



BSc in Psychology

Gender difference in Attention deficit hyperactivity disorder among adolescents in Iceland

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Foreword

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavik University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.

Abstract

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder which consists of symptoms of inattention and hyperactivity-impulsivity. ADHD can have a significant impact on well-being, academic achievement, and communication of children and adolescents. Previous studies showed that ADHD was more common among boys rather than girls. However, girls showed more inattention symptoms of ADHD. In the current study, gender differences on ADHD diagnosis and medication were examined. Gender differences in symptoms manifestation of inattention, hyperactive-impulsive and combined type of ADHD were also examined, also if boys are overdiagnosed and if girls are underdiagnosed. Also, were measured whether ADHD affected school performance. The participants were students in all elementary schools in Iceland and were in 8th, 9th and 10th grade. The data in the study was from ICSRA. The results showed that there was no significant gender difference in meeting the screening for the combined and the inattentive type of ADHD, but more boys met screening for the hyperactive-impulsive type. Significantly more boys than girls said they were diagnosed with ADHD and received medication for ADHD. The results also showed that ADHD had an impact on school performance.

Keywords; gender differences; adolescents; ADHD; combined type; inattention; hyperactivity; impulsivity; overdiagnoses; underdiagnoses; school performance.

Útdráttur

Athyglisbrests- og ofvirkni-röskun (ADHD) er taugabroskaröskun sem samanstendur af einkennum athyglisbrests og/eða ofvirkni og hvatvísi. ADHD getur haft veruleg áhrif á árangur í skóla eða vinnu, líðan og samskipti barna og unglunga. Fyrri rannsóknir sýna að ADHD sé algengara meðal stráka en að stelpur sýni meiri einkenni af athyglisbrest. Í þessari rannsókn var kynjamunur á ADHD greiningum og lyfjameðferðum skoðaður. Kynjamunur á birtingamynd einkenna á athyglisbrests- og ofvirkni-hvatvísis- og blandaðari gerð ADHD var einnig skoðaður, og hvort strákar séu ofgreindir, stelpur séu vangreindar. Einnig var mælt hvort ADHD hafi áhrif á árangur í skóla. Þátttakendur voru nemendur í 8., 9., og 10. Bekk í öllum grunnskólum á Íslandi. Gögnin í rannsókninni voru frá ICSRA. Niðurstöðurnar sýndu að ekki var marktækur kynjamunur á að mæta greiningarviðmiðum fyrir blandaðri gerð né athyglisbrest gerð ADHD, en fleiri strákar mættu greiningarviðmiðum fyrir ofvirkni-hvatvísis gerð. Þó voru marktækt fleiri strákar sem sögðust vera með ADHD greiningu og á lyfjum við ADHD. Niðurstöðurnar sýndu einnig að ADHD hafi áhrif á árangur í skóla.

Lykilorð: kynjamunur, unglingar; ADHD; blönduð gerð, athyglisbrestur; ofvirkni; hvatvísi; ofgreiningar; vangreiningar; skólaárangur.

Gender differences in Attention deficit hyperactivity disorder

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder, which consists of symptoms of inattention and hyperactivity-impulsivity (American Psychiatric Association, 2013). ADHD is one of the most prevalent diagnosed childhood disorders (Barkley, 2014). Population surveys indicate that about 5% of children have ADHD (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007) and about 2.5% of adults (Barkley, 2014). The latest researches in Iceland suggests a similar prevalence, or about 5% of adolescents meeting diagnostic criteria for ADHD (Gudjonsson, Sigurdsson, Sigfusdottir, & Young, 2012, 2014).

Inattention appears behaviorally as poor persistence, for example, having difficulty in maintaining focus, wade from one task to another, difficulty organizing tasks and activities, and being easily distracted by extraneous stimuli. (American Psychiatric Association, 2013). Hyperactivity refers to excess activity when it is inappropriate, excessive fidgeting or talkativeness, for example, answering a question before it has been completed. A child with ADHD could exhibit exaggerated body movements, for example, running around, climbing and having difficulty sitting still. In adults, ADHD symptoms could manifest as extreme restlessness. Impulsivity applies to rapid behavior without forethought, like making important decisions without consideration of long-term consequences, which could even lead to social intrusiveness and severe harm. The current official diagnostic criteria for ADHD is portrayed in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM 5). ADHD diagnostic criteria are met if an individual experiences six or more persistent inattention and/or hyperactivity-impulsivity symptoms that interfere with functioning or development. The symptoms are inconsistent with developmental level and have a negative impact on social activities and academic achievement. The symptoms have to persist for at least six months and have to onset before 12 years of age. For 17 years and older, at least five

symptoms are required. If the criterion for both inattention and hyperactivity-impulsivity symptoms are met for the past six months, the individual is diagnosed with a combined type of ADHD. If the criterion for inattention is met, but the criterion for hyperactivity-impulsivity is not, the individual is diagnosed with a predominantly inattentive type. In the same way, if the standard for hyperactivity-impulsivity is met, and not for the inattention, the individual is diagnosed with a predominantly hyperactive/impulsive type.

Gender differences in the manifestation of ADHD

ADHD is more frequently identified in boys than girls (Barkley, 2014) and they are more likely to receive medication than girls (Biederman et al., 2002; Gudjonsson et al., 2014). According to DSM-5, the male-to-female ratio ranges from 2:1 in children and 1.6:2 in adults (American Psychiatric Association, 2013). The male-to-female ratio in the general population studies was 3:1, and in the clinically referred samples, it was almost 9:1 (Gaub & Carlson, 1997; Gershon, 2002). One reason for such a profound difference between males and females with ADHD could be that boys are more likely to be referred to clinicians than girls (Gaub & Carlson, 1997), girls are under-identified (Sciutto & Eisenberg, 2007) and have different clinical presentations of ADHD (Biederman et al., 2002). Clinical referrals are often based on external behavior such as interference in the classroom, and studies indicate that girls show less of such behavior (Gaub & Carlson, 1997; Gershon, 2002), which may be one of the reasons why fewer girls receive ADHD diagnosis. In addition, girls have been rated higher in internalizing problems and intellectual functioning than males (Biederman et al., 1999, 2005; Gershon, 2002). Studies suggest that boys showed higher external behavior than girls (Diamantopoulou, Rydell, Thorell, & Bohlin, 2007).

Girls diagnosed with ADHD show lower ratings in hyperactivity, impulsivity and other externalizing behaviors, compared to boys (Gaub & Carlson, 1997; Gershon, 2002). With further examination of gender differences in ADHD subtypes, boys are more likely than

girls to be diagnosed with the combined type of ADHD (Biederman et al., 2002; Biederman & Faraone, 2004). However, girls are diagnosed with an inattentive type of ADHD twice as frequently as boys (Biederman et al., 2002; Biederman & Faraone, 2004).

Over-diagnosis and under-identification

Some studies suggest that the gender difference was caused by over-diagnosis (Bruchmüller, Margraf, & Schneider, 2012), where boys are more often overdiagnosed with ADHD and girls often underidentified (Biederman et al., 2002; Gaub & Carlson, 1997; Sciotto & Eisenberg, 2007). When talking about overdiagnosis of ADHD, it usually refers to those that are diagnosed but should not be (i.e., *false positives*) (Sciotto & Eisenberg, 2007). The incidence of false positive cases is not enough alone to conclude an overdiagnosis. There are also individuals who should be diagnosed, but because of unreliable diagnostic systems or other reasons, they are unidentified or undiagnosed (i.e., *false negatives*). Individuals who have not been diagnosed or identified were considered as false negatives when evaluating overdiagnosis. As described above, girls show lower ratings in hyperactive-impulsive symptoms compared to boys (Biederman et al., 2002; Gaub & Carlson, 1997; Gershon, 2002), and do not attract much attention, which could be one the reason why fewer girls are referred to ADHD assessment (Biederman et al., 2005). Another reason could be that symptoms of inattention are more likely to display in a structured educational environment, such as in college, which may lead to a higher onset of age and ADHD is less diagnosed early in childhood (Bruchmüller et al., 2012).

ADHD's impact on school performance

As previously mentioned, ADHD may have a wide and negative impact, for example at school (American Psychiatric Association, 2013; Biederman et al., 1999; Wolraich et al., 2011). Studies show that individuals with ADHD show higher school dysfunction compared to non-ADHD subjects (Biederman et al., 2005), and therefore poor school achievement

(Biederman et al., 2004; Diamantopoulou, Rydell, Thorell, & Bohlin, 2007). Boys diagnosed with ADHD are likely than girls to manifest problems in school and have learning disabilities (e.g., poor school achievement and poor grades) (Biederman et al., 2002, 2004).

Further research on gender differences in ADHD is still needed. Studies indicate that gender differences are in the manifestation of ADHD symptoms, which is important to consider when investigating ADHD further and to intervene early to prevent further deterioration. This neurodevelopmental disorder could have a significant impact on well-being, academic achievement, and communication of children and adolescents (American Psychiatric Association, 2013; Biederman et al., 1999, 2005; Wolraich et al., 2011). The purpose of this current study was to examine gender differences in ADHD among adolescents in Iceland and also the impact of ADHD on school performance. ADHD was classified into three types: combined, inattentive & hyperactive-impulsive type. Only participants who do not take medicine for ADHD were considered for that reason medication for ADHD could reduce the symptoms (Goldman, Genel, Bezman, & Slanetz, 1998; Jensen, 1999). Based on previous studies, the five hypothesis of this study were:

1. Boys were more likely than girls to have ADHD diagnosis and receive medication for ADHD.
2. It was more common among boys than girls to meet diagnostic criteria for the combined type of ADHD.
3. Boys were likely than girls to meet the criteria for the hyperactive/impulsive type.
4. Girls were likely than boys to meet the criteria for the inattentive type than hyperactive/impulsive type.
5. Boys were more likely to have ADHD diagnosis without meeting the diagnostic criteria than girls (*false positives*)
6. Girls were likely to have ADHD despite not being diagnosed (i.e., *false negatives*)

7. Adolescents who met ADHD diagnostic criteria were likely to have poorer grades than adolescents who did not meet the analytical criteria
8. Boys who met ADHD diagnostic criteria were likely than girls to have poorer grades.

Method

Participants

The data used in this study (*Youth in Iceland 2014*) were from The Icelandic Center for Social Research and Analysis (ICSRA), a survey conducted in February 2014. Total responses were received from 11013 adolescents that attended the class on the day the survey was conducted. The total response rate at the national level was 86.3% (Pálsdóttir et al., 2014). The participants were students in all elementary schools in Iceland and were in 8th, 9th and 10th grade. The participants did not receive compensation for their participation.

A random sample using 2055 participants answers from the original study was utilized, including 992 boys, 1036 girl and 27 did not give up their gender. In this study, only participants who do not take medicine for ADHD were considered ($N = 1855$), total 879 boys and 976 girls.

Procedure

Printed questionnaires were sent to all elementary schools in Iceland in February 2014. The survey was submitted by the teachers, on the same day in all schools. The estimated response time was one hour. Students were asked to answer the questions according to their best ability, and they could ask for help if something was unclear. Finally, the participants were asked to submit the questionnaire in an unmarked envelope to the teacher, to ensure anonymity and exclude the possibility of tracing answers to students. When everyone had answered, the teachers sent the envelopes to ICSRA.

Measurement

The measuring instrument of this study was a questionnaire designed by ICSRA (Pálsdóttir et al., 2014). The questionnaire contained 82 questions on 28 pages, about education, health, well-being, and alcohol/drug consumption. Statistic program IBM SPSS 24 was used to analyze the data (Field, 2013). This study is based on five questions, which form the parameters of the study. The following questions were used:

Gender. Participants were asked to answer the question "Are you a girl or a boy?" which was on a two-point scale: 1 = boy and 2 = girl.

ADHD symptoms. An 18-item self-reported questionnaire was used to screen for ADHD symptoms, which contained nine inattention symptoms and nine hyperactivity-impulsivity symptoms (Barkley, 1998). Participants had to answer how often they experienced these symptoms in the last six months (never or rarely, sometimes, often and very often) (see Appendix A). Inattentive or hyperactive/impulsivity type of ADHD was assigned if six or more of nine symptoms of inattention or hyperactive/impulsive items were answered as either "often" or "very often". This classification gave the subtypes of ADHD: inattentive and hyperactive/impulsive. The combined type is classified if both criteria filled.

ADHD diagnosis and medication. Participants were also asked if they had an ADHD diagnosis and if they took medication for ADHD, the answer options to both questions were 1 = yes or 2 = no. Only those participants who did not receive ADHD medication were examined, for that reason, medication for ADHD could reduce the symptoms of ADHD (Goldman et al., 1998; Jensen, 1999) and distort results.

School performance. The respondents answered questions about their grades that school year. In Iceland the grades ranges from 0 to 10, the response format was 1 = under 4, 2 = about 4, 3 = about 5, 4 = about 6, 5 = about 7, 6 = about 8, 7 = about 9, 8 = about 10. The

value "under 4" was taken out to get the mean score of the average grades. School performance was estimated with an average grade in Icelandic, English, and Mathematics.

Statistical Analysis

Chi-square test was used to analyze gender differences in diagnosis, medical status and on all three subtypes of ADHD. The independent variable was gender and the dependent variables were ADHD diagnosis, the diagnostic criteria, and medical status. The Chi-square test was also used to determine over- and underdiagnoses, if those who meet ADHD diagnostic criteria were more likely to have ADHD diagnosis, and whether a gender difference exists. The independent variable was gender, and the dependent variables were over- and underdiagnoses. Independent sample t-test was used to analyze if ADHD affected school performance among ADHD adolescents. The independent variable was ADHD, and the dependent variable was school performance. Another independent sample t-test was used to analyze gender difference among ADHD adolescents. Only participants who met ADHD diagnostic criteria for the combined type were examined. The independent variable was gender, and the dependent variable was school performance.

Results

Total responses in this study were 2055, and 260 (13.1%) of those participants who had an ADHD diagnosis. Three chi-square tests were used to test hypothesis 1, regarding gender difference in ADHD and medication. Significantly more boys had ADHD diagnosis than girls, $\chi^2(1, N = 206) = 27.426, p < .00$. More boys (8.8%) than girls (4.3%) said they were taking ADHD medicine, $\chi^2(1, N = 129) = 16.536, p < .001$. Participants who receive ADHD medication were then excluded, as medication may affect the symptoms of ADHD (Goldman et al., 1998; Jensen, 1999). Among those who did not receive ADHD medication 139 (7.5%) had ADHD diagnosis. Significantly more boys (9.7%) than girls (5.6%) received

ADHD medication, $\chi^2(1, N = 139) = 11.444, p < .05$. All three tests were significant and therefore the hypothesis 1 passed.

Of those who did not receive medication when responding to Barkley's self-reported scale (1998), 38 (2.2%) met screening for combined type of ADHD, 75 (4.3%) for inattentive type and 67 (3.8%) for hyperactive-impulsive type (See Table 1).

Table 1.

Percentage within gender of those who meet the diagnostic criteria for all the subtypes of ADHD.

	Meet screening for:		
	Combined	Inattentive	Hyperactive-
	type	type	impulsive type
	(<i>N</i> = 38)	(<i>N</i> = 75)	(<i>N</i> = 67)
Boys	2.9	4.8	4.8
Girls	1.7	3.9	2.9
Total	2.2	4.3	3.8

Cronbach's Alpha reliability test was run for the 18-item ADHD symptom scale, and in the current study, the Cronbach's Alpha for the combined type of ADHD was .89. For the one 9 question scale, each for the inattention and the hyperactive-impulsivity type of ADHD, the Cronbach's Alpha was .82 for inattention and .83 for hyperactivity-impulsivity.

Chi-square tests were used to test hypothesis 2-4, regarding gender differences in ADHD subtypes. Regarding meeting the diagnostic criteria with the combined type of ADHD, the difference was not significant, $\chi^2(1, N = 38) = 3.065, p = .080$. There was no significant difference between girls and boys with the inattentive type of ADHD, $\chi^2(1, N = 75) = .924, p = .336$. Therefore, hypothesis 2 and 4 cannot pass. However, boys were more

likely to meet the diagnostic criteria for the hyperactive-impulsive type of ADHD than girls, $\chi^2(1, N = 67) = 4.508, p < .05$. Those results support hypothesis 3.

Hypothesis 5 suggest overdiagnosis among boys. To determine overdiagnosis in this sample, those who had ADHD diagnosis were compared to those who did not meet ADHD diagnostic criteria. As shown in Table 2, it was compared to all three subtypes of ADHD.

Table 2.

False positives: Number of participants who have an ADHD diagnosis and do not meet screenings for the subtypes of ADHD

	Non- combined (<i>N</i> = 111)	Non- inattentive (<i>N</i> = 110)	Non-hyperactive- impulsive (<i>N</i> = 110)
Have been diagnosed			
Boys	8.8	8.8	8.5
Girls	4.9	4.7	4.3
Total	6.7	6.6	6.5

Chi-square test revealed that boys were more likely than girls to have ADHD diagnosis without meeting the diagnostic criteria for the combined type of ADHD, $\chi^2(1, N = 111) = 9.695, p < .05$. The results support hypothesis 5.

In the same way, to test hypothesis 6, the underdiagnoses was determined by comparing those had received ADHD diagnosis with those meeting the diagnostic criteria for ADHD. A Chi-square test did not show any significant differences in underdiagnoses between boys and girls, $\chi^2(1, N = 67) = 9.695, p < .05$. Based on these results, it cannot be concluded that girls are underdiagnosed and therefore, hypothesis 6 was not supported. Table 3 shows an overview of comparison to all three subtypes.

Table 3.

False negatives: The presentence of participants, by gender, who do not have ADHD diagnosis but meet the screening for the subtypes of ADHD

	Combined type	Inattentive type	Hyperactive- impulsive type
Have not been diagnosed	(<i>N</i> = 28)	(<i>N</i> = 59)	(<i>N</i> = 49)
Boys	73.9	78.9	72.5
Girls	78.6	82.9	76.9
Total	75.5	80.8	74.2

The impact of ADHD on school performance was examined. Independent samples t-test was used to see if ADHD affected school performance among those meeting the diagnostic criteria for the combined type. The results showed a significant difference and therefore support hypothesis 7; ADHD adolescents had a lower average grades ($M = 7.8$, $SD = 1.15$) than those who did not have ADHD ($M = 8.5$, $SD = 1.24$), $t(1658) = 3.63$, $p < .001$.

Another independent samples t-test was used to examine gender differences in school performance among adolescents who met the diagnostic criteria for the combined type. The results was significant and therefore supported hypothesis 8; ADHD boys had lower average grades ($M = 8.3$, $SD = 1.15$) than girls ($M = 8.5$, $SD = 1.18$), $t(1754) = -3.70$, $p < .001$.

Discussion

The results of this study indicated gender differences in ADHD diagnosis and hyperactive-impulsive symptoms of ADHD, similar to previous studies (American Psychiatric Association, 2013; Barkley, 2014; Biederman et al., 2002; Biederman & Faraone, 2004; Gaub & Carlson, 1997; Gershon, 2002; Gudjonsson et al., 2014). Hypothesis 1 suggests more boys than girls have ADHD diagnosis, meet the screening for ADHD and were

more likely to receive ADHD medication. Chi-square tests were significant for and therefore supports the hypothesis. Participants responded to Barkley's self-report scale which containing nine inattentive and hyperactive-impulsive symptoms (Pálsdóttir et al., 2014). As previous studies suggest, boys were more likely than girls to have ADHD, showed more hyperactive-impulsive symptoms (Biederman et al., 2002; Biederman & Faraone, 2004; Gaub & Carlson, 1997; Gershon, 2002). The findings in this study showed a similar result, showed that the combined type and the hyperactive-impulsive type were more common among boys than girls. These results supported hypothesis 2 and 4. Previous studies have indicated that girls show less of hyperactivity, impulsivity and external behavior (Biederman et al., 2002; Bruchmüller et al., 2012; Gaub & Carlson, 1997; Gershon, 2002). However, girls show more intellectual impairments (Biederman et al., 1999, 2005; Gershon, 2002) and are more likely to meet diagnostic criteria for the inattentive type of ADHD. Hypothesis 4 was confirmed since results revealed that girls were more likely to meet the criteria for the inattentive type of ADHD.

Studies suggested that boys were overdiagnosed (Bruchmüller et al., 2012) and girls were often under-diagnosed (Biederman et al., 2002; Gaub & Carlson, 1997; Sciotto & Eisenberg, 2007). According to Sciotto and Eisenberg's (2007) explanations of overdiagnosis, it can be concluded that boys may potentially be over-diagnosed and therefore support hypothesis 5. The results showed that boys in this sample are more likely than girls to have ADHD diagnosis without meeting the criteria for ADHD. However, hypothesis had to be rejected since the results showed no significant difference between gender. The results indicated that girls are not more likely to be underdiagnosed than boys. On the other hand, more boys met the screening for all three subtypes of ADHD, without having a diagnosis. However, the fact that few sections of participants meet the diagnostic criteria could affect

the results, as responses decreased even more when taking out those who receive ADHD medication.

Research showed that ADHD could have a negative impact on people's lives (American Psychiatric Association, 2013; Biederman et al., 1999, 2005; Wolraich et al., 2011), including in academic achievement, well-being, health and social conditions. Further researches on ADHD among adolescents were necessary because of these adverse effects. It was examined whether the impact of ADHD symptoms affected school performance. As previous studies indicated (Biederman et al., 2002, 2004, 2005; Diamantopoulou et al., 2007), the findings in the current study showed that ADHD had a significant effect on the school performance, which supports hypothesis 7. Research show ADHD boys are likely to manifest problems in school and have learning disabilities (Biederman et al., 2002, 2004). The findings of this study showed similar results; boys had significantly poorer average grades than girls. However, it is good to keep in mind that different ways to assess school performance are, for example, grades which can vary tremendously between countries

The main advantage of the study was that the data from ICSRA that have been developed for many years and have a high response rate on a national level (86.3%) (Pálsdóttir et al., 2014). The questionnaire included the Barkley's (1998) Self-Reported scale of ADHD, which has shown to have good psychometric properties. The major limitation of this study is that the Barkley's self-report questionnaire alone is not a competent measurement for ADHD. For example, ADHD frequently overlaps with other mental disorders such as Conduct disorder and Oppositional Defiant Disorder (American Psychiatric Association, 2013; Scituito & Eisenberg, 2007). Inattentive symptoms such as “difficulty in maintaining focus” can be symptoms of stress, anxiety, and depression (American Psychiatric Association, 2013). Besides, different ADHD analytical criteria may be used in research. Further research may investigate ADHD in other ways than just using a self-assessment

scale. It would also be interesting to assess the gender differences among ADHD adolescents on other factors, such as school contentment and comorbidity on other psychiatric disorders.

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