

Rucklidge and Tannock (2000) found that females with ADHD were more likely to report dissatisfaction with their teachers than female controls. Babinski et al. (2008) examined a sample of young adults with ADHD and found that these females self reported more depressive symptoms, conflicts with their mothers, fewer romantic relationships, lower achievement scores, and general difficulty academically and with family. Further, parent ratings of these subjects indicated that girlhood ADHD predicted more ADHD symptoms, fewer close friends, and more difficulty in relationship with peers, siblings and parents, school, work, self-esteem, and overall functioning by young adulthood (Babinski et al. 2008).

Females with ADHD have been shown to exhibit self derogatory perceptions of themselves and to be viewed socially inappropriate by others. Hoza et al. (2004) examined body perceptions of and found that girls in general (both ADHD and non ADHD) had less inflated self-perceptions and were more likely to have self derogatory perceptions of their body. Further, it has been found that peers of females with ADHD are more likely to be tolerant of higher levels of ADHD symptoms among boys than girls (Diamantopoulou, Hencrisson, & Rydell, 2005).

Psychiatric Functioning

Biederman et al. (2002) examined a sample of subjects referred to a psychiatric clinic by administering diagnostic interviews to mothers of children younger than 12 and directly to children older than 12 years. The researchers found that the girls with ADHD were at less risk for comorbid depression, conduct disorder, and oppositional defiant disorder than boys with ADHD. Interestingly, there was a significant gender-by diagnosis interaction, showing that ADHD in girls was a more serious risk factor for substance abuse disorders than it was in boys (Biederman et al,, 2002). Further, Biederman et al. (2005) examined a sample of non referred subjects and found that regardless of gender, the prevalence of psychiatric comorbidity was

higher in ADHD subjects when compared to non ADHD subjects. Bauremister at al. (2007) examined gender differences by utilizing parental interviews and rating scales and found that boys in the combined type group of ADHD were more likely to have a mood disorder than their female counterparts and girls with the inattentive type were more likely to have an anxiety disorder when compared with their male counterparts. In addition, findings based on a meta-analysis indicated higher ratings of internalizing problems being rated with girls who have ADHD (Gershon, 2002).

Parental reports assessed through structured interviews and rating scales suggest that young adult females with ADHD tend to have a more negative outcome than males with the disorder. Girls with ADHD have shown to have steeper increases in adolescent depression and anxiety than boys with ADHD (Lahey et. al 2007). Interestingly, gender has been found to be the single most important predictor for psychiatric admission in adulthood. Dalsgaard et. al. (2005) examined 10 to 30 year follow-up data on psychiatric admissions in adulthood of children aged 4-15 years and found that girls with ADHD had a higher risk of adult psychiatric admission than boys.

In addition, Biederman et al. (2006) examined the psychiatric outcome in a large group of females with and without ADHD and found that adolescent females with ADHD were at higher risk to manifest antisocial, addictive, mood, and anxiety disorders (Biederman et al. 2006). Robison and colleagues (2008) collected rating scales on ADHD symptoms and treatment responses in 515 subjects and about a third who were women. On every measure of ADHD symptoms, including the Conners' Adult ADHD Rating Scale-Investigation Format and total Wender-Reimherr Adult Attention Deficit Disorder Scale (WRAADDS), women were rated as more impaired than men. It was found that women had higher ratings of anxiety, depression, and

more sleep problems. Poor temper control, mood volatility, and emotional over-reactivity were also more common in women than in men (Robison et al. 2008).

ADHD in females often overlaps and co-occurs with symptoms of other disorders. Hinshaw (2008) found that adolescent girls with ADHD-C were at a greater risk for bulimia nervosa and body image dissatisfaction followed by girls with ADHD-I and lastly comparison girls. In addition, it was found that childhood impulsivity best predict adolescent eating pathology, above effects of inattention and hyperactivity (Hinshaw et al. 2008). It has been found that women with ADHD reported higher rates of abuse than their male counterparts and female controls. Rucklidge and colleagues (2006) found that 23.1% of the women with ADHD and 12.5% of the males with ADHD reported moderate-to-severe sexual abuse a child in comparison to rates of 2-5% in the controls. Further, a high overlap between ADHD and Post Traumatic Stress Disorder (PTSD) has been found in the literature. The symptoms of PTSD that often overlap with ADHD are inattention, restlessness, irritability, and impulsivity. These overlap in symptoms raise concern that the Diagnostic Statistical Manual of Mental Disorder, Edition Four (DSM-IV) does not include PTSD as a differential diagnosis of ADHD (Rucklidge, 2008).

Executive Functioning

Impaired executive functions in individuals with ADHD are associated with an inability to hold information in short-term memory, impaired organization and planning skills, difficulties in establishing and using goals to guide behavior, an inability to keep emotions from becoming overpowering, and an inability to shift efficiently from one mental activity to another (National Institute of Mental Health, 2006). Newer models of ADHD suggest that executive dysfunction, rather than attention, is the core deficit in ADHD and my serve as a neurobehavioral domain that differentiates between different groups of individuals with ADHD (ie. based on subtype or sex)

(Wodka et al. 2008). These models have led to recognition to focus on these deficits in executive function of the brain to better understand and describe ADHD. Currently, there is limited data available concerning gender differences on measures of Executive Functioning (Seidman, 2006).

Rucklidge (2006) examined a sample of adolescents with ADHD aged 13-17 years and found that males and females performed similarly on tasks of naming speed, processing speed, working memory, set shifting, interference, and a number of omissions and comissions in a continuous performance tasks. Further, Rucklidge (2006) found that females were slightly more impaired in spatial span and spatial memory, while their male counterparts had more variable scores on the test of continuous performance and were slower at naming color words. Findings from the NIMH Collaborative Multisite Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder (MTA) indicate that ADHD girls made fewer Continuous Performance Task impulsivity errors than boys (Newcorn et al. 2001).

Seidman et al. (2005) examined the neuropsychological functioning of pre-teens with ADHD tests such as the Rey-Osterrieth Complex Figure (ROCF), Vocabulary and Digit Span, Auditory Continuous Performance Test, Stroop Color and Word Test, Wide Range Assessment of Memory and Learning, California Verbal Learning Test, Wechsler Adult Intelligence Scale (WAIS), Wechsler Intelligence Scale for Children, and Wisconsin Card Sorting Test and found that the ADHD individuals were significantly more impaired than the non-ADHD group but males and females with ADHD did not differ significantly from one another on these measures.

Assessment Tools

Based on this review, it seems that most of the current knowledge about Attention Deficit Hyperactivity Disorder (ADHD) is derived from research studies that obtained parental reports and self reports by utilizing structured interviews and rating scales. In addition, some findings

are based on teacher ratings and direct observations by researchers. Although executive skills appear crucial to successful functioning, the field of neuropsychology has long suffered from a lack of measure of this construct (Donders, 2002). The majority of studies conducted on neuropsychological functioning and executive function utilize tests rather than rating scales as measures. Some of these tests include: The Continuous Performance Test, The Stroop, Trail Making, Verbal Fluency ("FAS"), and the Wechsler Intelligence Scales (Seidman, 2006).

A study by Burgess in 1997 suggests that most neuropsychological tests are inadequate in assessing the executive functions because they attempt to separate integrated functions into component parts (Gioia et al. 1997). Further, these measures only examine the cognitive components executive function over a short period of time and fail to consider an integrated, multidimensional, problem solving domain that is often demanded in every day functioning (Gioia et al. 2002; Goldberg & Poldell, 2000; Shallice & Burgess, 1991). Few studies look at self report ratings of executive functioning. Importantly, there is a great need for studies that examine gender differences in executive functioning and that investigate the differences on executive functioning while examining the self reports of individuals.

Behavior Rating Inventory of Executive Function (BRIEF)

The Behavior Rating Inventory of Executive Function (BRIEF) is a self-report rating scale designed to measure the neuropsychological construct of executive function and its various components (Gioia, Isquith, Retzlaff, & Espy, 2002). The BRIEF focuses less on psychopathology and more on everyday functioning associated with executive functioning, which makes it a useful tool when considering treatment implications (McCandless & O'Laughlin, 2007). In addition, the BRIEF's use of rating scale methodology offers the

advantage of ecological validity and assesses the integrated, multidimensional, relativisitic nature of executive processing that is often demanded in real life situations (Gioia et al., 2002).

Few significant correlations have been found between the BRIEF and performance on intelligence tests or between the BRIEF and other neuropsychological measure (Anderson et al. 2002; Mahone et al. 2002). This suggests that the BRIEF may detect executive functioning deficits that are unable to be identified with commonly used executive function assessment tools. In addition, it appears that findings on the BRIEF may be critical to effective assessment and treatment for individuals with ADHD. For example, Jarratt, Riccio and Siekierski (2005) examined both the BRIEF and The Behavior Assessment System for Children (BASC); a common used measure of social and emotional behavior in children and found that while both the BASC and BRIEF assessed similar behavioral constructs specific to ADHD, the BRIEF focused on specific and important areas of ADHD. It was found that the BRIEF focused more on specific areas pertaining to metacognition and working memory, facets of ADHD that are not routinely assessed in the diagnostic evaluation of ADHD (Jarratt, Riccio, & Siekierski, 2005).

The BRIEF scales have clinical utility when identifying ADHD and determining ADHD subtypes (McCandless & O'Laughlin 2007). The BRIEF Inhibit and Working Memory scales have been helpful in identifying individuals with Attention Deficit Hyperactivity Disorder (ADHD) (Gioia et al. 2002). Consistent with recent models of ADHD, the Working Memory Scale has been helpful in detecting the Inattentive type of ADHD and the Inhibit scale has been helpful in identifying the Hyperactive/Impulsive and Combined types of ADHD (Gioia et al. 2002). For example, Barkley (1997) offered a model of executive function within the disorder of ADHD that views inhibition as the underlying factor that enables other functions including

working memory (verbal and non verbal), emotional regulation, and goal directed behavior in problem solving. His theory places these factors into separate components (Gioia et al., 2002).

Importantly, studies have supported the clinical utility of the BRIEF. McCandless and O'Laughlin (2007) found all parental rating correlations between the BRIEF scales and the Attention and Hyperactivity scales on the Behavior Assessment System for Children (BASC), a social emotional assessment tool widely used on children. Results indicated that parents, but not teachers, rated children diagnosed with ADHD-Combined type higher on the Behvioral Regulation Index than children with the Inattentive type or without a diagnosis of ADHD. Parent and teachers also rated children with ADHD higher on the Metacogntive Index than the non ADHD group. Consistent with previous research, the Working Memory scale distinguished the ADHD group from the non ADHD group. For the Inhibit subtype, parents rated the ADHD-Combined group significantly higher than the ADHD Inattentive and non-ADHD groups (McCandless & O'Laughlin, 2007).

Mahone et al. (2002) compared parent ratings on the BRIEF to other psychological measures for children with Tourette's syndrome, ADHD, and both Tourettes and ADHD and found that the Inhibit and Working Memory scales and Behavioral Regulation Index and Metacognitve Index scores were higher in the ADHD group and ADHD and Tourettes group as compared to the Tourettes group only and control group. Pratt (2000) examined parental ratings on the BRIEF of children with ADHD only, ADHD and reading disorder, reading disorder only, or no diagnosis found that children with ADHD had higher scores on all BRIEF scales when compared to their controls. Interestingly, the children with the combined type of ADHD had higher scores on the Inhibit, Emotional, and Self Control scales than children with the inattentive

type. There were also no differences found between the ADHD only and ADHD and reading group (Pratt, 2000).

Gender Differences on the BRIEF-A

Gender differences are found on self-report rating scales. However, it seems that no studies have examined gender differences on the BRIEF-A. This is an important area to investigate because it has been found in the literature that the inattentive type of ADHD may have neuropsychological correlates different from those of ADHD hyperactive and impulsive types (McCandless & O'Laughlin, 2007). Considering that females with ADHD are more likely to be diagnosed with the inattentive type of ADHD, gender differences in executive functioning may be detected. This study's hypothesis was there would be differences between males and females who completed the BRIEF-A.

CHAPTER THREE

Method

For this study archival data collected from Rochester Institute of Technology college students who self identified with Attention Deficit Hyperactivity Disorder (ADHD) was used. Specifically the participants' responses on the Brief Inventory of Executive Functioning- Adult Version (BRIEF-A) was analyzed to examined whether gender differences in the self-report of ADHD symptoms was present.

Participants

The sample used for this study included fifty two undergraduate college students who self reported to have ADHD. Of the fifty two participants, 75% (39) were male and 23% (12) were female. The ages of the participants ranged from 18-27 with the mean age being 21.

Instruments

The participants filled out the Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A), a 75-item standardized self-report measure of an individual's everyday executive functioning (Gioia et al., 2002). The 75 items involve statements about the individual's daily life requiring a forced-choice response of Never (N), Sometimes (S), or Always (A). Clinically significant scores are equal to or greater to a t-score of 65.

The BRIEF consists of eight empirically derived scales; Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitors which comprise the Behavioral Regulation Index (BRI) and the Metacognitive Index (MI) and the global executive composite (GEC). The Inhibit scale measures inhibitory control or the ability to stop one's behavior at the appropriate time. The Shift scale measures the ability to be flexible when moving from one situation, activity, or aspect of a problem to another when the

circumstances demand. The Emotional Control scale assesses an individual's ability to modulate, control, and regulate emotional responses. The Initiate scale measures how well an individual can begin or initiate a task, activity, or problem solve. The Working Memory scale measures how well an individual can hold information in the mind while completing a task. The Plan/Organize scale assesses how well a study can manage a work load and plan for future events. The Organization of Materials scale measures how well one can maintain his or her own environment in an orderly, proper way. The Monitor Scale measures how well an individual assesses his or her performance. The Behavioral Regulation Index (BRI) consists of the Inhibit, Shift, and Emotional Control scales. Whearas, the Metacognition Index (MI) compromises the Initiate, Working Memory, and Plan/Organize, Organization of Materials, and the Monitor Scales and assesses the ability to use working memory while initiating, planning, organizing, and sustaining future problem solving (Gioia et al., 2000).

Reliability of the BRIEF-A ranges from .73 to .90 and is considered moderate to high. Inter rater agreement between the self report and informant report version ranges from .44 to .68 and is considered moderate. Importantly, the BRIEF scales have been found to have clinical utility when identifying ADHD and ADHD subtypes. In addition, the instrument includes two validity scales that screen for excessively negative or inconsistent response styles (Donders, 2002).

Procedure

The following procedures were used to generate the archival data. The Institutional Review Board at the Rochester Institute of Technology approved the study in 2006. Advertising on campus such as posters, fliers, announcements, and e-mails was used to recruit participants. Involvement was voluntary and individuals were compensated with $10 for their participation.

First, participants were instructed to complete a consent form. Once consent was obtained, they were asked to complete the measures.

Data Analysis

Analysis of variance (One way ANOVA) were conducted to determine significant differences between males and females self ratings on the Behavioral Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite (GEC) of the BRIEF-A.

CHAPTER FOUR

Results

The research question concerned differences between genders on the Behavior Rating Inventory of Executive Functioning- Adult Version (BRIEF-A). Shown in Table 1 are the t-score means and standard deviations for the Behavioral Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite (GEC) by gender. Females with ADHD obtained higher but not statistically significant higher scores on the BRI, MI, and GEC. No significant mean differences between females and males with ADHD were observed for the Behavioral Regulation Index (BRI) F (1,49)=.096, p=.758, the Metacognition Index (MI) F (1,49)=.270, p=.605, and Global Executive Composite (GEC) F (1,49)=.986, p=.326.

CHAPTER FIVE

Discussion

General Overview of Study

The purpose of this study was to investigate gender differences in executive functioning between males and females with Attention Deficit Hyperactivity Disorder (ADHD). Experts argue that ADHD is underdiagnosed in females (National Institute of Mental Health, 2006). Unfortunately, most studies that have studied ADHD have not included females in their samples (Hinshaw, 2002).

Self reports are crucial to identifying ADHD in females who have been found to have more internalizing symptoms of ADHD (Quinn, 2005). Current models of executive function suggest that executive function is the core deficit of ADHD and that it may serve as a neurobehavioral domain the different groups of individuals with ADHD based on subtype and gender (Wodka et al. 2008).

The purpose of this was to better understand gender differences between males and females who self indentified as having ADHD on self reports of the BRIEF-A, a measure of executive function. The study compared the scores on the behavioral regulation index (BRI), metacognition index (MI), and global executive composite (GEC) between males and females.

Results of Hypotheses

The hypothesis that self report differences will be detected on the BRIEF-A between females and males with ADHD was not supported and results did not yield significant differences between males and females on the BRIEF-A. Females obtained higher but not statistically significant higher scores on the Behavioral Regulation Index (BRI), Metacognition Index (MI) and Global Executive Composite (GEC).

Results yielded in this study were similar to what was found in literature which indicates that the presentation of ADHD in females is more similar than different from the presentation of ADHD in males (Rucklidge, 2008). Results are consistent with findings that indicate that females are less likely to have a diagnosis of ADHD and that they display levels of ADHD that are as severe as or even more severe than their male counterparts (Biederman et al. 2005, Carlson, Tamm, & Gaub, 1999, Dalsgaard et al., 2005; Dupaul et al. 2006; Reimherr et al., 2008, Rucklidge & Tannock, 2001).

Implications of the Results

Although fewer females identified as having a diagnosis of ADHD, they were as impaired or more impaired on all major indexes of executive functioning when compared to their male counterparts. Female mean scores on all major indexes were higher but not statistically higher than male mean scores; this indicates that females with ADHD are at similar or higher rates of risk to have problems with executive functioning which is a core neurobehavioral domain of ADHD.

Research has shown that girls are more likely to be diagnosed with the predominantly inattentive type of ADHD. Due to the internalizing symptoms associated with this type, it is not easy to be identified or observed than the more overt symptoms that males have been found to display. Females in this study self-reported to have similar rates of executive functioning as their male counterparts. This implies that self-reports may be useful in identifying and better understanding ADHD in females, as are executive functioning self reports.

Limitations

The small sample size reduced the likelihood to detect gender differences. Due to gender inequality in prevalence, small sample sizes are not uncommon when examining females with

ADHD. Although females obtained higher scores than males on the BRI, MI, and GEC, these findings were not statistically significant. A larger sample size may have yielded statistically significant results. Another limitation of this study was it was based on sample that consisted of only undergraduate college students, with a mean age of 21. A follow-up study should include a larger sample that is more representative of the ADHD population.

Future Directions

This study reaffirms the need to research ADHD in females utilizing larger sample sizes. It is important that females be included in ADHD research studies and more studies examine gender differences in ADHD in all areas of functioning including executive functioning. Future research should consider exploring gender differences on self-reports measures in all areas of functioning and further examine gender differences on executive functioning.

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Table 1

BRIEF-A Scores and ANOVA Results as Function of Gender for Female and Male Participants with ADHD

Measure	Female ADHD Participants (n=12)		Male ADHD Participants (n=39)				
	Mean	SD	Mean	SD	df	F	p
BRI	61.83	8.601	60.92	8.975	1	.096	.758
MI	74.33	13.013	72.10	12.987	1	.270	.605
GEC	69.58	9.020	66.64	8.966	1	.986	.326

Note. BRI= Behavioral Regulation Index; MI=Metacognition Index; GEC= Global Executive Composite; SD= Standard Deviation.