

Running head: SUBCATEGORIES IN ADD

Are Subcategories in Attention Deficit Disorder

Explained by Gender Differences?

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Abstract

The current literature was reviewed to determine if inattentive and impulsive-hyperactive subtypes of Attention Deficit Disorder (ADD) could be explained by gender differences. Studies selected were limited to children and directly compared boys and girls on symptomology, comorbidity, biology, or social factors. Most studies supporting the existence of gender differences were criticized on statistical grounds. Finally, because male-female differences were discussed in general but not with respect to male-female differences in the subcategories, conclusions that subcategory sex ratios can be explained by male-female differences remain speculative.

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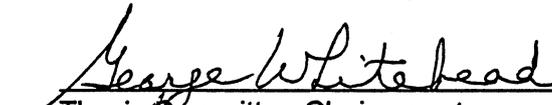
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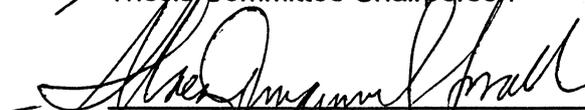
This is to certify that on September 1, 2000
(date)

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oral defense of her Thesis entitled Are Subcategories in Attention Deficit Disorder
Explained by Gender Differences

presented in partial fulfillment of the requirements for the Master of Arts degree in Psychology.


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Acknowledgements

Special thanks goes to members of this thesis committee: Dr. G. Whitehead, Dr. N. Stovall, and Dr. C. Chappell for their input and encouragement during the development and revision of this work. Additional thanks goes to family members, particularly my husband Mark for their support and encouragement, and my son Joshua for motivation.

Above all, thanks goes to God for the completion of this work.

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Are Gender Differences in Attention Deficit Disorder

Supported by the Current Literature?

Chapter One: Introduction

Attention Deficit Disorder (ADD) is a disorder first manifested in childhood with patterns of inattention and distractibility that can occur with behavioral hyperactivity. The DSM-IV (APA, 1994) categorizes ADD into four subtypes: inattentive (without hyperactivity), hyperactive/impulsive, combined (meeting the criteria for both inattentive and hyperactive subtypes) and NOS (not otherwise specified).

The ratio of children with ADD ranges from 3 to 5 percent (Wheeler & Carlson, 1994). Of those with ADD, it is estimated that between 49 to 56 percent are of the inattentive subtype, 16 to 22 percent are of the hyperactive/impulsive subtype, and 23 to 29 percent are a combined subtype (Wolraich, Hannah, Baumgaertel, & Feurer, 1998). Percentages regarding the NOS subtype of ADD were not given by Wolraich et al. The overall ratios of boys to girls range from 3:1 for the hyperactive/impulsive type to 2:1 for the inattentive type (Wolraich et al., 1998). From these and similar studies it is estimated that more males than females meet the criteria for ADD for both the impulsive and the inattentive subtypes. Although boys are diagnosed more frequently for both subtypes, it appeared to some clinicians that when girls were diagnosed they tended to be diagnosed as the inattentive subtype more frequently than as the hyperactive subtype, and boys tended to be diagnosed more frequently as the hyperactive/impulsive subtype. From these observations researchers theorized that the ratio favoring boys might be explained by gender

differences in the manifestation of ADD symptomology (Arcia & Connors, 1998; Brown, Madan-Swain, & Baldwin, 1991). Such researchers argue that both genders may have ADD, but many girls are overlooked in diagnosis and treatment because ADD symptomology may manifest differently in the two genders.

It was thought that behavioral differences that occur as a result of biological, diagnostic, and socialization variables (expected behavior of boys compared with expected behavior of girls in society) could explain why many ADD boys appear more hyperactive than their female counterparts, and why ADD girls tended not to exhibit the levels of hyperactivity that ADD boys seem to exhibit and why they appeared to be more inattentive. From the biological perspective, although the most common medication intervention given for ADD is methylphenidate (Ritalin), it was unknown if boys and girls responded similarly to methylphenidate intervention regardless of subcategory diagnosis. If responses differed between the genders, it is possible that there might be biological differences to explain behavioral differences in the manifestation of ADD. From the diagnostic perspective, it is also possible that diagnostic instrumentation may play a role in why boys are diagnosed more frequently than girls, especially if instruments commonly used are ADD subcategory biased.

From a socialization perspective boys tend to externalize their ADD symptomology into behaviors such as aggression, inattention, and hyperactivity, whereas girls internalize their ADD symptomology into withdrawal, anxiety, and depression (Brown et al., 1991). It is unclear whether this supposed internalizing versus externalizing of symptomology is a biological factor or

results from differences in socialization. According to Horn, Wagner, and Ialongo (1989) researchers may identify primary characteristics of ADD which include impulsivity, inattention, and overactivity, as well as secondary characteristics of ADD which include learning difficulties, externalizing versus internalizing symptomology, peer difficulties, and self-perception in addition to identifying ADD subcategories. Some researchers (Berry, Shaywitz & Shaywitz, 1985; Breen & Altepeter, 1990; McGee & Feehan, 1991) have speculated that the behavioral differences between genders in behavior tend to have an effect on teacher referral. Teachers tend to refer boys more often than girls because of the disruptiveness of the ADD boy in the classroom and girls tend to be referred less by their teachers for treatment (McGee & Feehan, 1991). If in fact girls tend to be overlooked in the classroom because of a lack of behavioral difficulties and may therefore be denied needed treatment, it has been suggested that the DSM-IV provide separate criteria and designate alternate cutoff scores on diagnostic instruments in an effort to ensure treatment for all ADD children (McGee & Feehan, 1991). In an effort to examine this further, the current literature includes the following topics in the study of gender differences: severity of symptoms among both sexes, symptoms that may occur with one sex and not the other, and other disorders and behaviors that may occur with ADD (comorbidity) that may occur in one sex and not the other.

If boys and girls demonstrate different behaviors while still suffering from ADD, the literature should show that there are equal numbers of both sexes affected with ADD. However, the subcategories should show more boys in the hyperactive and more girls in the inattentive type. If boys and girls do

demonstrate different behaviors, then the following differences should be manifested. First, if sex differences in the ADD subcategories are a function of biological differences, it is expected that the genders would differ in biological systems thought to play a role in ADD. Second, comorbidity issues would differ between the sexes, with girls tending to be diagnosed more frequently with depression and anxiety related disorders. Boys would tend to have secondary diagnoses of conduct disorder, delinquency, or anger management problems. Moreover, ADD symptoms will differ between the sexes, with girls having more difficulty with attention, forgetfulness, and avoidance of disliked activities and boys having more difficulty with fidgeting, hyperactivity, and impulsivity. Third, if sex differences in the ADD subcategories are a function of treatment differences, or response to medication intervention used for the treatment of ADD, it is expected that the genders would differ in the responses to medication intervention affecting those biological differences. Fourth, if gender differences are due to biases in diagnostic instrumentation, instruments used in studies reflecting these subcategory differences should be shown to be biased toward hyperactivity. Furthermore, studies with equal numbers of both genders in the ADD subcategories would utilize instrumentation focusing on inattention and impulsivity. The conclusions of this review will be framed within these four logical arguments. They are biological, comorbidity, treatment, and diagnostic differences.

Chapter Two: History of the Problem

Upon reviewing the literature, it seems that most studies that explored gender differences tended to compare ADD boys and girls on behavioral factors

(inattention, hyperactivity, excessive talking) usually based on parent, teacher, or researcher ratings. Assessments used included the Child Behavior Checklist (CBC) (Carlson, Tamm & Gaub, 1997), Revised Connors Teacher Rating Scale and Hyperactivity subscale (Horn, Wagner & Ialongo, 1989), and the Weschler Intelligence Scale for Children (Arcia & Connors, 1998). Additionally, factors such as depression, anxiety, isolation, academic and social functioning, and motor skills were sometimes but not always measured.

One argument for studying these differences in ADD children assumes that socialization differences for boys versus girls exists. It is believed that girls are socialized to internalize their behaviors, whereas boys are taught to externalize their behaviors (Brown, Madan-Swain, & Baldwin, 1991). This difference (internalizing versus externalizing) should indicate a difference in symptomology, with girls tending to show more depression and anxiety and boys appearing to be more hyperactive and tending to have conduct disorder.

Along with behavioral differences thought to be caused by differences in socialization, there may be biological differences between boys and girls attributed to differences in brain structure and hormonal levels. Glucose metabolic rates have been measured to compare ADD boys and girls, as well as ADD and normal girls. In addition, girls with ADD exhibited abnormal asymmetry in the parietal cortex (located in the temporoparietal region and has a role in orienting visual attention), indicating possible difficulties with visual attention. Boys were noted to have dysfunctions in the putamen (located in the subcortical region of the brain), which plays a role in regulating motor function

and may be a possible explanation for hyperactivity. This dysfunction was not found in girls (Ernst, Cohen, Liebenauer, Jons, & Zametkin, 1997).

Researchers theorize that by showing that gender differences do exist in the subcategories of ADD, steps could be taken to make ADD girls more easily identifiable to parents, teachers, and clinicians. In addition, this would facilitate girls receiving the correct diagnosis and treatment. These steps might include different criteria for each sex or criteria cutoff scores for tests. In addition, teachers and parents would be educated about the symptomology of ADD in both boys and girls, and how it manifests differently in the sexes.

In this review, studies were selected that focused on children and gender differences, choosing only those completed within the past ten years. Few studies specifying gender differences regarding ADD subcategories were discovered, drastically less than were anticipated considering the concern expressed regarding this subject in the literature. Additionally, Gaub and Carlson (1997) conducted a meta-analysis and critical review on gender differences in ADD. As a result, the relevant studies up to and including research from 1997 regarding gender differences are included in the meta-analysis. Some studies from the meta-analysis are included individually in this work due to their exclusive focus on girls or their analysis of boys versus girls.

Upon initial review of the literature, it appeared that there may in fact be some argument for limited gender differences regarding ADD subcategories, specifically between a non-referred population (those participants not referred for treatment but diagnosed as ADD from the community) and a clinic (referred to and currently under the treatment of a psychiatrist) sample of children.

Interestingly, the clinic population tended to have similar rates of aggression and hyperactivity regardless of sex, whereas the non-referred population tended to express some of the gender differences discussed earlier (comorbidity, internalization differences). Interestingly, there were only a few studies that supported gender differences in the ADD subcategories when clinical psychiatric populations and non-referred populations including children in school settings were considered (Gaub & Carlson, 1997).

Chapter Three: Critical Review of the Literature

The following chapter will be divided into two sections: literature supporting gender differences and literature supporting gender similarity.

Studies in Support of Gender Differences

Biological Differences

One of the stronger theories behind gender differences in ADD includes a focus on biology. There appear to be several studies examining brain differences between hyperactive and normal boys, but few studies focusing on these differences in girls. Surprisingly, one study focused exclusively on female participants rather than males only or male-female participant comparisons. Participants were selected from newspaper advertisements and ADD support groups. ADD diagnosis was made or confirmed by psychologists using the DSM-III-R. Ernst, Cohen, Liebenauer, Jons, and Zametkin (1997) used positron emission tomography (PET) to measure glucose metabolic levels in the brains of normal and ADD adolescent females. All participants were medication free for at least two weeks prior to the study. Participants were asked to perform an auditory continuous performance task for thirty minutes.

Results of this study indicated that metabolic rates were lower on the left side in the parietal and subcortical regions for ADD girls. Metabolic rates were higher in the limbic regions for ADD girls compared to normal girls. In addition, the authors commented that in studies by Ernst and Zametkin (1994) global metabolic rates were not different between ADD and normal boys. However, the current study indicates that global metabolic rates were fifteen percent lower in ADD girls than in normal girls, indicating slower brain metabolic rates in the brains of ADD girls. The researchers speculated that this may account for the inattentiveness in ADD girls. However, this statement could not be substantiated in the current study.

In addition to glucose metabolic rates, differences in brain structures were examined in addition to glucose metabolic rates. ADD girls were noted to have an asymmetrical parietal cortex, which has been thought partly to mediate ADD symptomology due to its role in visual-spatial attention. This asymmetry was not found in control girls, nor in ADD or control boys. It is possible that this difference in the parietal cortex may in fact contribute to the increased inattention and "daydreaming" seen frequently in ADD inattentive type girls. This may be an explanation as to why girls might fall into the inattentive subcategory more frequently than the hyperactive subcategory.

The researchers also measured differences in the subcortical region, which they stated had not been done in previous studies. Ernst et al. noted that the left and right caudate of the putamen was abnormally small in boys with ADD, but not in control boys, control girls, or ADD girls in a previous study. The current study indicated an asymmetry in the putamen of ADD girls, but not

the abnormally small size indicated in the putamens of ADD boys. The putamen is thought to play a role in simple motor function, "including adaptation of motor activity to internal and external contexts" which may indicate an increase in motor hyperactivity over those with normal putamen (Ernst et al., 1997).

Although the results of this study appear to indicate a biological explanation for gender differences as they occur in the brain, it is important to note that the authors believe this study to be the only one at the time of that writing that used brain imaging with girls with ADD. They also noted that because of this fact, much replication is needed to validate their results and that conclusions were tentative at best.

Comorbidity

In a review of the conclusions on sex differences in ADD, Arnold (1996) noted that females with ADD tended to have fewer symptoms of ADD (fewer attention problems, less hyperactivity) than did their male counterparts. It appeared that ADD females made fewer errors on the Continuous Performance Test (CPT), a test widely used to assess ADD that measures attention to task. ADD females also had slower reaction times on the CPT than their male counterparts. However, the consensus of the conference was that the data available at that time indicated that the same criterion should be used for both sexes, but that thresholds, or cutoff scores, on instruments such as the CPT should be sex-specific and account for any initial screening differences known to exist for the two genders.

Moreover, conference findings suggested that symptomology in girls was not as severe as boys and may have a later onset. Conference results argued that limited gender differences appear to surface in some of the literature with regard to behavioral and brain structure differences (Ernst & Zametkin, 1994; Connors, 1994). With regard to commonly used treatments for ADD such as Ritalin, gender differences did not appear to surface. No differential sex differences have been noted for drugs generally used in the treatment of ADD. Arnold stated that at the time of this conference there were no data to support any sex differences that may occur with psychosocial or pharmacological treatments because of the exclusion of female participants. Arnold indicated that more research was needed in this area to make any strong conclusions regarding psychosocial treatment issues in gender.

The results of the conference attempted to provide some answers as to the existence of gender differences. Problems with much of the research included a lack of female participants. Such an underrepresentation of girls could lead to a greater danger of true sex differences being missed, and false negatives in sex comparisons resulting.

A large, adequate sample size was one statistical improvement attempted by Carlson, Tamm, and Gaub (1997). This study assessed 2,984 children in a school population labeled as behavior disordered (DBDs). The authors state that the school population was chosen because the Gaub and Carlson (1997) meta-analysis (to be discussed later in this work) found a possible distinction between clinic and nonreferred populations in the literature.

In the Carlson et al. study boys and girls were diagnosed by teacher report as "pure" Oppositional Defiant Disorder (ODD), "pure" Attention Deficit Disorder combined type (participants who met the criteria for both the inattentive and hyperactive subcategories), co-occurring ADHD-C and ODD, or control (not meeting the above diagnostic categories). Participants were compared on the Achenbach Teacher's Report Form scales (Carlson, Tamm, & Gaub, 1997), symptom ratings, and social functioning. The authors stated that "More lenient diagnostic criteria...were necessary for the current report, to ensure an adequate number of girls for gender analysis." In order to create a large enough sample size, researchers stated that only ADHD-C girls were sampled in the analysis of the data due to the low numbers of girls identified as inattentive or hyperactive subtype.

The authors used a two (gender) by four (diagnostic group) analysis of variance to interpret the results. Main effects of gender were found, with girls being rated as having more appropriate behavior, less attention problems, more peer dislike, lower aggression, and lower externalizing scores than their male peers. Aggression was rated higher in boys than in girls, and boys appeared to have more severe symptomology. The authors also noted that girls appeared to have significantly more severe social impairment scores than did their male counterparts despite their showing less impairment with symptomology. It is possible that this finding was due to socialization factors, and that because girls tend to have higher rates of internalized symptomology (depression, anxiety, withdraw) that girls may appear to be more socially impaired than boys. Additionally, social functioning was measured using three questions in a Likert

scale format and rated by teachers. This does not seem to be an adequate measurement of social functioning, and a true measurement of the participants' social functioning would be better substantiated by more thorough means.

Even though this study used a large sample size attempting to ensure adequate female participation, there are a few questions that need to be asked when looking at the structure of the study. The large number of participants would lead one to believe that adequate power existed to interpret the results, but it is possible that the large number of participants sampled could have made small differences statistically significant.

Additionally, the authors state that the diagnostic criteria were relaxed in order to ensure adequate female participation (see above explanation of the researchers' relaxation of criteria). One needs to question why this would be necessary considering the large size of the participant group, not to mention that the participants were selected from a school, not a clinic (clinic populations tend to have the small number of female referrals), whereas the school population should have enough females to ensure a similar gender ratio. By relaxing the diagnostic criteria, it is questionable whether or not many of the ADD diagnoses may have been clinically invalid, calling into question the results of the study.

Also of note is the fact that only the combined subtype of ADD (participants meeting the diagnostic criteria for both the inattentive and hyperactive subcategories) was examined, excluding those who were solely ADD-inattentive and ADD-hyperactive subtype. The authors did not state that conclusions made in this paper may only pertain to the ADD-combined subtype.

Interestingly, whereas many studies included predominantly white children, this study had an overwhelming majority of Hispanic participants. Because the Hispanic community has stricter behavioral expectations of females than do other cultures, it would be interesting to note teacher ethnicity in the ratings of the children's behavior to determine if teacher ethnicity affected how severely the teachers rated participant symptomology. In addition, it may be noteworthy to compare the ratings given to the Hispanic children with a Caucasian or African-American child with similar behaviors. This might offer insight into possible rater biases resulting from ethnic background. Due to the largely Hispanic population used in the study, the generalizability of the results to the overall population needs to be carefully evaluated.

Admitting that there was scarce evidence at the time of their writing, McGee and Feehan (1991) argued that girls are underrecognized because of the current diagnostic norms and that a "more appropriate method for identifying such (attentional and behavioral) problems in girls" should be adopted. The authors suggested comparing ADD girls against normal girls in order to determine what may be "behavioral problems" for girls rather than a comparison against ADD or normal boys.

McGee and Feehan used the DSM-III-R for diagnostic criteria at the time of their review. Researchers conducted a review of the existing literature to determine if girls with attentional problems were underrecognized. McGee and Feehan examined "Sex Differences in Prevalence," "Sex Differences in Pattern of Correlates," and "Sex Differences and Normative Behavior" for both genders. When looking at the different prevalence rates among sexes, it was

discovered that teachers tended to refer boys more frequently for assessment for ADD because of their hyperactivity and disruptive behaviors in the classroom rather than attentional difficulties. They suggested that controlling for hyperactive and antisocial behaviors would more accurately reflect a teacher's rating of inattentiveness. This would lead to teachers being focused on inattentive behavior rather than hyperactivity as an indicator of ADD. This in turn would lead to an increased number of girls exhibiting ADD inattentive type being referred for treatment.

McGee and Feehan also noted a lack of research focusing on girls with ADD. They stated that either boys were used exclusively, or in studies where girls are used, only a small number of females are included in the participant pool. The researchers noted that Fuhrman and Kendall (1986) found "no hyperactivity x sex interactions". Although they felt that if an adequate number of female participants were used that gender differences would emerge, the researchers concluded that the evidence they examined showed that boys and girls appeared to be similar in their manifestations of ADD. In addition, the researchers noted that the treatments studied, in particular medication therapy, were identical for both genders.

The authors also stated that the cutoff scores widely used by practitioners to identify hyperactivity were inappropriately pooled with both sexes included. They argued that if one were to combine reading and I.Q. scores for boys and girls, then more boys would be identified as reading disabled, rather than having these criteria gender specific. Hence, the pooled criteria for cutoffs for hyperactivity may lead to fewer girls being identified as ADD due to the focus

on hyperactivity and pooled cutoff scores for hyperactivity being utilized for both genders.

McGee and Feehan argue that to provide accurate hyperactivity scores in order to correctly diagnose ADD, the cutoff scores need to be gender specific. However, if sex-specific cutoff scores were used, it may also cause girls to be identified as ADD who would show too few symptoms to meet the criteria for ADD or would better fall into another diagnosis, leading to a misdiagnosis of ADD in females. More emphasis would need to be placed on inattentiveness and impulsiveness, with less focus on the hyperactive symptomology. Additionally, the existence of such a problem should be verified in future research before such steps are undertaken for gender specific cutoff scores.

Another study included in the Gaub and Carlson meta-analysis, Horn, Wagner, and Ialongo (1989) measured clinic-referred ADHD boys and girls on fifty-four factors. The factors included both primary (impulsivity, inattention, and hyperactivity) characteristics and secondary (learning disorders, externalizing and internalizing behaviors, self and social perceptions). Diagnosis of ADHD was made by a psychologist utilizing the DSM-III-R, clinical interviews, and the Connors Parent and Teacher Rating Scales. On thirty nine of these measures, boys and girls with ADHD demonstrated similar patterns of functioning deficits (impulsivity, inattention, self report variables, peer problems, conduct problems). The overall results of this study failed to show significant gender differences. Although not statistically significant, boys overall were rated by their teachers as being more hyperactive, had less self-control, and had higher I.Q. scores than ADHD girls. Although this study is

included in the meta-analysis that seems to show gender differences, it will be elaborated on in the next section as it appears to support gender similarities. Other studies from the meta-analysis were not included due to their focus on boys exclusively.

Further regarding gender specific cutoff scores, McGee and Feehan (1991) is cited stating "inattentive (ADD inattentive type) boys and girls showed the same degree of disadvantage." This review argued for "the use of separate cutoff' scores for boys and girls," because of the studies cited indicating that teachers rated more boys than girls as ADD but did not indicate separate cutoff scores for the different subtypes of ADD (Achenbach, Bird & Canino, 1990; de Haas, 1986; Rutter, Tizard, & Whitmore, 1970; Schachar, Sandberg, & Rutter, 1986; Silva, McGee, & Williams, 1985). The authors stated that a study by Halperin, Newcorn, and Sharma (1990) indicated that some children rated by their teachers as ADD more accurately met the criteria for Conduct Disorder (CD), and showed few problems with inattention when tested with the Continuous Performance Test (CPT). This finding argues that teachers place more emphasis on disruptive behavior in the classroom when making referrals over inattentive symptoms. In addition to this research indicating a bias toward referring boys over girls by teachers, the authors argued that hyperactive children behave similarly and inattentive children behave similarly regardless of sex. This may indicate that if girls in fact are more prone to be ADD inattentive type, their inattention would be overlooked in the classroom as it is not seen by most teachers as a behavior problem. Boys falling into the ADD hyperactive type would be referred more often due to their disruptive behaviors.

The researchers argue that an ADD diagnosis in girls should be made by comparison with non-ADD females.

In an effort to examine all the existing literature regarding gender differences in ADD, Gaub and Carlson (1997) conducted a meta-analysis (a method where the results from different studies regarding a specific topic are gathered quantitatively and compared in order to gain insight into or reach a conclusion about that topic) on 18 studies. Areas studied included primary symptomology, intellectual and academic functioning, comorbid behavior problems, social behavior, and family variables. Studies were chosen on the following criteria: data directly comparing males and females; at least 10 subjects aged 13 or younger; I.Q. of the participant was at least 80 or greater, and studies had to document that the ADHD diagnosis was made using DSM-II, DSM-III, or DSM-III-R criteria. All dependent variables were coded for each diagnostic group, and an assistant coded a subset of randomly selected variables. The researchers stated that the coded data represented approximately forty-seven percent of the total data. The dependent variables included symptomology, intelligence, academic and social functioning, externalizing and internalizing difficulties, motor skill, and family variables. Researchers used the Q statistic to test for heterogeneity within the mean pooled effect sizes.

Gender differences did not emerge for parental depression, parent level of education, social/peer functioning, impulsivity, or academic performance. Little variability was indicated for Verbal I.Q., Full Scale I.Q., Performance I.Q. (which I.Q. tests were utilized was not indicated), hyperactivity, externalizing behaviors, or conduct disorders.

However, some significant gender differences did emerge in that boys who were referred as ADD tended to show higher rates of conduct disorder and externalizing behaviors than did girls. The researchers suggested that the higher rates of externalizing behaviors in boys may get them referred more often than their female counterparts, particularly by teachers. In addition, girls displayed lower levels in inattention, less aggression, and a trend towards lower socioeconomic status.

There appeared to be moderate effects for referral source as well. For "nonreferred" children, girls showed lower rates of inattention, less internalizing behavior, less peer aggression, and lower peer dislike than boys. This appears to be inconsistent with other studies, which found these factors to be higher in girls (e.g., Arcia & Connors, 1998). It is possible that these differences may stem from variations that may exist between the non-referred and the clinic populations. Regardless of gender, hyperactive and aggressive children are referred to clinics, indicating that such populations may be biased towards common traits not found in a non-referred population. In the "clinic-referred" populations, girls with ADD showed greater levels of inattention that more closely matched the clinic referred ADD male population. ADD clinic-referred girls scored similarly on other measures (hyperactivity, internalizing behaviors) in comparison to their male counterparts.

Gender differences also emerged when comparing parental and teacher referrals. For inattention and hyperactivity measures, teachers were more likely to rate boys with ADD higher on these measures than girls with ADD. However, parents tended to rate girls with ADD as more greatly impaired than

boys with ADD. Gaub and Carlson stated that this may be due to parents having a better understanding of their child's impairment due to the increased number of hours and settings in which parents spend interacting with their children compared to the teachers.

There were mixed results from this meta-analysis, and Gaub and Carlson stated that there were a few problems with their analysis. Problems could have arisen from the fact that there were a small number of studies in existence with which to conduct a meta-analysis. They stated that the "existing literature allowed for only a tentative evaluation" of the effects of gender differences which, in their opinion, may be attributable to referral bias. Gaub and Carlson further indicated that of the studies that existed relevant to their research, there were methodological constraints including referral bias (teachers ratings and parental ratings differing significantly), comorbidity issues (participants who may fall into more than one diagnostic category), possible developmental differences (age and maturational differences), rater effects, and diagnostic classification issues (DSM-III versus DSM-III-R versus DSM-IV). Few studies existed for an examination of the effects of these variables.

Additionally, not enough information existed in the research available to examine comorbidity, ADD subtype, and age of the participants and their effects on the results. Although there appeared to be a tentative argument for these differences existing between the "non-referred" ADD population (indicating differences in gender) and the "clinic" population (little or no gender differences) the authors stated that the meta-analysis only provided a foundation

for future research, and could provide no definite conclusions regarding gender differences.

This meta-analysis of the literature left many of the researchers' critical questions unanswered regarding gender differences regarding the ADD subcategories that might exist. The researchers noted that the findings of the meta-analysis should be looked at as areas of further research, and not as concrete arguments for or against gender differences due to the limited number of studies that included girls, as well as their opinion that ADD in females has not been adequately explored.

Interestingly, the review indicated that gender differences may exist between non-referred and clinical ADD populations, such that non-referred populations showed less aggression and lower rates of Conduct Disorder than clinical populations, particularly in girls with ADD. Unfortunately, on the basis of this meta-analysis alone one cannot determine if gender differences that account for the ADD subcategories do in fact exist for ADD children regardless of referral status. The presence of many confounding variables, including rater bias, diagnostic issues, and comorbidity issues, restrict conclusions regarding gender differences that appeared to emerge.

Treatment

No research was found in this area that supported gender differences.

Instrumentation

Two studies used instrumentation that showed possible problems. Carlson et al. used DSM-IV criteria, Achenbach Teacher's Report Form, and the SNAP-IV, an unpublished diagnostic checklist for ADD and ODD

developed by Swanson and Carlson (Carlson et al., 1997). Participants who were diagnosed as ADD were divided into the hyperactive, inattentive, or combined subcategories. However, diagnoses were made only in one setting (school) and by one rater (the participant's teacher). No instruments such as the Continuous Performance Test (CPT) or the Brown Diagnostic Scales were used, and ADD diagnosis was made using only the teacher's reports.

In contrast, an earlier study by McGee and Feehan (1991) used the CPT to verify ADD diagnosis in their teacher referred participants. Upon diagnosis with the CPT, some boys who were identified as ADD by their teachers in fact were diagnosed as Conduct Disordered. It was speculated by the researchers that this change in diagnosis was due to using an instrument that focuses on the inattentive and distractability factors of ADD rather than the hyperactivity factor of ADD. The use of instrumentation that focuses on the inattentive and distractability factors to confirm diagnosis may lead to higher rates of participants in research who are ADD inattentive type. In addition, it would lead to those who are more accurately diagnosed as Conduct Disorder to be excluded from ADD research.

Statistical

There are a few statistical issues that should be stated for the literature supporting gender differences in ADD. First, the one study that focused on biological differences (Ernst et al., 1997) is unique, and there has been no replication of it found in the current literature. Second, Arnold (1996) gave no statistics that support the findings of the conclusions of the ADD conference. Third, Carlson et al. (1997) used only ADD-combined type girls as participants.

In addition, the researchers relaxed the ADD criterion for the female participants which may have led to girls being diagnosed as ADD when in fact they were not. A large number of participants were also used for this 1997 study, which may have caused gender differences because of statistical artifacts. Fourth, the Gaub and Carlson (1997) meta-analysis only had a small number of studies available for research. Gaub and Carlson admit to statistical difficulties in the areas of comorbidity issues, rater effects, diagnostic classification issues, developmental differences, referral bias. Hence, the meta-analysis can only be used to provide a foundation for further research.

Summary

It appears upon looking at the results of the above studies that some support does exist for gender differences in the areas of teacher referral bias, severity of symptoms, and comorbidity, and that these differences are largely limited to the non-referred ADD population. In contrast, few if any gender differences seem to appear in the clinic population. Although these results seem valid and perhaps desirable to those looking for gender differences in ADD, many of these studies have structural problems that lend doubt as to how accurate the results are.

First, there is a severe lack of replication of any of these studies. In particular, these studies include those that indicate gender differences for either the non-referred or clinical populations or in brain structure or functioning. Second, the ratio of females to males included in the study may not be large enough to lend accurate results. This could be due to the majority of studies relying on teacher ratings or upon instrumentation that is biased towards ADD

hyperactive type. Third, at least one study (Carlson et al., 1997) relaxed the diagnostic criteria for ADD, calling into question the results of that study. Fourth, the claims by researchers regarding gender differences are being made on a limited number of studies. Lastly, it is unknown if all participants were medication free at the time of their inclusion in the research. If participants were not medication free, the ADD symptomology may not be present in ADD participants. This could call into question the conclusions of these studies.

The meta-analysis that indicated some differences in the non-referred population has few studies included, and fewer studies still that compared sufficient numbers of boys and girls. The Gaub and Carlson meta-analysis also indicated that few studies were available to include in the study, and those that were available had a number of confounding variables that limited the results of the meta-analysis to areas to be examined for further research.

In addition, the researchers overall did not address the question as to if differences that appeared to emerge in the studies could be due to normal variances in gender that would exist in the presence or absence of ADD. It is also possible that these results that indicate gender differences could be influenced by the large number of dependent measures studied, as larger numbers of variables tend to produce results where none may in fact exist. Unfortunately, no studies were found to address the treatment concerns area of ADD, in particular the use of methylphenidate or other medications used to treat ADD. At this time, the empirical research does not support a statement verifying that gender differences occur within the ADD subcategories due to the many methodological problems encountered in the studies available. More

importantly, there are no studies that compare gender differences within the subcategories.

Studies in Support of Gender Similarities

Biological

No research was found to be included in this section at this present time.

Symptomology

In a recent study Arcia and Connors (1990) investigated the difference between referred and non-referred clients. The participants of this study were selected from a private, university-based clinic as well as schools, physicians, and self-referral. Participants had to meet the criteria for ADD as well as obtain a *t* score of 65 or greater on the Hyperactivity Index of the Connors Rating Scales. For the juvenile participants in this study, parent and teachers completed the Connors Rating Scales (Arcia & Connors, 1998). Two subscales of the Connors Rating Scales, the Conduct Disorder Scale and the Hyperactivity Index, were used in their analysis of the data.

Children were then administered achievement tests, the Rey-Osterrieth Complex Figure Task (Arcia & Connors, 1998) which assesses planning, organizational, and the ability to organize complex tasks; the Connors Continuous Performance Test, which measures response speed and impulsivity (Arcia & Connors, 1998); and/or the Weschler Intelligence Scale for Children-Revised (Arcia & Connors, 1998). Analyses of Variance (ANOVAs) were conducted on the I.Q. and neuropsychological testing including the measures on impulsivity, teachers and parents ratings, self ratings, and verbal spacial abstraction and memory scores.

Results of the ANOVAs failed to discriminate between boys and girls on any of these measures. Moreover, demographic characteristics of the sample studied included primarily highly educated, white collar workers and participants with ADD-hyperactive subtype. The researchers speculated that this population, which was professional with high socioeconomic status (SES) may be more "sensitive to the psychosocial needs of their children, regardless of gender" (Arcia & Connors, 1998). Additionally, not only were participants from a higher SES and ADD hyperactive type (excluding the inattentive subtype) but they were from a clinical sample. By using patients of a clinic and a small sample size, the researchers should be wary that the results from this study may not be generalizable to all ADD populations.

Breen and Altepeter (1990) noted that at the time of their research few studies suggested gender differences in ADD, but that the previous research had focused on specific behaviors and their prevalence. Children were referred by three pediatric psychological clinics. The participants were diagnosed as ADHD by Ph.D. level licensed psychologists using the DSM-III-R, history of the child, the Child Behavior Checklist (CBC), Inattentive and Nervous-Overactive factors and the Revised Connors Teacher Ratings Scale's Hyperactivity factor. Parents of the children filled out the Home Situations Questionnaire (HSQ) and teachers of the children filled out the School Situations Questionnaire (SSQ) (Altepeter & Breen, 1989; Barkley & Edelbrock, 1987).

A one way ANOVA did indicate significant gender differences between boys and girls for three of the twelve SSQ items which included: free time play

in class ($F=2.99$), on the bus ($F=2.73$), and the Mean Severity summary score ($F=3.20$). No gender differences were obtained in the parental reports of behavioral problems including non-family interactions, custodial interactions, isolate play, and task-performance transactions. Breen and Altepeter suggested that limited gender differences in social situations may exist particularly in those children where the "externally imposed structure is often ambiguous" (inconsistent rules or freetime for example). This indicates that in this study ADD boys tended to exhibit more behavior problems in non-structured or loosely-structured situations than ADD girls. Although the researchers did not indicate why this difference may have occurred, it is possible that this could be due to the particular population studied or to socialization differences.

In all other situations parents reported similar levels of ADD related behaviors in boys and girls. Again, the participants of this study were from three different psychiatric clinics, diagnoses were ADHD (DSM-III-R), children were white, and researchers used primarily assessment instruments that focused only on hyperactivity as a primary diagnostic issue. Clearly, using assessments that target ADHD with these constraints and not ADD criteria will result in more ADHD diagnosis being made solely using the hyperactivity factors.

In addition to assessment instrument bias, the way a study is conducted may produce gender differences where none exist (Cohen, Cohen & Brook, 1994). Ten random samples with replacement were generated for fifty boys and fifty girls. The total sample number of children was seven hundred and fifty. These samples were analyzed on six measures of psychopathological symptoms, as well as ten measures of parenting.

Cohen, Cohen, and Brook argued that the emergence of gender differences in their study may have resulted from the large number of variables included in the study. The researchers concluded that it is more likely to get sex differences, or any other effect examined, purely by chance if enough variables are included as they attained more sex differences the more variables they included in this present study. Many variables tend to be examined in some experiments, and may in fact lead to the gender differences discussed by many researchers (Arcia & Connors, 1999; Carlson, Tamm, & Gaub, 1997; Ernst, Cohen, Liebenauer, Jons, & Zametkin, 1997; Gaub & Carlson, 1997).

Not only do gender differences emerge more readily when many variables are simultaneously examined, but gender differences also appear to emerge more easily when a smaller sample size rather than a larger sample size was used. When the Cohen et al., experiment was conducted with a larger sample size, gender differences failed to emerge. This may be due to the fact that as the number of participants increase, the power of the study tends to increase, lending greater probability to achieving accurate results. Specific numbers of participants in the "smaller" compared to the "larger" experimental conditions were not given. The researchers argued that gender differences are likely to be overestimated to a large degree, especially those based on relatively small samples. Because clinic referred females are less numerous than their male counterparts, small gender differences that might occur between the groups become stronger. In addition, Cohen et al. indicate that sex differences in published reports "are likely to be grossly overestimated" (1997). It would be

interesting to replicate these experiments with a larger number of females and determine which, if any, gender differences emerge.

It appears upon examining the available literature that many studies use clinical populations (for example, residential treatment center or psychiatric patients) exclusively. In contrast, Berry, Shaywitz, and Shaywitz (1984) attempted to identify if girls with ADD were underrecognized. Participants were obtained from both a school population and a University clinic, possibly due to the large number of studies that include clinic populations only. A control group was selected from a separate school. Participants were categorized as ADD with or without hyperactivity. The researchers did not separate the ADD school participants and the ADD clinic-referred participants for evaluation, and did not indicate why they did not do this. Each child received a comprehensive evaluation, neurological and neuromaturational exams, and was evaluated by both parents and teachers. Most of the participants were from upper and middle class families.

The results indicated that girls with hyperactivity were referred earlier than their male and female peers for treatment. Conversely, girls without hyperactivity tended to be older than their peers at the age of referral. However, it seemed that both girls and boys with ADD with hyperactivity exhibited similar characteristics, as did girls and boys without ADD. It appeared that children with ADD with hyperactivity tended to be more likely to exhibit cognitive dysfunction (learning disabilities, dyslexia, language delays) more often than their non-hyperactive peers. Girls in general were more prone

to social difficulties with their peers, which is consistent with other findings regarding higher peer dislike among ADD girls.

Although this study appeared to indicate a support for gender differences, gender differences were not statistically significant. The researchers noted only slight differences between the hyperactive-impulsive and inattentive subtypes, and these were not divided by gender. In addition, many assessments were used in analyzing the data. The researchers argued that by using too many assessments in the analysis, they may have contributed to or caused any gender differences that appeared to emerge by chance when using a large number of dependent measures in the results when no significant differences existed.

This study is unique in that the researchers specifically included a school based population in order to "establish a true prevalence of attention deficits among girls in the general population" (Berry, Shaywitz, & Shaywitz, 1985). According to the results of this study, there were similar prevalence rates among both boys and girls (approximately a 3:1 ratio of males to females for both hyperactive and inattentive subtypes). However, this study used many variables and there was a disproportion of males to females overall (102 boys and 32 girls).

Although most studies focused on current DSM symptomology when examining ADD, Horn, Wagner, and Jalongo (1989) attempted to investigate gender differences in what has been termed the primary and secondary characteristics of ADD symptomology. The Connors Parent and Teachers Rating Scales as well as structured interviews carried out by doctoral level

candidates were used to make the ADD diagnosis in participants. There were fifty-four participants who were selected from patients who were referred from a university based clinic. Age of the participants was between seven and eleven years. The initial assessments of the children upon admission to the clinic provided the data used in the study and included evaluation with DSM-III-R criteria, and the Connors Parent and Teacher Questionnaires.

Upon examination of the data, no clinically significant differences were found for gender either within the sample or for main effects for either the primary (impulsivity, inattention, and overactivity) or secondary (learning problems, externalizing versus internalizing symptoms, peer difficulties, and self-perception) characteristics of ADD. They also noted that to be included in this study, pervasive ADD across situations had to be demonstrated for each participant. It was their observation that other studies they had examined while preparing for this research did not make that requirement of participants, as participants in other studies were not required to demonstrate "cross-situational" ADD. This means that participants in other studies would have to exhibit ADD symptomology in a single setting. The researchers indicated that only a small percentage of those who exhibit ADD symptomolgy in a single setting also exhibit symptoms across other settings, and hence may not truly be ADD.

Statistically, the researchers indicated that this study may have been flawed because a MANOVA (multivariate analysis) was used to analyze the data, increasing the probability of a Type II error. In addition to possible statistical flaws, the researchers also noted that the results may not be generalized to all ADD persons due to the focus on pervasive ADD (ADD

symptomology demonstrated across most or all situations) and hyperactivity, as well as the use of assessment instruments that focused on hyperactivity (Impara & Plake, 1998). Horn et al. stated that for the results of this study to be generalized, larger numbers of participants need to be used.

Treatment

Generally, most studies focused on the behavioral manifestations of ADD, but one study was found that compared the effects of methylphenidate (Ritalin) on boys and girls. Pelham, Walker, Sturges, and Hoza (1989) matched 12 boys and 12 girls for I.Q. and age. Participants were referred for treatment to the summer treatment program for children due to behavioral and/or learning problems. A single dosage (.3 mg/kg of body weight) was used for all participants. The participants were either given the drug dosage or a placebo randomly at various times of the day. After receiving either methylphenidate or a placebo, the participants' behavior was measured and the number of time outs, compliance with rules, conduct disordered behaviors, verbal abuse/cursing, positive peer interactions, and non-compliance were recorded. Negative behaviors decreased for both boys and girls in the methylphenidate group, but there was not a significant difference for those in the placebo group.

As of the date of this study, no research had examined whether or not boys and girls with ADD responded similarly to either behavior modification or medication. The researchers state that this study was to examine if boys and girls with ADD respond similarly to methylphenidate treatment. If both genders respond similarly to the same drug intervention for ADD, this might indicate

that ADD may have the same biological basis for both genders. If gender differences occur with methylphenidate administration, this may indicate that methylphenidate affects ADD symptomology differently in boys and girls.

The results indicated that participants responded similarly to the drug intervention regardless of sex. Both boys and girls demonstrated significant positive reactions to the drug, with a decrease in negative behaviors and an increase in positive behaviors. This indicates that methylphenidate works the same way in both genders.

Although this study appears to indicate that boys and girls with ADD respond similarly to methylphenidate treatment, it should be noted that this is only one study indicating that similar responses occur across genders. Again, as with other studies, the participants were considered to be severely affected and may not be representative of the ADD population as a whole. Additionally, of the 24 chosen participants, eight boys and seven girls were medication responders and thus, only their data was included in the analysis of the data. Lack of medication response may have been due to either these children not being sensitive to methylphenidate, needing a larger dosage in order to respond, or misdiagnosis. In order for the results to be more generalizable, a larger sample size should be used as well as include participants with less severe symptomology. Of note, the socioeconomic status (SES) of the participants was not discussed. Future research should attempt to generate a participant pool that would reflect the population parameters for SES and race when testing, as well as study non-referred populations with a larger participant size.

Diagnostic Instrumentation

In studies utilizing diagnostic instrumentation to select participants, it is important to note that some instruments focus primarily on hyperactivity rather than on the inattentive and impulsivity characteristics of ADD. Examples include the Connors Rating Scales and the Connors Teachers Rating Scales, as only the Hyperactivity Factor was used in the data collection (Impara & Plake, 1998; Murphy, Conoly & Impara, 1994). Such instruments clearly bias diagnosis in the direction of ADD with hyperactivity.

Of note, the Child Behavior Checklist looks at overall behavior, and was normed on responses of Caucasian mothers. The CBC's main focus is not on ADD specifically, however. Additionally, it was discovered that 17.7% of those children identified as "normal" by the CBC were in fact from a clinic population (Impara & Plake, 1998). Horn et al. (1989) admitted to using instrumentation that focused primarily on hyperactivity. Arcia and Connors (1998) used a combination of the Hyperactivity Index of the Connors Rating Scales and the Connors Continuous Performance Task (CCPT) which measures inattention, response speed, and impulsivity and has less of an emphasis on the hyperactivity factor of ADD. In future research, it may be of interest to use diagnostic instruments that do not focus exclusively or primarily on hyperactivity. Additionally, tests designed to diagnose ADD specifically should be utilized to ensure appropriate diagnosis. Examples of such instruments may include the Gordon Diagnostic System, the Connors Continuous Performance Test, and the Brown Rating Scales for ADD (Impara & Plake, 1998). These instruments focus on inattentiveness and distractability with less of a focus on hyperactivity. For example, data regarding the Brown Rating Scales for ADD

indicate high levels of internal consistency, and item correlations to the overall score ranged from .50 to .80, falling into the moderate to high range of reliability. Additionally, test-retest reliability was .87 when the test was administered for the second time two weeks after the initial testing.

Unfortunately, evidence for validity of the Brown Rating Scales was limited and unexplored (Muniz, 1996).

Statistical

When examining the literature supporting gender similarities, some statistical problems become apparent. First, some studies did focus primarily on hyperactive, not inattentive, participants (Breen & Altepeter, 1990; Horn et al., 1989). In most studies, middle or upper class Caucasian males were the primary participants. Pelham, Walker, Sturges, and Hoza (1989) had a small number of participants in the study, and fewer still that responded to methylphenidate intervention. In addition to what Horn et al. (1989) felt was too few subjects to be generalizable, they also analyzed the results with a MANOVA which may have, in their summation, increased the probability of a Type II error.

Summary

Upon the examination of the current literature, it can be seen that the evidence argues against gender differences in ADD subtypes. Interestingly, there were no biological studies to support gender similarities. Regarding treatment issues, girls and boys appear to respond similarly to methylphenidate treatment, indicating homogeneous response to methylphenidate regardless of

ADD subtype. Additionally, it is unclear if all participants were medication free at the time of their inclusion in the studies.

Overall, gender differences failed to emerge. The few gender differences discovered were not statistically significant and focused mainly on the secondary (learning problems, externalizing versus internalizing symptoms, peer difficulties, self perception), not the primary (impulsivity, inattention, overactivity), characteristics of ADD. As of this date, these secondary characteristics of ADD are not included in the DSM-IV criteria for diagnosing ADD. Regarding the Berry et al. (1984) study that examined ADD hyperactive type and inattentive type for both school and clinical populations, no significant gender differences emerged. Although replication of this study is needed, this may indicate that no gender differences for ADD exist regardless if the participant is from a school or clinical population.

Another problem encountered with the literature examined includes the large number of dependent measures in these studies. If studies tend to use many dependent variables, this can result in a false rejection of a true null hypothesis due to differences occurring by chance. This would indicate gender differences that may not truly exist. However, this did not appear to be an overwhelming problem in most studies reviewed, considering that few gender differences surfaced. As in the section supporting gender differences, there are few studies and a severe lack of replication of studies that indicate support for or against gender differences. In addition, as with the methylphenidate study, some studies also have a small number of participants which may lead to differences being found between the sexes that may not truly exist. This could

explain some gender differences that appeared but were not statistically significant. Most importantly, no gender comparisons within ADD subcategories were even considered in any study.

Chapter Four: Discussion and Conclusion

Only a small number of studies existed before the 1997 meta-analysis conducted by Gaub and Carlson that examine gender comparisons or with a large enough sample of females to be included in this review. Further, only a handful at best after this date specifically look at gender differences. Hence, there are only a few studies that deal specifically with gender comparison and none that examined gender differences between subgroups. The purpose of this review was to examine literature regarding gender differences within the ADD subtypes, however, literature at the time of this writing on the topic does not currently exist. Hence, conclusions regarding gender differences within the ADD subtypes could be considered as areas for further research only at this time. No conclusion for or against gender differences within the subtypes can be made at this time due to a lack of empirical evidence in the current research.

Although the literature did not specifically examine gender differences within the ADD subcategories, the literature did attempt to examine gender differences in general in ADD. Differences that appeared to emerge between the genders were not statistically significant and may be explained by too few participants. Additionally, these differences were limited to the secondary characteristics (such as peer relationships, externalizing and internalizing behaviors, and self-esteem) of ADD, but do not seem to include the primary characteristics (impulsivity, inattention, and hyperactivity). The primary characteristics of ADD appear similar between the genders for both the hyperactive and inattentive subtypes. Studies that indicated gender differences in ADD in general had many methodological problems. Hence, these studies

that supported gender differences in ADD did not appear to be methodologically sound enough to make a conclusion that true gender differences emerged.

Additionally, only two of the studies examined (Arcia & Connors, 1998; Ernst et al., 1997) indicated that participants were medication free before inclusion in the research. At least four studies (Breen & Altepeter, 1990; Berry et al., 1985; Horn et al., 1989; Carlson, et al., 1997) diagnosed participants as ADD or non-ADD during the research. Participants may or may not have had an ADD diagnosis prior to the studies. Also, participant use of medication was not noted in these studies. If medication was being used at the time of research by the participants, it could call into question the results of the study as medication may diminish ADD symptomology. The use of medication by the participants should be noted by the researchers in future research.

A study which did note the use of medication by the participants was Ernst et al. (1997). The results of the Ernst et al. study found differences in brain functioning between ADD boys and girls as well as ADD girls and normal girls. However, there is a lack of replication of this study in the research and it is difficult to determine if similar results could be obtained in future research. Additionally, Pelham, Walker, Sturges, and Hoza (1989) found that both sexes respond similarly to methylphenidate treatment. It is unclear at this time if methylphenidate affects those areas of brain functioning found to differ by Ernst et al. as this was not examined in either the Ernst or Pelham studies, nor in the other literature examined.

Regarding instrumentation, most studies used instruments that focused on the hyperactivity aspect of ADD. This may be due to the large number of

studies conducted before the current DSM-IV criteria included the inattentive subtype, as well as the fact that many studies used teacher referral which may lead to a large number of hyperactive participants over inattentive participants being identified and utilized for research purposes. However, Berry et al. (1984) noted that gender differences failed to emerge even when both hyperactive and inattentive, as well as school based versus clinical, participants were included. The results of the Berry et al. study bring into question if the clinical and school (referred versus non-referred) and hyperactive versus inattentive populations differ at all.

There are problems with the existing literature that need to be corrected in future research. First, as discussed earlier, some of these studies included only a small number of subjects, or included too many dependent variables in the analysis of the data which may produce false results where none in fact may exist, and any results from these studies may be questionable. Second, at least one study (Carlson, Tamm & Gaub, 1997) made allowances for the diagnosis of girls for their study in order to gain an equal number of females to males as participants, which can call into question the validity of the results as correct diagnosis becomes questionable. Third, there is a lack of replication for many of these studies, regardless of their support for gender differences or similarities. Furthermore, most tests utilized by researchers for diagnostic purposes appear to be consistently biased in favor of ADD hyperactive type, with less emphasis being placed on instrumentation designed to identify attentional difficulties. This might lead to an overrepresentation of the ADD hyperactive subtype in research. Use of instrumentation focusing on inattention

and impulsivity for diagnostic purposes may contribute to discovering that girls may be underrepresented, or that the current statistics regarding ADD subcategories for both boys and girls are correct. Most importantly, no within ADD subgroup gender comparisons were ever made in any study. In order to make conclusions regarding gender differences existing within the ADD subtypes, research needs to be conducted focusing on comparing boys and girls in the hyperactive and inattentive subcategories. Conclusions of these future studies could then be examined in an attempt to determine if there are gender differences within the ADD subtypes.

It appears that at this time no conclusions regarding gender differences in the ADD subtypes can be made due to methodological problems that exist in the current literature. In addition, replication of studies and corrections for lack of power need to be undertaken before a strong argument could be made for gender differences in ADD. Interestingly, the studies that appeared to be more methodologically sound tended to report a lack of gender differences and, if gender differences appeared, were not statistically significant. It may be that if a replication of a statistically sound study is undertaken, gender differences regarding ADD subcategories could be better examined .

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