CHAPTER TWO

Gender differences in symptoms of ADHD and associated factors in normal Icelandic children as rated by parents and teachers

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Submitted
ABSTRACT

Objective: To examine gender differences in symptoms of attention deficit hyperactivity disorder (ADHD) and associated factors as rated by parents and teachers in a sample of normal Icelandic children.

Method: A school-based sample of 115 children (68 boys and 47 girls), aged 6 to 11 years old, was evaluated by their parents and teachers with the Behavior Assessment System for Children (BASC).

Results: Parents and teachers rated boys significantly higher than girls on hyperactivity/impulsivity and aggression symptoms. Teachers rated boys higher than girls on inattention symptoms but parents did not. Externalizing problems best predicted hyperactivity/impulsivity symptoms and internalizing problems and learning problems best predicted inattention symptoms in both boys and girls. There was a significant correlation between parents’ and teachers’ ratings of ADHD symptoms in boys but not in girls.

Conclusion: More externalizing behaviours of boys than girls may be inflating their ratings of ADHD symptoms, especially among teachers. The clinical relevance of the observed poor concordance between parents and teachers in their reports of ADHD symptoms in girls is discussed.
INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is the most commonly diagnosed neuropsychiatric disorder of childhood, and is associated with serious academic and behavioural problems, that in many cases impair the quality of life throughout, for the inflicted individuals (Barkley, 2002; Klassen et al., 2004). The main characteristics of the disorder are inattention, hyperactivity and impulsivity. The DSM-IV-TR (American Psychiatric Association, 2000), differentiates three subtypes of the disorder according to levels of presenting symptoms: The predominantly inattentive subtype (ADHD-I), the predominantly hyperactive-impulsive subtype (ADHD-HI), and the combined subtype (ADHD-C).

Prevalence rates of ADHD range between 1% to 12% of school-aged children depending on the stringency of criteria used and the settings and cultures examined (American Academy of Pediatrics, 2000; American Psychiatric Association, 2000; Brewis & Schmidt, 2003; Hudziak et al., 1998; Leung et al., 1996; Swanson et al., 1998). The ratio of boys versus girls with symptoms of ADHD ranges from 2-3:1 in community samples to 9:1 in clinical samples (American Psychiatric Association, 2000), while equal gender distribution has been found in studies of adult ADHD (Biederman et al., 1994; Hartung & Widiger, 1998). Because of the much higher rates of boys in clinical samples, research on ADHD has tended to rely on male subjects (Arnold, 1996).

ADHD is highly comorbid with other externalizing disorders (oppositional defiant disorder (ODD) and conduct disorder (CD)), internalizing disorders (depression and anxiety disorders), and cognitive disorders (language impairment and learning disorders) (American Psychiatric Association, 2000; Barkley, 1998; Cohen, 2000). This high rate of comorbidity has led some researchers to question the validity of the ADHD diagnosis (Hudziak, 1998). The three subtypes of ADHD have shown differing degrees of associated behavioural and learning variables (e.g. Chhabildas et al., 2001; Decker et al., 2001; Gaub & Carlson, 1997a; Lockwood et al., 2001; Marshall et al., 1999; Schmitz et al., 2002; Todd et al., 2002; Warner-Rogers et al. 2000; Weiss et al., 2003; Willcutt et al., 1999; Wolraich et al. 1996; Wolraich et al. 2003). Generally the ADHD-I subtype has been found to have more internalizing problems, learning disorders and speech and language problems and to have less serious behavioural impairment than the ADHD-HI and the ADHD-C subtypes. The ADHD-HI type is characterized by behavioural problems and minimal cognitive impairment. The ADHD-C type has been found to have problems with both learning and behaviour and represents the most serious form of the disorder with the worst prognosis (e.g., Faraone et al., 1998; Todd et al., 2002; Willcutt, 1999; Wolraich et al. 1996). It has been suggested that symptoms of inattention, rather than symptoms of hyperactivity/impulsivity, are associated with neuropsychological impairment in children with ADHD (Chhabildas et al., 2001). The most common subtype in community samples, for both sexes, is the ADHD-I, while the most frequent subtype in clinical samples, for both girls and boys, is the ADHD-C subtype (Biederman, 2004; Crystal et al., 2001; Gaub
& Carlson, 1997a; Hudziak, 1998; Wolraich et al., 1996). In clinical samples, girls with ADHD have been found to be 2.2 times more likely to be diagnosed as ADHD-I, than boys with ADHD (Biederman, 2004).

According to DSM-IV, symptoms of ADHD have to be present in multiple settings to fulfil diagnostic criteria. This requirement is customarily met by obtaining information about the child’s behaviour from both parents and teachers. Concordance between parents’ and teachers’ ratings of children’s behaviour have generally been found to be modest (e.g. Achenbach et al., 1987; McNamara et al., 1994; Mitsis et al., 2000; Montiel Nava & Pena, 2001; Sherman, 1997). Achenbach et al. (1987) found for example only a mean correlation of .28 between ratings of parents and teachers in a meta-analytic study. In most, if not all studies on agreement between parents’ and teachers’ assessments of children’s behaviour problems, boys and girls are treated as one group. To the authors’ best knowledge, no studies have been conducted so far that examine if agreement between parents and teachers vary as a function of gender.

Studies of sex differences in ADHD symptoms have most commonly been examined with various behavioural rating scales. These studies have typically found that boys in general have higher elevations of hyperactive/impulsive and inattentive symptoms than girls, both according to parents and teachers (Abicoff et al., 2002; Jackson & King, 2004; Magnusson et al., 1999). Other studies have shown different results indicating that ADHD symptoms can be assessed differently depending on both culture and rater (e.g. Brewis, 2002; Brewis & Schmidt 2003; Esparo et al., 2004; Gomez et al., 1999). Esparo et al. (2004) found for example that 6-year-old Spanish girls had significantly more borderline problems than boys and also tended to have more externalizing problems. In a study on Mexican children Brewis et al. (2003) found that while teachers ascribed more inattention symptoms to boys than girls, parents did not report any differences between boys and girls in symptoms of ADHD.

It has been suggested that because of more overtly aggressive and disruptive behaviour, boys are being referred for ADHD treatment more often than girls. (Abikoff, 2002; Gaub & Carlson, 1997b; Jackson & King, 2004). It has also been suggested that girls with ADHD tend to be inattentive rather than aggressive and disruptive and therefore they may be overlooked by teachers and healthcare providers (Quinn & Wigal, 2004). Aggressive and disruptive behaviour has been found to inflate teachers’ ratings of ADHD (Jackson & King, 2004).

The aim of the current study was to investigate sex differences in symptoms of hyperactivity/impulsivity and inattention, and associated factors in a school-based sample of Icelandic boys and girls between the ages of 6 and 11, as rated by parents and teachers. The ratings scales used were parent and teacher authorized Icelandic-language versions of the Behavior Assessment System for Children (BASC: Reynolds & Kamphaus, 1992). This is the first study that has examined sex differences in ADHD symptoms and associated factors in Icelandic children using the BASC. In view of the current literature it was hypothesized that boys would score higher than girls on hyperactivity/impulsivity and inattention according to both parents and teachers. It was also hypothesized that
externalizing factors would best predict hyperactive/impulsive symptoms and that learning problems and internalizing factors would best predict inattention symptoms. It was also hypothesized that male-to-female ratio of severe ADHD symptoms would be higher among teachers than parents. Moreover, we were especially interested in possible differences in concordance rates between parents and teachers with respect to gender. It should be emphasized that in the current study we are investigating normal variation in child behaviour but not children affected with ADHD.

**METHOD**

**Participants**

A randomized sample of 232 children, aged 6 to 11-year-old was selected from the pupils of an elementary school in Reykjavik, Iceland. The parents of 137 children consented to participate and gave their permission for the children’s teachers to rate their behaviour. Eighteen out of nineteen teachers agreed to rate the children. This procedure provided 115 children (68 boys and 47 girls), aged 6 to 11, who were rated by both their parents and their teachers.

**Procedures**

The parents of the 115 children participating in the study filled out the Parent Rating Scales (PRS) of the BASC and the teachers of the children filled out the Teacher Rating Scales (TRS). The BASC Enhanced ASSIST computer program (American Guidance Service, 1999) was used to score the forms in order to obtain scales’ raw scores. The raw scores of each scale were subsequently entered into the SPSS program and analyzed.

**Instruments**

*Behavior Assessment System for Children (BASC)*

The BASC is a multimethod, multidimensional measure designed to evaluate numerous aspects of behaviour, emotions and self-perceptions of children and adolescents aged 2½ to 18 years. It measures both adaptive and problematic dimensions, as well as behaviour linked to ADHD. One of the advantages of the BASC is that, unlike some other commonly used rating scales for children e.g. the Child Behavior Checklist (CBCL), Achenbach, 1991), it measures hyperactivity/impulsivity symptoms and inattention symptoms on two separate scales. Research has shown that the BASC is better suited than the CBCL for predicting ADHD subtypes, especially the predominantly inattentive subtype (Vaughn, Riccio, Hynd, & Hall, 1997). Crystal et al. (2001) using the BASC, performed logistic regression equations to predict membership in control versus ADHD groups, and to discriminate between ADHD subtypes. Results showed that the *Attention Problems* scale
of the BASC was the most powerful predictor of membership in the ADHD group versus the control group. Contrary to expectations, however, the Aggression scale rather than the Hyperactivity scale emerged as the second most predictive variable of an ADHD diagnosis. The authors did not however do a separate analysis on gender.

The Parent Rating Scales (PRS) of the BASC have nine clinical scales. Three scales called Hyperactivity (including both hyperactivity and impulsivity items), Aggression, and Conduct Problems measure externalizing problems. Three scales called Anxiety, Depression, and Somatization, measure internalizing problems. Three additional scales are called Attention Problems, Atypicality and Withdrawal.

The Teacher Rating Scales (TRS) have in addition to the aforementioned nine scales, a clinical scale called Learning Problems. In this study an additional scale called ADHD symptoms was formed by combining scores on the Hyperactivity scale and the Attention Problems scale.

The child form of the BASC (ages 6-11) was used in this study. The scales used in multiple regression analysis were the scales measuring externalizing problems, internalizing problems and learning disorders. On the child form of the BASC, parents and teachers rate 138 and 148 symptoms respectively. Symptoms are rated on a 4-point scale of frequency (never = 0, sometimes = 1, often = 2, and almost always = 3).

Internal consistency coefficients (Kjartansdottir, 2002) for the BASC Icelandic-language version of the PRS child form range from .52 (Atypicality) to .90 (Depression). The TRS child form correspondingly has coefficients that range from .69 (Withdrawal) to .93 (Aggression).

**Statistical analyses**

Results were analyzed using the Statistical Package for the Social Science-Windows version 11. Univariate analyses of variance (ANOVA) were used to examine group differences. Pearson correlation coefficients were calculated to test the strength of the linear relationships between the ratings of parents and teachers with respect to boys and girls. Exploratory stepwise regression analyses were performed, using scales measuring externalizing problems, internalizing problems and learning disorders, to establish which variables accounted for the most variability in hyperactive/impulsive and inattentive symptoms. The ratio of boys versus girls with ADHD symptoms ratings exceeding 1½ SD from the combined groups’ mean, according to both parents and teachers, was calculated.
RESULTS

Difference between boys and girls on the BASC subscales as rated by parents and teachers

One-way analysis of variance (ANOVA) was performed to measure possible differences in subscales’ scores between boys and girls. With respect to the PRS, a significant difference was observed on the subscales Hyperactivity and Aggression, and a trend for the subscale Conduct Problems. The difference between both groups on these three subscales was due to higher mean scores for the boys compared to the girls. For means, standard deviations, F and p values and effect sizes, see Table 1. Analyses of the scores on the TRS also showed significantly higher scores for boys on the subscales Hyperactivity and Aggression, in comparison with girls. In addition, compared to girls, boys scored significantly higher on the subscale Attention Problems. For means, standard deviations, F and p values and effect sizes, see Table 2.

TABLE 1

Difference between boys and girls on the clinical scales of the BASC Parent Rating Scales. F and p values and effect sizes

<table>
<thead>
<tr>
<th>BASC subscales</th>
<th>Boys (n=68)</th>
<th>Girls (n=47)</th>
<th>F ratio (df=114)</th>
<th>P value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperactivity</td>
<td>6.37 (4.01)</td>
<td>4.74 (3.40)</td>
<td>5.135</td>
<td>.025</td>
<td>.21</td>
</tr>
<tr>
<td>Aggression</td>
<td>8.40 (3.78)</td>
<td>6.96 (3.89)</td>
<td>3.935</td>
<td>.050</td>
<td>.18</td>
</tr>
<tr>
<td>Conduct Problems</td>
<td>2.49 (2.16)</td>
<td>1.81 (2.09)</td>
<td>2.797</td>
<td>.097</td>
<td>.16</td>
</tr>
<tr>
<td>Anxiety</td>
<td>7.32 (3.99)</td>
<td>8.17 (5.16)</td>
<td>.983</td>
<td>.324</td>
<td>.09</td>
</tr>
<tr>
<td>Depression</td>
<td>4.87 (4.36)</td>
<td>5.45 (5.63)</td>
<td>.385</td>
<td>.536</td>
<td>.06</td>
</tr>
<tr>
<td>Somatization</td>
<td>4.38 (3.12)</td>
<td>4.13 (2.92)</td>
<td>.195</td>
<td>.659</td>
<td>.04</td>
</tr>
<tr>
<td>Atypicality</td>
<td>2.49 (2.48)</td>
<td>2.17 (1.87)</td>
<td>.544</td>
<td>.463</td>
<td>.07</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>5.25 (3.29)</td>
<td>5.51 (2.94)</td>
<td>.190</td>
<td>.664</td>
<td>.04</td>
</tr>
<tr>
<td>Attention Problems</td>
<td>6.15 (3.75)</td>
<td>5.09 (3.41)</td>
<td>2.399</td>
<td>.124</td>
<td>.15</td>
</tr>
<tr>
<td>ADHD symptoms¹</td>
<td>12.50 (6.93)</td>
<td>9.83 (5.72)</td>
<td>4.741</td>
<td>.032</td>
<td>.21</td>
</tr>
</tbody>
</table>

¹ ADHD symptoms = Hyperactivity and Attention Problems scales combined
## TABLE 2

Difference between boys and girls on the clinical scales of the BASC Teacher Rating Scales. F and p values and effect sizes

<table>
<thead>
<tr>
<th>BASC subscales</th>
<th>Boys (n=68)</th>
<th>Girls (n=47)</th>
<th>F ratio (df=114)</th>
<th>P value</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperactivity</td>
<td>8.85 (7.40)</td>
<td>4.38 (5.50)</td>
<td>12.402</td>
<td>.001</td>
<td>.32</td>
</tr>
<tr>
<td>Aggression</td>
<td>8.69 (8.53)</td>
<td>4.91 (6.27)</td>
<td>6.700</td>
<td>.011</td>
<td>.24</td>
</tr>
<tr>
<td>Conduct Problems</td>
<td>1.90 (2.46)</td>
<td>1.36 (2.16)</td>
<td>1.449</td>
<td>.231</td>
<td>.12</td>
</tr>
<tr>
<td>Anxiety</td>
<td>2.37 (2.91)</td>
<td>3.38 (4.10)</td>
<td>2.414</td>
<td>.123</td>
<td>.14</td>
</tr>
<tr>
<td>Depression</td>
<td>3.15 (3.51)</td>
<td>3.06 (4.41)</td>
<td>.013</td>
<td>.911</td>
<td>.01</td>
</tr>
<tr>
<td>Somatization</td>
<td>1.51 (2.37)</td>
<td>2.28 (3.40)</td>
<td>2.007</td>
<td>.159</td>
<td>.13</td>
</tr>
<tr>
<td>Atypicality</td>
<td>1.47 (2.62)</td>
<td>1.00 (1.97)</td>
<td>1.088</td>
<td>.299</td>
<td>.10</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>3.46 (3.29)</td>
<td>3.53 (3.51)</td>
<td>.014</td>
<td>.906</td>
<td>.01</td>
</tr>
<tr>
<td>Attention Problems</td>
<td>7.26 (4.84)</td>
<td>4.23 (4.61)</td>
<td>11.331</td>
<td>.001</td>
<td>.31</td>
</tr>
<tr>
<td>Learning Problems</td>
<td>5.69 (5.15)</td>
<td>5.51 (5.07)</td>
<td>.035</td>
<td>.853</td>
<td>.02</td>
</tr>
<tr>
<td>ADHD symptoms¹</td>
<td>16.12 (11.16)</td>
<td>8.64 (8.93)</td>
<td>14.628</td>
<td>.000</td>
<td>.35</td>
</tr>
</tbody>
</table>

¹ ADHD symptoms = Hyperactivity and Attention Problems scales combined

### Prediction of Hyperactivity and Attention Problems in boys and girls

We conducted a series of multiple regressions with Hyperactivity and Attention Problems completed by the parents and teachers as criterion measures and Aggression, Conduct Problems, Anxiety, Depression, Somatization, and Learning Problems (only included in the TRS) as predictors. The scale Attention Problems was also used as predictor when the Hyperactivity scale was the criterion measure and the scale Hyperactivity was added as predictor when the Attention Problems scale was the criterion measure. Regressions were conducted with respect to separate outcomes of (1) Attention Problems in boys and girls, obtained from the PRS, (2) Attention Problems in boys and girls, obtained from the TRS (see Table 3), (3) Hyperactivity in boys and girls, obtained from the PRS, and (4) Hyperactivity in boys and girls obtained from the TRS (see Table 4).
### TABLE 3

Standard regression analyses for variables predicting *Attention Problems* in boys and girls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardised Coefficient (B)</th>
<th>t-value</th>
<th>p-value</th>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention Problems in boys, obtained from the PRS</strong></td>
<td></td>
<td></td>
<td></td>
<td>25.31</td>
<td>.000</td>
</tr>
<tr>
<td>Aggression</td>
<td>.24</td>
<td>1.92</td>
<td>.059</td>
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<td>Anxiety</td>
<td>.34</td>
<td>3.66</td>
<td>.001</td>
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<tr>
<td>Hyperactivity</td>
<td>.28</td>
<td>2.56</td>
<td>.013</td>
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</tr>
<tr>
<td><strong>Attention Problems in girls, obtained from the PRS</strong></td>
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<td></td>
<td></td>
<td>14.94</td>
<td>.000</td>
</tr>
<tr>
<td>Somatization</td>
<td>.42</td>
<td>2.48</td>
<td>.017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.23</td>
<td>2.46</td>
<td>.018</td>
<td></td>
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<tr>
<td><strong>Attention Problems in boys, obtained from the TRS</strong></td>
<td></td>
<td></td>
<td></td>
<td>43.97</td>
<td>.000</td>
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<tr>
<td>Learning Problems</td>
<td>.40</td>
<td>5.00</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.49</td>
<td>4.16</td>
<td>.000</td>
<td></td>
<td></td>
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<tr>
<td>Hyperactivity</td>
<td>.16</td>
<td>2.59</td>
<td>.012</td>
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<td><strong>Attention Problems in girls, obtained from the TRS</strong></td>
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<tr>
<td>Learning Problems</td>
<td>.44</td>
<td>4.48</td>
<td>.000</td>
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<tr>
<td>Hyperactivity</td>
<td>.22</td>
<td>2.68</td>
<td>.010</td>
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<tr>
<td>Depression</td>
<td>.27</td>
<td>2.42</td>
<td>.020</td>
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<td></td>
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</table>
TABLE 4

Standard regression analyses for variables predicting *Hyperactivity* in boys and girls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardised Coefficient (B)</th>
<th>t-value</th>
<th>p-value</th>
<th>F-value</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td><strong>Hyperactivity in boys, obtained from the PRS</strong></td>
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<tr>
<td>Aggression</td>
<td>.50</td>
<td>4.13</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somatization</td>
<td>.26</td>
<td>2.37</td>
<td>.021</td>
<td></td>
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<tr>
<td>Conduct Problems</td>
<td>.45</td>
<td>2.13</td>
<td>.037</td>
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<tr>
<td><strong>Hyperactivity in girls, obtained from the PRS</strong></td>
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<tr>
<td>Conduct Problems</td>
<td>.75</td>
<td>3.22</td>
<td>.002</td>
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<td>Aggression</td>
<td>.33</td>
<td>2.62</td>
<td>.012</td>
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<td><strong>Hyperactivity in boys, obtained from the TRS</strong></td>
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<tr>
<td>Aggression</td>
<td>.44</td>
<td>5.46</td>
<td>.000</td>
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<td>.82</td>
<td>2.81</td>
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<td><strong>Hyperactivity in girls, obtained from the TRS</strong></td>
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<td>.000</td>
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<tr>
<td>Learning Problems</td>
<td>.47</td>
<td>4.97</td>
<td>.000</td>
<td></td>
<td></td>
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<tr>
<td>Anxiety</td>
<td>-.26</td>
<td>-2.18</td>
<td>.035</td>
<td></td>
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</tbody>
</table>

**Prediction of inattentive symptoms in boys and girls**

*Attention Problems in boys, obtained from the Parent Rating Scales (PRS).* The combination of the predictors *Aggression*, *Anxiety*, and *Hyperactivity* was significantly related to *Attention Problems* (see Table 3). The sample multiple correlation coefficient was .74, indicating that approximately 54% of the variance of the score on the *Attention Problems* subscale could be accounted for by the combination of *Aggression*, *Anxiety*, and *Hyperactivity*.

The unstandardized coefficients indicate that *Anxiety* is the strongest predictor for *Attention Problems* in boys as rated by parents.

*Attention Problems in girls, obtained from the Parent Rating Scales (PRS).* The combination of the predictors *Somatization* and *Anxiety* was significantly related to *Attention Problems* (see Table 3). The sample multiple correlation coefficient was .64, indicating that approximately 40% of the variance of the score on the *Attention Problems* subscale could be accounted for by the combination of *Somatization* and *Anxiety*.

The unstandardized coefficients indicate that *Somatization* and *Anxiety* are the strongest predictors of *Attention Problems* in girls as rated by parents.
Gender differences in symptoms of ADHD

**Attention Problems in boys, obtained from the Teacher Rating Scales.** The combination of the predictors Learning Problems, Depression, and Hyperactivity was significantly related to Attention Problems (see Table 3). The sample multiple correlation coefficient was .82, indicating that approximately 67% of the variance of the score on the Attention Problems scale could be accounted for by the combination of Learning Problems, Depression, and Hyperactivity.

According to the unstandardized coefficients Learning Problems and Depression were the strongest predictors for Attention Problems.

**Attention Problems in girls, obtained from the Teacher Rating Scales (TRS).** The combination of the predictors Learning Problems, Hyperactivity and Depression was significantly related to Attention Problems (see Table 3). The sample multiple correlation coefficient was .81, indicating that approximately 67% of the variance of the score on Attention Problems could be accounted for by the combination of Learning Problems, Hyperactivity and Depression.

The unstandardized coefficients indicated that the scale Learning Problems was the strongest predictor of Attention Problems in girls as rated by teachers.

When Learning Problems was taken out as a predictor for Attention Problems the scale Depression was the best predictor for Attention Problems in both boys and girls as rated by teachers.

**Prediction of hyperactive/impulsive symptoms in boys and girls**

**Hyperactivity in boys, obtained from the Parent Rating Scales (PRS).** The combination of the predictors Aggression, Somatization and Conduct Problems was significantly related to Hyperactivity (see Table 4). The sample multiple correlation coefficient was .74, indicating that approximately 55% of the variance of the score on the Hyperactivity subscale can be accounted for by the combination of Aggression, Somatization and Conduct Problems.

The unstandardized coefficients show that the Aggression scale is the strongest predictor of Hyperactivity in boys as rated by parents.

**Hyperactivity in girls, obtained from the Parent Rating Scales (PRS).** The combination of the predictors Conduct Problems and Aggression was significantly related to Hyperactivity (see Table 4). The sample multiple correlation coefficient was .79, indicating that approximately 62% of the variance of the score on the Hyperactivity scale can be accounted for by the combination of Conduct Problems and Aggression.

The unstandardized coefficients indicate that the scale Conduct Problems is the strongest predictor for Hyperactivity in girls as rated by parents.

**Hyperactivity in boys, obtained from the Teacher Rating Scales (TRS).** The combination of the predictors Aggression, Conduct Problems, and Attention Problems was significantly related to Hyperactivity (see Table 4). The sample multiple correlation coefficient was .86, indicating that approximately 75% of the variance of the score on Hyperactivity could be accounted for by the combination of Aggression, Conduct
Problems, and Attention Problems.

The unstandardized coefficients indicate the scale Conduct Problems as the strongest predictor of Hyperactivity in boys as rated by teachers.

Hyperactivity in girls, obtained from the Teacher Rating Scales (TRS). The combination of the predictors Aggression, Learning Problems and Anxiety, was significantly related to Hyperactivity (see Table 4). The sample multiple correlation coefficient was .89, indicating that approximately 80% of the variance of the score on the Hyperactivity scale could be accounted for by the combination of Aggression, Learning Problems, and Anxiety.

The unstandardized coefficients indicate Aggression as the strongest predictor of Hyperactivity in girls as rated by teachers.

Correlations between ratings of parents and teachers on the BASC

The correlation matrices of the parents’ and teachers’ ratings are shown in Table 5. The results indicate that there is a great difference in the significance of the correlations depending on gender rated. Thus there is a significant correlation between the ratings of parents and teachers with respect to boys on all 10 measures, but with respect to girls there is only significant correlation on 3 out of 10 measures. With respect to ADHD symptoms, the correlation between parents’ and teachers’ ratings of boys is significant at the 0.01 level, but with respect to girls the correlation is not significant.

**TABLE 5**

Correlations between parent and teacher ratings on the BASC, child level form

<table>
<thead>
<tr>
<th></th>
<th>US norms boys and girls (n = 745)</th>
<th>Icelandic sample boys and girls (n = 115)</th>
<th>Icelandic sample boys only (n = 68)</th>
<th>Icelandic sample girls only (n = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression</td>
<td>0.38</td>
<td>0.25**</td>
<td>0.30*</td>
<td>0.08</td>
</tr>
<tr>
<td>Conduct Problems</td>
<td>0.49</td>
<td>0.28**</td>
<td>0.32**</td>
<td>0.17</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>0.42</td>
<td>0.30**</td>
<td>0.30*</td>
<td>0.14</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.12</td>
<td>0.33**</td>
<td>0.41**</td>
<td>0.25</td>
</tr>
<tr>
<td>Depression</td>
<td>0.37</td>
<td>0.49**</td>
<td>0.54**</td>
<td>0.46**</td>
</tr>
<tr>
<td>Somatization</td>
<td>0.19</td>
<td>0.20*</td>
<td>0.26*</td>
<td>0.15</td>
</tr>
<tr>
<td>Attention Problems</td>
<td>0.62</td>
<td>0.49**</td>
<td>0.58**</td>
<td>0.31*</td>
</tr>
<tr>
<td>Atypicality</td>
<td>0.31</td>
<td>0.31**</td>
<td>0.32**</td>
<td>0.26</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>0.24</td>
<td>0.48**</td>
<td>0.52**</td>
<td>0.42**</td>
</tr>
<tr>
<td>ADHD symptoms¹</td>
<td>0.42**</td>
<td>0.47**</td>
<td></td>
<td>0.21</td>
</tr>
</tbody>
</table>

**, Correlation is significant at the 0.01 level (2-tailed)
*, Correlation is significant at the 0.05 level (2-tailed)
¹ADHD symptoms = Hyperactivity and Attention Problems scales combined
The ratio of boys versus girls with ADHD symptoms

The ratio of boys versus girls with ADHD symptoms ratings exceeding 1½ SDs from the group’s mean was calculated. According to parents the ratio is 3 boys versus 1 girl, and according to teachers the ratio is 9 boys versus 1 girl.

DISCUSSION

Differences between genders according to parents

As had been expected, parents rated boys significantly higher than girls on the externalizing scales Hyperactivity and Aggression and somewhat higher (a trend) for the scale Conduct Problems. This is in agreement with the findings of Crijnen et al. (1997) who found that parents rated boys higher than girls on externalizing problems in 12 different cultures. These results are also in line with those of Bongers et al. (2003, 2004), who performed a large longitudinal multiple birth-cohort study of children aged 4 – 18 years old, based on parental reports of problem behaviours. They found that, overall, males showed higher levels of externalizing behaviour than did females. Our findings are in contrast to those of Esparo et al. (2004) who found in a non-clinical group of 6-year-old Spanish children, no differences between sexes in the prevalence of total psychological problems, while girls tended to have more externalizing problems than boys.

Contrary to our expectation, there was not a significant difference between boys and girls on the Attention Problems scale according to parents. This is not in agreement with those studies that have generally found higher levels of inattention in boys on parent rating scales (Bohlin & Janols, 2004; Gomez, 1999; Magnusson, 1999). Our findings also contrast with those of Brewis & Schmidt (2003) who did not find significant gender differences in identification of children’s ADHD symptoms in parents’ ratings of 206 middle-class Mexican children, aged 6-12 years. Possibly these differences can be explained by cultural differences in expected and socially acceptable behaviour of boys and girls.

Differences between genders according to teachers

Teachers rated boys higher than girls on the subscales Hyperactivity, Aggression and also on Attention Problems in contrast to parents. Our findings partly agree with those of Brewis & Schmidt (2003) who found that teachers ascribe more inattention problems to boys than girls. The reason why teachers find boys to have more inattention symptoms than girls while parents do not might be that relatively higher teacher scores of boys on hyperactivity and aggression are inflating their ratings of attention problems. Our findings are in line with most previous findings in other cultures (e.g. Abikoff et al. 2002; Bohlin & Janols, 2004; Jackson & King, 2004) but in contrast to the findings of Esparo et al. (2004). These results emphasize that there may be cultural variations in how hyperactive/
impulsive and inattentive symptoms are rated by parents and teachers with respect to gender.

**Prediction of inattentive symptoms in boys and girls**

According to parents’ ratings the scale *Anxiety* best predicted *Attention Problems* in boys and the scales *Somatization* and *Anxiety* best predicted *Attention Problems* in girls. These findings were expected and are in accordance with most of the previous literature that has found high associations between inattention and internalizing problems in boys and girls.

According to the teachers, the best predictor of inattentive symptoms was the *Learning Problems* scale for both boys and girls. These findings are in line with numerous other studies that have found high associations between inattentive symptoms and learning problems (e.g. Chhabildas, Pennington, & Willcutt, 2001; Gomez et al., 2003; Levy et al., 2005; Willcutt, & Pennington, 2000; Wolraich et al., 2003). Interestingly, Gomez et al., (2003) found a moderate to strong correlation (.60) between inattention and academic problems trait factors, while the correlation between hyperactivity/impulsivity and academic problems trait factors was almost zero (.02). Most learning problems like reading disorders, spelling disorders and mathematical disorders are language based and are related to deficits in verbal working memory (e.g. Rucklidge & Tannock, 2002; Wilson & Swanson, 2001). Specific language impairment which is also highly comorbid with ADHD is also associated with deficient verbal working memory (Jonsdottir, 2005; Montgomery, 2003). The question remains to what extent inattention problems in children are in fact caused by deficits in verbal working memory (e.g. Martinussen et al., 2005).

When *Learning Problems* was taken out as a predictor for *Attention Problems* the scale *Depression* was the best predictor for *Attention Problems* in both boys and girls as rated by teachers. Our findings agree with those of Willcutt et al. (1999) who found that symptoms of inattention were associated with lower full scale intelligence and higher levels of depression, whereas symptoms of hyperactivity/impulsivity were more associated with oppositional defiant disorder and conduct disorder. The causal relationship between learning problems, inattention and depression needs further examination.

According to teachers there is no gender difference in ratings of *Learning Problems* and *Depression* (see Table 2) which are the two best predictors of inattention in both boys and girls. Therefore it is suggested that higher ratings of boys on the *Hyperactivity* subscale, which is the third best predictor of inattention in the regression analysis, may be elevating their scores on the *Attention Problems* subscale as rated by teachers (see Table 2).

**Prediction of hyperactive/impulsive symptoms in boys and girls**

According to parents, externalizing problems (*Aggression* and *Conduct Problems*) best predicted *Hyperactivity* in both boys and girls. These findings are consistent with those of Levy et al. (2005) who examined gender differences in ADHD symptom comorbidity
in a large sample of twins and siblings in Australia. They found no significant gender differences in comorbidity for externalizing disorders. In a similar vain, Gabel et al. (1996) did not find any sex differences in comorbid externalizing problems on parental behaviour ratings of hyperactive boys and girls aged 6-11 years.

According to teachers Conduct Problems associated with Aggression and Attention Problems best predicted hyperactivity symptoms in boys while Aggression associated with Learning Problems and Anxiety best predicted hyperactivity symptoms in girls. Thus it seems that externalizing problems are predicting hyperactivity symptoms in boys to a greater extent than in girls and that internalizing problems and learning disorders are predicting hyperactivity symptoms to a greater extent in girls than in boys. Our results also show that more observable behaviour is predicting hyperactivity to a greater extent in boys than in girls.

**Correlations between ratings of parents and teachers on the BASC**

Correlational analysis showed that agreement between parent and teacher ratings in the sample as a whole were generally in the low to moderate range (see Table 5). When the sample was divided according to gender, interesting and unexpected differences became apparent. While the correlations between parent and teacher ratings of boys were significant on all 10 measures they were only significant on 3 measures of girls (Attention Problems, Depression and Withdrawal). On the scale with ADHD symptoms combined, the correlation was .47 (significant at the .01 level) with respect to boys, but only .21 (nonsignificant) with respect to girls (see Table 5). These results are difficult to explain but may reflect the finding of Quinn & Wigal (2004) who found that 4 out of 10 teachers reported more difficulty in recognizing ADHD symptoms in girls than in boys. They also found that the majority of parents and teachers think that girls with ADHD are more likely to remain undiagnosed. Possible explanation for the better agreement between parents and teachers with respect to boys might be that because they have more externalizing problems than girls their behaviour is more easily observable.

**The ratio of boys versus girls with ADHD symptoms**

According to parents, the ratio between boys and girls with the highest ratings of Attention Problems and Hyperactivity combined was 3 boys to 1 girl. This is similar to findings generally reported in the literature of ratios between girls and boys with ADHD in community samples. According to teachers the comparable ratio was 9 boys to 1 girl which is similar to the ratio between boys and girls with ADHD in clinic-referred samples. This large difference of boys and girls with severe ADHD symptoms in a normal sample as assessed by teachers is unexpected, although most of the literature suggests that teachers tend to report higher rates of ADHD in children than parents do (e.g. Sherman et al.,
1997). It has been proposed that this may be because teachers ascribe ADHD symptoms in children who have a variety of other behavioural problems. It has also been suggested that parents underreport ADHD in children because they do not have the benefit of a large reference group like teachers do (Gaub and Carlson 1997b).

Abikoff et al. (1993) found in their study that oppositional tendencies in a male model tended to inflate teachers’ ratings of ADHD. Jackson and King (2004) did a similar study using both male and female models and found that oppositional behaviour was associated with higher teacher ratings of hyperactivity and inattentiveness. They also found gender differences in the effects of oppositional behaviour on teacher ratings of ADHD symptoms suggesting that teacher rating tendencies could contribute to higher diagnostic rates of ADHD among boys and conduct disorders among girls. Interestingly, in our study teachers did not find a significant difference in Conduct Problems between boys and girls although they found very significant differences in Hyperactivity. In contrast, parents found less differences between sexes in Hyperactivity ratings than teachers and more differences between genders in Conduct Problems. Our findings suggest that teachers may, to a greater extent than parents, rate conduct disorders as Hyperactivity in boys and as Conduct Problems in girls, agreeing with the findings of Jackson and King (2004).

**SUMMARY AND CONCLUSION**

The main findings of the study are that in a normal Icelandic school-based sample, boys score higher than girls on ratings of hyperactivity/impulsivity and aggression according to both parents and teachers and also on ratings of inattention according to teachers. The results of the present study also show that inattentive symptoms in boys and girls are mainly related to learning problems and internalizing variables like anxiety and depression, while hyperactive/impulsive symptoms are mainly associated with externalizing problems like aggression and conduct problems, supporting the two symptom clusters model of ADHD. With respect to internalizing problems, inattention problems associated more with anxiety according to parents and with depression according to teachers.

The differences in levels of inattention, hyperactivity and aggression between boys and girls found in this study are similar to those that have been found between boys and girls with ADHD in nonreferred populations (Gaub & Carlson, 1997b), supporting the view that sex differences that have been observed in studies of ADHD might be a reflection of normal sex variation and not a specific attribute of ADHD.

The fact that boys are rated more aggressive than girls both according to parents and teachers might be explained by the effect of sex hormones on behaviour. A study has shown that there is a positive relationship between levels of testosterone and serious aggression in preschool boys (Sánchez-Martín et al., 2000). Another study found significantly higher levels of androgen in male but not in female adolescents with elevated scores of externalizing behaviour. The study also showed that boys with persistent externalizing behaviour had the highest levels of androgens (Maras et al., 2003).
It is suggested that more aggressive behaviour in boys than girls may be inflating their ADHD ratings especially among teachers. It seems that more aggressive behaviour is a normal attribute of being a boy (e.g. Hudziak et al., 2003) and the question remains if there might be other ways to tackle boys’ aggressive behaviour problems than with medication. Parent management training has been shown to be an effective means of treating aggression in children (e.g. Kazdin, 2000) and social cognitive intervention programs have shown promising results (Van Manen et al., 2004). In view of the difference between the genders in temperament and personality traits, such as aggression, it might be possible that different teaching methods are needed for boys and girls. Teaching the genders in separate classes might be interesting to try.

The poor concordance between parents and teachers in their ratings of ADHD symptoms in girls in this study is an unexpected and new finding that may be of clinical importance. According to DSM-IV diagnostic criteria for ADHD, symptoms have to be present in multiple settings e.g. both at home and at school. Poor interrater agreement has been found to decrease diagnostic rates for ADHD in a clinical sample (Wolraich et al., 2004). The poor concordance between parents’ and teachers’ ratings of ADHD symptoms with respect to girls may result in their underdiagnosis and can potentially partly explain the much higher diagnostic rates of boys with ADHD.
REFERENCES


Chapter two


