Psychiatric, Psychosocial and Cognitive Functioning of Female Adolescents with ADHD

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Abstract

Objective: To characterize the psychiatric, psychosocial and cognitive functioning of adolescent ADHD females in comparison with female controls and ADHD males. Female controls were also compared to male controls to verify gender differences in a nonclinical sample.

Methods: 107 adolescents from Southern Ontario aged 13 to 16 were included: 24 ADHD females, 35 ADHD males, 28 control females and 20 control males. All were assessed using semi-structured interviews, questionnaires and tests of achievement and intellectual functioning.

Results: After controlling for parental education and estimated FSIQ, ADHD females were more impaired than control females in: depression, anxiety, distress, teacher relationships, stress, attributional styles, locus of control, and on all cognitive and achievement measures. ADHD females were more impaired than ADHD males in self-reported anxiety, distress, depression, locus of control, and vocabulary scores. These group differences were confirmed by higher ratings by parents and teachers in symptoms of psychopathology. ADHD males were more impaired in processing speed. Some gender differences (locus of control and vocabulary scores) were eliminated when controlling for ADHD severity. The absence of any differences between male and female controls indicates gender differences were specific to the clinical groups.

Conclusion: ADHD females are at high risk for more psychological impairment than both ADHD males and control females. The identified psychosocial problems point to areas for intervention.

Key Words: ADHD, adolescents, females, gender, psychosocial functioning, cognition

Introduction

Current understanding of Attention-Deficit/Hyperactivity Disorder (ADHD) is derived primarily from research on males (mostly school-aged boys) due to the greater preponderance of males in clinically-referred samples (APA, 1994). Therefore, the study of ADHD in females presents as a neglected area of research, creating a public health concern because even a small proportion of such a common disorder translates into thousands of affected females (Arnold, 1996).

Two approaches are discernible in the limited research on ADHD in females: 1) comparisons of females with and without ADHD (e.g., Biederman et al., 1999; Castellanos et al., 2000; Faraone et al., 2000; Rucklidge and Kaplan, 2000; Seidman, et al., 1997), and 2) comparisons of ADHD females and ADHD males (e.g., Arcia and Conners, 1998; Carlson et al., 1997). Comparisons of females with and without ADHD show that ADHD females have significant impairment manifest by high risk for driving offenses and traffic accidents (Nada-Raja et al., 1997); poorer social skills, internalizing and externalizing behavior and more peer aggression (Gaub and Carlson, 1997); and higher prevalence of substance abuse (Horner and Schiebe, 1997). Previous research with adults (Rucklidge and Kaplan, 1997) indicated that women identified in adulthood with ADHD are significantly impaired in many areas of psychosocial functioning, including attributional styles, stress, loci of control, self-esteem, and coping strategies as compared with nonADHD women. An important question is whether these impairments manifest at a younger age - in adolescent females with ADHD.

Preliminary comparisons of the psychiatric and psychological profiles of ADHD males and ADHD females suggest that girls may not be as impaired as males in certain domains, such as behavioural variables, including hyperactivity, peer aggression, conduct disorder, and externalizing behaviours (Gaub and Carlson, 1997), although Disney et al. (1999) suggest that females with ADHD may be at a slightly greater risk of substance abuse as compared with ADHD males. With respect to cognitive functioning, ADHD females may have lower IQs than ADHD males (Gaub and Carlson, 1997) as well as poorer language function (Berry et al., 1985). By contrast, one study suggested that girls may be less vulnerable

to the executive deficits displayed by boys since ADHD females and control females exhibited similar performance on tests of executive functioning (Seidman et al., 1997). However, a major confounding factor in Seidman et al.'s study was that 84% the ADHD females were medicated at the time of the assessment, medications (such as methylphenidate) well known to affect cognitive function (e.g., Berman et al., 1999). Moreover, it is not known whether these findings generalize to adolescents. Further, little research has investigated whether other psychological variables such as self-esteem, attributional styles, and locus of control are less or more affected in ADHD girls compared with ADHD boys. To date, no study has investigated all three domains (psychiatric, psychosocial and cognitive) using a controlled design to permit the two critical comparisons of 1) females with and without ADHD, and 2) males and ADHD females.

The objectives of the current study were to compare the psychiatric, psychosocial and cognitive functioning of ADHD female adolescents with: 1) female controls and 2) ADHD adolescent males. Male controls were also included as a comparison group to the female controls in order to establish whether gender differences existed in a nonclinical sample in the domains measured. None of the participants were medicated with psychostimulants at the time of the assessment. This design allows us to not only better understand gender differences but also further document how ADHD manifests in female adolescents, an age group rarely studied in the female ADHD population.

Method

Subjects

A total of 107 subjects (aged 13 to 16 years) were included in this study: 24 ADHD females, 35 ADHD males, 28 control females and 20 control males. One third of the clinical female group and 70% of the clinical male group were recruited from patients who were previously assessed in the Department of Psychiatry with a confirmed diagnosis of ADHD in childhood based on a standard clinical diagnostic protocol and standardized parent and teacher behavior rating scales. The lower number of ADHD females recruited from previous assessments was due to considerably lower numbers of females previously

assessed at the clinic. The remaining clinical subjects were recruited through advertisements at pediatric offices specializing in ADHD as well as from new referrals to the Hospital for Sick Children. Adolescents in the control group were recruited through Hospital staff and community resources.

Inclusion criteria for ADHD group: a confirmed diagnosis of childhood ADHD as well as current diagnosis of ADHD (see below). Exclusion criteria for all groups: 1) estimated IQ below 80, using the Block Design and Vocabulary subtests, and 2) subjects with uncorrected problems in vision or hearing, serious medical problems, such as epilepsy or cerebral palsy, or serious psychopathology, such as psychosis, that would preclude a current differential diagnosis of ADHD. Specific exclusion criteria for the control group: history or current complaints of problems in attention, hyperactivity or impulsivity. All children participating in the study were native English speakers.

Diagnostic Protocol for ADHD and other psychiatric disorders: Systematic information about current and lifetime disorders was obtained from both the child and the parent separately using the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL), an interview which generates both DSM-IIIR and DSM-IV diagnoses. This semi-structured interview has been used extensively to make diagnostic decisions based on DSM criteria and has been validated with children aged 6 to 17 (Kaufman et al., 1997). Behaviour rating scales: The Revised Ontario Child Health Study Scales (OCHSS; Boyle et al., 1993) and the Conners' Rating Scales-Revised (Conners, 1997) were used to assess ADHD as well as internalizing and externalizing disorders including depression, anxiety and conduct disorder. These two instruments provide separate rating forms for parents, teachers and adolescents. The OCHSS also provides separate scales for parent, teacher and adolescent to give an overall estimate of impairment. To assess for presence or absence of ADHD, the following diagnostic algorithm was used: 1) the child met DSM-IV criteria for ADHD according to the clinician summary based on the K-SADS parent and adolescent interview, 2) met the clinical cutoffs for the externalizing symptoms of ADHD on the Conners teacher questionnaires in order to ensure pervasiveness of symptoms across settings, and 3) showed evidence of ADHD symptoms prior to the age

of seven established either through a past diagnosis of ADHD or in new cases, according to parental report and school report cards. Impairment was confirmed using the OCHSS. The presence/absence of DSM-IV internalizing disorders was based on information from either the parent or adolescent K-SADS interview. Note that the information from the adolescent K-SADS did not supersede parental report for the presence/absence of externalizing symptoms.

Measures of demographic variables

Measures of the socioeconomic status of the family was determined using the Blishen Index (Blishen et al., 1987), an index which assigns Canadian occupations with a socio-economic score (SES) from 1 (low SES) to 6 (high SES). Highest education level achieved by each parents (from 1 “no high school” to 6 “university degree”) was also used as a measure of economic status.

Dependent measures

Measures of psychological functioning:

Anxiety: Current levels of anxiety were measured using the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds and Richmond, 1978), a 37 item true-false questionnaire that has been validated on children between the ages of 6 and 19 years of age (Lee et al., 1988).

Depression: Depression was measured using the Children's Depression Inventory (CDI; Kovacs, 1985), a 27 item self-report scale designed for use with children and adolescents.

Global Distress: the Brief Symptom Inventory - youth version (BSI; Derogatis, 1993) was used as a measure of overall level of distress. The BSI, a short version of the Symptom Checklist-90 (SCL-90), is a multidimensional self-report symptom checklist designed to assess symptomatic psychological distress, recently normed with adolescents (Derogatis, 1993).

Drug use: The Drug Use Inventory (DUI) was used to obtain an overall estimate of illegal drug use (Friedman and Glickman, 1987) over: 1) the last month, and 2) the last year.

Attributional style: Attributional style was measured using the Children's Attributional Style Questionnaire-Revised (CASQ-R; Thompson et al., 1998), a 24 item shortened measure derived from the

48 item CASQ designed to assess children's causal explanations for positive and negative events. Three dimensions of attributions are assessed (causal locus, stability, globality). The higher the score for each type of event, the more the individual attributes internal ("it's due to me"), stable ("this event will continue to reoccur for me") and global ("this happens to me in every situation") factors to that event.

Locus of control: the Nowicki-Strickland Internal-External Control Scale (Nowicki and Strickland, 1973) was used to assess locus of control. This is a well validated instrument that contains 40 items that describe reinforcement situations across interpersonal and motivational areas such as affiliation, achievement and dependency. The higher the score, the more the individual externalizes locus of control. The scale has been validated and the factors confirmed with adolescent samples (Belter and Brinkman, 1981; Wolf et al., 1982).

Life events: The Life Events Checklist (LEC) developed by Johnson and McCutcheon (1980) for use with older children and adolescents was used to measure number of both positive and negative life events (46 in total) events and how much those events impacted their life from 0 (no effect) to 3 (great effect).

Perceptions of Childhood Dissatisfaction: This questionnaire is a modified version of one used to assess perceptions of childhood in female adults with ADHD (Hojat et al., 1990; Rucklidge and Kaplan, 2000). It consists of three scales assessing dissatisfaction with parents, peers, and school. The higher the score, the more dissatisfaction being reported.

Measures of academic and intellectual functioning:

The psychoeducational and cognitive assessment comprised subtests of the Wechsler Intelligence Scales for Children (WISC-III; Weschler, 1991), including arithmetic, vocabulary, block design, digit span, symbol search and coding; and measures of achievement: word identification, passage comprehension, and the spelling, reading, and arithmetic subtests of the Wide-Range Achievement Test (WRAT-III; Wilkinson, 1993).

Procedures

The interviews and the tasks (total 6 hours) were carried out in the research unit of a large paediatric health sciences research centre in metropolitan Toronto. The local institutional review board approved the study and written informed consent and assent (for children under the age of 16) were obtained from parent and adolescent respectively. Questionnaire packages were sent to the adolescent's teachers with the consent of the parents. A Ph.D. level clinical psychologist (JR) conducted all psychiatric interviews. Psychology graduate students blind to the diagnostic status of the child administered the performance and adolescent self-report measures. All subjects were reimbursed for costs of parking and lunch. All adolescent controls were assessed using the KSADS; their parents were only interviewed if concerns were raised based on their responses in the parent questionnaires. A total of 123 adolescents participated: five were eliminated from analyses as their estimated FSIQ was below 80 and eleven were eliminated as they showed some symptoms of ADHD but did not meet full criteria according to the diagnostic protocol described above.

Clinical subjects who were receiving psychostimulant (dextroamphetamine or methylphenidate) medication (37.5% females, 45.7% of males) discontinued this treatment 24 hours before the day of testing. Three of the ADHD females (12.5%) and three of the ADHD males (8.6%) were taking a medication other than a stimulant (e.g., fluoxetine, sertraline, bupropion, citalopam). These other medications were not discontinued. One of the controls was taking sertraline.

Statistical Analyses

Results were analyzed using the Statistical Package for the Social Sciences-Windows version 10. Multivariate and univariate analyses of variance (MANOVA & ANOVA) were used to examine group differences. All the subscales of each measure were entered in one test of MANOVA (e.g., all the WISC-III subscales or all the subscales of the BSI). Wilks' lambda was used as the overall test of significance ($p < .05$). Three planned comparisons were then performed: 1) the female ADHD group was compared with the normal female controls, 2) the female ADHD group was compared with the male ADHD group, and 3) the female control group was compared with the male control group. Chi-square analyses were used for

group comparisons of the dichotomous variables. Effect sizes were calculated according to Cohen's (1988) effect size correlation ($r_{xy} = d / (d^2 + 4)$ where $d = M_1 - M_2 / \sqrt{((SD_1^2 + SD_2^2) / 2)}$).

Results

Sample Characteristics, Psychiatric Profiles, and Clinical Presentation

There were no group differences in age: ADHD females: 14.68 (1.51), ADHD males: 14.80 (1.22), female controls: 15.31 (1.04), and male controls: 14.80 (1.22). There was an overall group difference in level of education of mothers and fathers and in overall estimates of socio-economic status (F (9, 245.96) = 2.591, p = .007). Specifically, the education level of the fathers of the ADHD females was found to be lower than the education level of the fathers of the female controls. No group differences were found in marital status: 89.5% of the controls (both male and female) had married parents versus 50% of the parents of ADHD females and 65.7% of the parents of ADHD males.

The OCHS and Conners scales were used to verify group differences on observed and reported level of impairment on externalizing and internalizing behaviors. Wilk's lambda revealed significant group differences on the Parent Conners (F (42, 267.75) = 4.073, p < .001), the Teacher Conners (F (39, 270.22) = 3.467, p < .001), the Adolescent Conners (F (21, 279.082) = 4.376, p < .001), and the OCHS Impairment Scale (F (9, 245.96) = 9.802, p < .001).

There were significant differences between the ADHD females and the control females on all the individual Conners subscales (Figures 1a-c) and on reported impairment from the OCHS parent, teacher, and self-report, with ADHD females being reported as more impaired than female controls according to all three informants. Further, the ADHD females were rated significantly higher on many of the Conners scales as compared with the ADHD males (see Figures 1a-1c – significant differences are indicated with an asterisk above the ADHD male average scores).

Insert Figures 1a-c here

There were no group differences between the ADHD females and males on age of diagnosis (F (1, 57) = .606, NS): average age of diagnosis for the females was 10.67 years (SD 3.94) and 9.94 years (SD 3.18) for the males. One third (n=8) of the ADHD females and 20% (n=7) of the ADHD males were newly identified as ADHD following their participation in this study. Seventy-one percent of the ADHD females had received some form of psychological/psychiatric treatment versus 68.6% of the ADHD males. Table I shows the percentage distribution across the two ADHD groups on ADHD subtype (i.e., inattentive, hyperactive/impulsive or combined) and major Axis I psychiatric comorbidities. After controlling for Type I errors using Bonferroni corrections, there were no group differences between the males and the females on any Axis I disorder. Overall, 58.3% of the ADHD females and 45.7% of the ADHD males had at least one comorbid disorder. With respect to the control group, two female controls met criteria for dysthymia, and one female control met criteria for generalized anxiety disorder.

Insert Table 1 about here

Number of ADHD symptoms was also compared across the two clinical groups according to the summary of the K-SADS interview and a group difference emerged on number of hyperactive/impulsive symptoms (F (1, 57) = 4.795, p = .033), with the ADHD females showing more of these symptoms than the males. ADHD females had 7.08 (SD 1.50) inattentive symptoms and 3.58 (SD 2.41) hyperactive/impulsive symptoms and the ADHD males had 6.51 (SD 1.80) inattentive symptoms and 2.29 (SD 2.11) hyperactive symptoms.

Psychosocial variables

Wilks' lambda was significant for the RCMAS (F (15, 273.70) = 2.239, p = .006), the CDI (F (18, 274.84) = 2.245, p = .003), the BSI (F (36, 266.643) = 1.965, p = .001), the scale of dissatisfaction (F (9, 214.09) = 3.879, p < .001), and the LEC (F (12, 259.58) = 2.636, p = .002). Planned comparisons revealed that the ADHD females reported higher overall levels of anxiety, physiological symptoms of

anxiety and more social concern and concentration problems compared with the control females. On the CDI, ADHD females reported more depressive symptoms, anhedonia, more ineffectiveness and more negative self-esteem than both the female controls and ADHD males; and more interpersonal problems and negative mood than the control females. On the BSI, ADHD females were more elevated on many of the dimensions as compared with BOTH the control females and the ADHD males (see Table 2). On the scale of dissatisfaction, the ADHD females reported more dissatisfaction with their teacher relationships compared with the female controls. On the LEC, the females with ADHD reported more negative life events than the female controls but same number for positive events; however, the ADHD females reported that the negative events had a greater effect on them than both the female controls and the ADHD males. Effect sizes ranged from small to medium.

ANOVAs revealed significant group differences in attributions for negative events (F (3, 101) = 4.537, $p = .005$) and in locus of control (F (3, 101) = 6.623, $p < .001$). The ADHD females reported more global and stable attributions for negative events as compared with the female controls. The ADHD females also reported a more external locus of control as compared with both the ADHD males and the female controls. There were no group differences in severity of reported drug use and attributions for positive events. Although statistically, there were no group differences on any of the psychosocial variables between the male and female controls, the effect sizes reveal that there may be small group differences on depression scores and negative life events.

Insert Table 2 about here

During the semi-structured interview (K-SADS), subjects were also asked about current and past suicidal ideation and self-harm behaviors. None of the male and female controls reported past or present self-harm behaviors nor current suicidal ideation; however, five (17.9%) female controls and one (5%) male control reported past suicidal ideation. For the ADHD females, 16.7% (n=4) reported current

suicidal ideation, 50% (n=12) recalled past suicidal ideation, 4.2% (n=1) reported current self-harm, and 25% (n=6) past self-harm. For the ADHD males, 5.7% (n=2) reported current suicidal ideation, 25.7% (n=9) past suicidal ideation, 5.7% (n=2) reported current self-harm and 11.4% (n=4) reported past self-harm behaviors. Chi-square analyses revealed that the ADHD females reported more current suicidal ideation (χ^2 (1, 52) = 5.056, p = .025), past suicidal ideation (χ^2 (1, 52) = 6.068, p = .014) and past self-harm (χ^2 (1, 52) = 5.094, p = .024) as compared with the female controls.

Drug use was also examined as a dichotomous variable (i.e., positive if the subject reported any drug use over the last month/year). There were no group differences: 17.9% (n=5) of the female control group, 0% of the male controls, 20.8% (n=5) of the ADHD females and 37.1% (n=13) of the ADHD males reported some drug use over the last month and 25% (n=7) of the female controls, 10% (n=2) of the male controls, 33.3% (n=8) of the ADHD females and 48.6% (n=17) of the ADHD males reported some drug use over the last year. Subjects who were taking psychotropic medications (45.8% of the ADHD females and 45.7% of the ADHD males) were no more likely to report drug use than those who were not on any medications at the time of the assessment. Indeed, those who were not taking psychotropic medications were twice as likely to report drug use (of all the subjects taking medications currently, 33.3% of the subjects also reported current drug use versus 66.7% who did not).

Cognitive and Academic Variables

Wilk's lambda revealed significant group differences on the WISC-III (F (27, 263.49) = 2.626, p < .001). As indicated in Table 3, ADHD females had lower scores on overall estimated IQ, the Freedom from Distractibility Index and the Processing Speed Index compared with the female controls. The ADHD females were found to have significantly lower vocabulary scores but higher coding and Processing Speed Indices as compared with the ADHD males.

Wilks' lambda was significant for the academic variables (F (18, 277.671) = 3.905, p < .001). Planned comparisons revealed that the ADHD females had lower scores on the reading, spelling, and arithmetic subtests of the WRAT-III as compared with the female controls. There were no group

differences on any of the achievement tests between the ADHD females and ADHD males. Again, there were no group differences on any of the cognitive variables between the male and female controls.

Insert Table 3 about here

Covariates

As the adolescent groups differed on estimated FSIQ and father's education level, which could explain group differences, analyses were repeated entering these variables as covariates separately. As indicated in the tables, a few group differences were eliminated. The analyses were also repeated controlling for number of ADHD H/I symptoms; however, only the comparisons between the two ADHD groups were interpreted given that it would not be logical to control for the symptoms that created the control groups. This procedure eliminated the gender differences found in locus of control and vocabulary. Analyses were also repeated excluding the six clinical subjects and one control subject who were taking medications other than stimulants at the time of the assessment: the only change noted was that there were no longer gender differences on the vocabulary scores of the WISC-III. Finally, to investigate whether a previous diagnosis of ADHD impacted on the psychosocial reports, the groups were collapsed across gender and the previously diagnosed (n=44) and previously undiagnosed groups (n=15) were compared: the only group difference noted was in the coding scores: the undiagnosed group had higher coding scores than the diagnosed group (10.4 (SD 3.34) and 8.00 (SD 3.37) respectively).

Discussion

This study represents the first comprehensive investigation of psychiatric, psychosocial and cognitive functioning together in a controlled design to compare adolescent ADHD females with female controls and ADHD males. Further, a male control group was included to verify whether gender differences were evident in both a clinical and nonclinical sample.

Female ADHD versus Female Control

Overall, the ADHD females were significantly more impaired than the female controls on most measures of psychosocial functioning including levels of self-report depression, anxiety, locus of control, self-esteem, overall symptom distress, and stress levels. They showed more maladaptive attributional styles for negative events, a style that is a high risk for future psychological problems (Abramson et al., 1989). The ADHD females reported more dissatisfaction with their relationships with their teachers compared with the female controls. Moreover, they were perceived as being more impaired as reported by both teachers and parents. Further, the fact that 50% of the ADHD females endorsed past suicidal ideation to some degree and 25% reported past episodes of self-harm are clear indicators of the struggles of this group. There were no group differences, however, in reported drug use.

The combination of psychosocial social problems being reported place these females at high risk for future difficulties. Comparing this cohort to a cohort identified with ADHD much later would enable us to determine if the early identification does indeed protect individuals from many of the devastating psychological effects of this disorder (Rucklidge and Kaplan, 2000). Regardless of future studies, these psychosocial problems point to alternative interventions beyond medication management. Targeting symptoms of depression, anxiety, low self-esteem and external locus of control are all possible within a therapeutic context.

Female ADHD and Male ADHD

There were many intriguing findings when the ADHD males and females were compared. In terms of psychiatric findings, contrary to previous research (Gaub and Carlson, 1997), there were no overall group differences in any of the major Axis I disorders, including externalizing problems. With respect to the psychosocial findings, any group differences indicated that the females were more impaired than the males. They reported more overall distress, anxiety, depression, a more external locus of control, and more conduct, cognitive and hyperactivity symptoms. According to parent and teacher report, the females showed more difficulties in attention, hyperactivity, oppositional behaviors, conduct problems, social difficulties, anxiety and depression. Interestingly, despite endorsing more items of

psychopathology in the females, parents and teachers did not view the females as being more impaired than the males. On the WISC-III, an intriguing gender pattern emerged in that the males had lower scores on the Processing Speed Index (specifically coding) and the females had lower vocabulary scores, suggesting two ways in which the genders may differ in their cognitive patterns. That there were no group differences between the male and female controls confirms that the gender differences observed within the ADHD groups suggest that the combination of having ADHD and being female may place an individual at higher risk for reporting greater psychological distress.

This study suggests that not only are adolescent ADHD females as impaired cognitively as ADHD males, but that having ADHD may be more impairing psychologically for ADHD females than ADHD males. There are a number of possible explanations for these documented group differences. First, when controlling for severity of ADHD, some ADHD gender differences were eliminated (specifically vocabulary and locus of control), suggesting that severity of ADHD symptoms influences to some degree psychological functioning. Second, it is possible that both ADHD males and females experience psychological difficulties, females may be simply more likely to actually report these problems. Third, hormonal differences may explain the gender differences; however, as there were no gender differences in the nonclinical sample, hormonal variations are less likely to be a significant effect. Fourth, given that ADHD females have been overlooked in the past, it is possible that females and males are treated differently within the school and home environments. Rhue et al. (1999) have suggested that ADHD females may be more affected by environmental factors than ADHD males. Only further exploration of these environments could clarify the role these external factors play in the development of more difficulties in this group.

The lack of group differences on level of drug use deserves some discussion. There were no group differences in severity of drug use as well as overall reported drug use. It is possible that the significant amount of treatment received by the clinical groups served as a protective factor in the emergence of overall drug experimentation. Indeed, it was more likely that a subject would report no drug

use if he/she was on medications at the time of the assessment, confirming previous research showing that prescribed stimulant use was not associated with increased drug abuse (Biederman et al., 1999).

The sample was also different from many other research studies in that the majority of the ADHD participants were ADHD, Predominantly Inattentive Type. That group differences were still apparent implies that this group may have many of the deficits often found in combined groups. Future research would need to look at the different subtypes and how they may differ on the variables assessed. However, the fact that many of these individuals did meet full criteria for the combined type when younger again supports previous follow-up research (e.g., Weiss and Hechtman, 1993) that has shown that many of the hyperactive/impulsive symptoms subside over time.

Limitations

First, there was a difference in the method of recruitment between the ADHD males and females. The males were mainly recruited from previous assessments performed through the clinic whereas 75% of the ADHD females were new referrals due to a lack of females previously assessed in the clinic. However, there was no difference in numbers of males and females identified as ADHD through the study or in age of diagnosis, nor were there differences in the number in each group who had previously received treatment. Therefore, it is unlikely that the source of referral influenced the severity of psychopathology of the female sample. However, given that the sample was largely ascertained from pediatric and psychiatric referrals to a single clinical site, we do not know to what extent these results can generalize to ADHD adolescents in the community.

Although stimulant medications were discontinued, a number of the ADHD subjects were taking other psychotropic medications (10.2% of the entire clinical sample) and therefore, we cannot rule out a medication effect influencing the differences noted. Nevertheless, the fact that the pattern of results was identical with and without the seven subjects taking these medications suggests that medications cannot account for the observed differences. Given the large number of analyses conducted, there is always the chance that some findings may be spurious. Further, the sample sizes may not have been large enough to

detect small effects as indicated by the effect sizes comparing the male and female controls – although a small number of variables had small effects (e.g., depression inventory), statistically they were not found to be significant. Finally, given the cross sectional nature of the design, it is impossible to establish etiology. Follow-up studies would allow us to determine whether there are risk factors for the observed psychological and psychiatric problems.

Clinical Implications

ADHD females, especially adolescents, have been widely neglected in the ADHD research. This study reaffirms the importance of investigating ADHD in a female sample. The ADHD females were found to be at high risk for more psychological problems as compared with the males, despite having very similar cognitive profiles. In consequence, they may be more vulnerable to react emotionally to these difficulties, suggesting that treatment may need to address these psychological side effects more systematically in females. It also points to the need for better education about ADHD in females for teachers as they represent the primary professionals who come in contact with this group of underserviced individuals.

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Table 1: Percentages affected (current and past) and Chi-square analyses on selected[a] comorbid diagnoses by ADHD groups

Comorbid Diagnosis	ADHD Females (n=24): % (n)	ADHD Males (n=35): % (n)	chi-square
ADHD In. current	75 (18)	80 (28)	
ADHD H/I current	0 (0)	11.4 (4)	
ADHD Combined current	25 (6)	8.6 (3)	
ADHD In. past	50 (12)	45.7(16)	
ADHD H/I past	0 (0)	8.6 (3)	
ADHD Combined past	50 (12)	45.7 (16)	
ODD current	37.5 (9)	28.6 (10)	
ODD past	33.3 (8)	34.3 (12)	
CD current	12.5 (3)	5.7 (2)	
CD past	16.7 (4)	17.1 (6)	
Tics past	8.3 (2)	14.3 (5)	
MDD current	12.5 (3)	2.9 (1)	
MDD past	20.8 (5)	25.7 (9)	
Dysthymia	12.5 (3)	5.7 (2)	
SAD past	29.2 (7)	8.6 (3)	4.29†
GAD current	29.2 (7)	17.1 (6)	
GAD past	14.3 (5)	25 (6)	
OCD past	12.5 (3)	0 (0)	4.609†
Social Phobia past	0 (0)	8.6 (3)	
Enuresis past	16.7 (4)	22.9 (8)	
Bulimia current	12.5 (3)	0 (0)	4.609†

Note: [a] only disorders where there were two or more in at least one group are reported, ADHD = Attention-Deficit/Hyperactivity Disorder (In = inattentive, H/I = hyperactive/impulsive), ODD = Oppositional Defiant Disorder, CD = Conduct Disorder, MDD = Major Depressive Disorder, SAD = Separation Anxiety Disorder, GAD = Generalized Anxiety Disorder, OCD = Obsessive Compulsive Disorder, †ns with Bonferroni correction

Table 2: Selected[a] Psychosocial variables by Group: Means and Standard Deviations

Variable	Male Control (n=20): Group 1		Female Control (n=28): Group 2		Female ADHD (n=24): Group 3		Male ADHD (n=35): Group 4		Planned Comparisons (mean difference) ADHD		gender		control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	(2 vs 3)	ES[d]	(3 vs 4)	ES	(1 vs 2)	ES
RCMAS: Total	43.85	8.88	44.82	9.69	51.79	12.48	50.26	9.86	6.970*	.3		.07		.05
Physiological Anxiety	8.55	2.86	8.32	3.33	11.21	3.66	10.2	2.40	2.887**	.38		.16		.04
Social Concerns	7.80	2.19	8.00	2.51	10.2	2.90	10.06	2.80	2.208**	.38		.02		.04
CDI: Total Score	40.95	4.07	43.96	8.28	54.17	15.91	47.47	8.98	10.202***	.37	6.696*	.25		.22
Negative mood	42.7	4.78	45.71	7.68	51.46	13.68	47.06	8.43	5.744*c	.25		.19		.23
Interpersonal problems	44.55	2.70	48.68	10.01	54.67	12.10	50.76	10.84	5.988*c	.26		.17		.27
Ineffectiveness	43.55	7.38	45.32	11.21	57.67	14.03	51.35	9.74	12.345**	.44	6.314*	.25		.09
Anhedonia	42.00	4.39	44.71	5.99	52.25	13.51	46.44	8.37	7.536**	.34	5.809*	.25		.25
Negative self-esteem	43.35	3.20	45.07	7.79	50.79	13.91	46.06	7.66	5.720*c	.25	4.733*c	.21		.14
BSI: Somatization	42.15	5.69	43.18	7.00	52.39	12.58	47.65	8.57	9.213***	.41	4.744*c	.22		.08
Obsessive-compulsive	44.60	9.64	43.68	6.62	56.04	13.51	49.53	9.39	12.365***	.5	6.514*	.27		.06
Anxiety	41.55	6.16	40.07	7.94	51.22	13.00	45.15	8.24	11.146***	.46	6.070*	.27		.1
Phobic Anxiety	43.90	6.20	44.68	6.24	51.83	11.73	45.82	7.76	7.148**	.36	6.003**	.29		.06
Paranoid Ideation	38.25	7.22	39.79	7.80	48.13	10.53	44.74	9.85	8.345***	.41		.16		.1
Psychoticism	40.10	6.30	41.29	10.95	49.26	12.91	46.18	8.36	7.975**	.32		.14		.06
PSDI	41.25	6.88	41.5	6.03	53.74	10.00	45.91	11.69	12.239***	.60	7.827**	.34		.01
GSI	38.70	7.51	40.82	7.03	49.70	13.94	45.12	8.99	8.874**	.35		.19		.14
Dissatisfac. with teachers	6.80	2.91	6.46	3.42	9.30	3.66	10.56	3.65	2.840**	.37		.17		.05
Number of neg. life events	1.75	1.59	3.11	3.14	5.13	3.48	4.56	3.10	2.023*	.29		.09		.26
Impact of neg. events	3.10	3.29	4.14	3.93	8.09	6.55	5.29	4.78	3.944**	.34	2.793*	.24		.14
Attributions for neg. events	2.90	1.55	2.50	1.67	4.39	2.71	3.68	1.82	1.891***	.39		.15		.12

Locus of Control	8.80	4.36	10.36	4.18	15.04	6.28	12.18	4.79	4.686***	.40	2.867* b/c	.25	.18

Table 2 (con't)

Note: [a] only those variables where group differences were found were included in the table, RCMAS = Revised Child Manifest Anxiety Scale, CDI = Child Depression Inventory, BSI = Brief Symptom Index, PSDI = Positive Symptom Distress Index, GSI = Global Symptom Index, [b] not significant after controlling for number of ADHD H/I symptoms, [c] not significant after controlling for father's level of education and/or Estimated FSIQ, [d] ES = Effect Size $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 3: Cognitive Functioning by Group: Means and Standard Deviations

Variable	Male Control (n=20): Group 1		Female Control (n=28): Group 2		Female ADHD (n=24): Group 3		Male ADHD (n=35): Group 4		Planned Comparisons (mean difference) ADHD		gender		control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	(2 vs 3)	ES	(3 vs 4)	ES	(1 vs 2)	ES
WISC-III (Standard Scores)														
Estimated FSIQ	112.53	14.89	109.04	10.97	100.00	10.99	102.97	9.47	9.907**	.38		.14		.13
Freedom from Distractibility	106.68	15.43	105.81	12.82	93.48	17.11	95.46	16.37	12.337**	.38		.05		.03
Processing Speed	114.63	11.97	119.89	15.12	106.13	15.16	96.67	17.03	13.758**	.41	9.464*	.28		.19
Arithmetic	11.47	3.13	11.33	3.56	8.87	3.40	8.67	3.47	2.464*	.33		.03		.02
Vocabulary	11.53	2.70	11.41	2.55	8.65	2.50	9.94	1.87	2.755***	.48	1.287* b	.28		.02
Digit Span	10.53	3.32	10.74	2.69	8.57	3.27	9.42	3.13	2.176*	.34		.13		.03
Coding	11.37	2.56	13.11	3.57	9.87	2.80	7.82	3.67	3.242**	.45	2.051*	.30		.27
Block Design	12.79	3.69	11.52	2.91	10.74	3.02	11.03	2.85		.13		.04		.19
Symbol Search	13.95	3.41	14.15	2.78	12.13	3.86	10.55	3.50	2.018*c	.29		.21		.03
WRAT-III (Standard Scores)														
Reading	109.68	9.84	107.93	10.26	99.00	12.06	97.63	14.87	8.214*	.37		.05		.09
Spelling	106.89	12.05	112.41	9.19	96.33	13.95	93.69	14.59	15.238***	.56		.09		.25
Arithmetic	108.21	10.11	112.78	12.34	96.33	13.85	90.57	15.95	15.702***	.53		.19		.20

Note: WISC = Wechsler Intelligence Scale for Children, WRAT = Wide Range Achievement Test, [b] not significant after controlling for number of ADHD H/I symptoms, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Figure Legends

Figure 1a: T scores for Conners' Parent Rating Scale across the four groups

Figure 1b: T scores for Conners' Teacher Rating Scale across the four groups

Figure 1c: T scores for Conners-Wells' Adolescent Self-Report Scale across the four groups

Note: $^{*}p < .05$ & $^{**}p < .01$ as compared with the ADHD females, OPP = oppositional, COG = cognitive problems, HYP = hyperactivity, ANX = anxiety, PERF = perfectionism, SOC = social problems, SOM = psychosomatic, C-ADHD = Conners' ADHD Index, C-H/I = Conners' Global Index: Restless-impulsive, C-EMOT = Conners' Global Index = Emotional-lability, C-GI = Conners' Global Index: Total, DSM-IN = DSM-IV: Inattentive, DSM-H/I = DSM-IV: Hyperactive-impulsive, DSM-Tot = DSM-IV: Total