

ATTENTION DEFICIT/HYPERACTIVITY DISORDER AND COMORBID DISORDERS IN 6-12 YEAR OLD GIRLS AND BOYS

Kristina SESAR¹, Arta DODAJ², Damir SESAR³

¹Centre of Mental Health, Široki Brijeg Health Care Centre and ³Široki Brijeg Health Care Centre, Široki Brijeg, Bosnia and Herzegovina, ²Department of Psychology, University of Mostar Mostar, Bosnia and Herzegovina

Corresponding author:

Kristina Sesar
Centre of Mental Health, Široki Brijeg Health Care Centre
Dr. J. Grubišića 11
88 220 Široki Brijeg
Bosnia and Herzegovina
kristina.sesar@tel.net.ba
Tel.: + 387 39 703 870
Fax.: + 387 39 704 936

Received: December 16, 2013

Accepted: January 20, 2014

Copyright © 2014 by University Clinical Hospital Tuzla. E-mail for permission to publish: *paediatricstoday@ukctuzla.ba*

Introduction

Attention deficit/hyperactivity disorder (ADHD) is one of the most common neuro-psychiatric disorders in childhood and adolescence. The *Diagnostic and Statistical Handbook for Mental Disorders (DSM-V)* defines three ADHD clinical phenotypes: attention difficulties, hyperactivity/impulsivity and the combined subtype (1).

The frequency of ADHD at school age varies between 5% and 12% (2-7). Boys are

Objective – The aim of this study was to examine the prevalence of attention deficit/hyperactivity disorder (ADHD) and to identify comorbid disorders according to subtype of ADHD. **Method** – The study sample included 404 children aged from 6-12 years old. Parents completed The Child Behaviour Checklist/4-18 to detect internalizing and externalizing psychological difficulties in children. Assessment of ADHD was performed using the Attention-Deficit/Hyperactivity Disorder Test. **Results** – ADHD symptoms were found in 15% of girls and 12.1% of boys. The differences in the frequency of different subtype of ADHD in terms of the gender were obtained for the subtype of hyperactivity ($Z=-2.075$, $p=0.038$). Boys had more pronounced symptoms of hyperactivity compared to girls. There was no statistically significant gender difference for the subtype of impulsivity ($Z=-1.422$, $p=0.155$) and inattention subtype ($Z=-0.234$, $p=0.815$). The results obtained showed a higher prevalence of internalized and externalized difficulties with the combined subtypes of ADHD compared to other subtypes. **Conclusion** – ADHD is a complex condition, affecting a significant number of children and therefore it needs to be better identified. Children who seek medical or psychological help have at least one or more comorbid disorder and these problems also need to be appropriately identified and treated.

Key words: ADHD ■ Internalizing and externalizing psychological difficulties ■ Comorbidity ■ Gender.

from 2 to 9 times more affected than girls (1). The differences in frequency vary due to factors such as the way ADHD is defined, the weaknesses of the precisely determining factors of ADHD and subjective differences in assessments between parents, teachers and professionals (8). Some research has dealt with examining the connection between gender and DSM-IV subtypes of ADHD. It was established that attention problems are more common in girls (9-10), whilst in some other research this was not confirmed (11-12).

ADHD is linked to a wide spectrum of negative consequences for the person diagnosed with it, and with a high level of comorbidities (13-15). Comorbidities, which include oppositional defiant disorder (35%), conduct disorders (30-50%), anxiety disorders (25%) and mood disorders (15-75%) have been found in children with diagnosed ADHD (2). A high level of comorbidities has also been established through epidemiological research (16-20). In population research undertaken on girl twins, to establish comorbidities of ADHD, a connection was established between attention problems and oppositional defiant disorder; a combined subtype of ADHD with oppositional defiant disorder, separation anxiety and depressive syndrome (21). In another population study, which included boy and girl twins aged from 7 to 19 years, five significant clusters were established: no comorbidity; depression, oppositional defiant disorder and conduct disorder; oppositional defiant disorder; oppositional defiant disorder, conduct disorder and depression (22). In children with high levels of ADHD symptoms, high levels of comorbidities were established with oppositional defiant disorder and conduct disorder, and lower levels of comorbidities with mood disorders and anxiety (23).

In some research conducted so far (24) comorbidity of ADHD and internalized emotion disorder was established, whilst the results of other research indicate that comorbidity of ADHD and internalized emotion disorder do not necessarily indicate a severe form of ADHD (25). Some authors undertook research into whether the frequency of anxiety disorder was characteristic for certain subtypes of ADHD. An increased level of anxiety was established in children who did not have any expressed symptoms of hyperactivity, in relation to those who have expressed symptoms of hyperactivity (26). Lower levels of impulsivity were found in children who had ADHD with

symptoms of anxiety, in relation to children without anxiety symptoms (27).

Regarding the frequency of comorbidities of ADHD in relation to gender, in a meta-analysis undertaken by Gaub and Carlson (28) it was established that, in comparison with boys, girls with ADHD had greater intellectual deficits, a lower level of hyperactivity, a lower level of conduct disorder, and a higher level of mood disorder and anxiety disorder. Moreover, girls with ADHD in comparison with girls without ADHD had lower success in school, and more difficulties in social, school and family functioning (29). The same form of comorbidity and dysfunction was also found in boys with ADHD. The frequency of conduct disorders and oppositional defiant disorder established in boys without ADHD was half that found in boys with ADHD (30).

The assessment of the psychological condition of a child by its parents is very interesting for both researchers and clinicians. With the help of the Child Behaviour Check List (CBCL) it is possible, with a very high degree of reliability, to identify children with a greater degree of risk of the development of some form of psychological disorder (31). Kroes et al. (32) attempted to establish the degree of connection between data obtained using the CBCL and the subsequent occurrence of a psychiatric diagnosis in children, based on the criteria defined in the DSM-IV. They concluded that the CBCL is a good quality instrument, which may be used to predict the occurrence of various types of problems in the behaviour of children and adolescents. Longitudinal studies relating to the stability of the assessment of parents demonstrate the high level of reliability of their assessments over a long period of time, for various types of psychological problems (33-34). It was also confirmed that gender or age does not affect the stability of the assessment. The assessment of parents has better predictive capacity

and stability than assessments by pre-school or school teachers, and therefore it is justified to use this instrument to assess comorbid disorders in children with ADHD. In our country there is no organized, systematic monitoring of school children, which would reveal symptoms or psychological problems in the general population, and the same applies to the frequency of ADHD and internalizing or externalized psychological difficulties.

The aim of this research was to establish the frequency of ADHD in elementary school children, and examine the type and frequency of comorbid psychological disorders in children in whom symptoms of ADHD were diagnosed.

Method

Subjects

Children aged from 6 to 13 years, who attended the first and second public elementary schools in Široki Brijeg, were rated by their parents. A total of 850 questionnaires were distributed to parents during parents' meetings. Of the total of 850 questionnaires distributed, 560 completed questionnaires were returned, 159 were incomplete, and 131 were not returned. The data analysis comprised data for 209 girls and 195 boys, for whom the questionnaires had been completed adequately.

Materials

The social demographic characteristics taken into consideration in the research were: gender, age, and the class the child attended. For an assessment of the symptoms of problems with attention, hyperactivity and impulsivity, the Attention-Deficit/Hyperactivity Disorder Test (ADHDT) was used (35). ADHDT is a standardized test intended for assessment of the behaviour of persons with ADHD or persons with behavioural problems, and for

diagnosing pupils with ADHD. The test is based on the Diagnostic and Statistical Manual of Mental Disorders (1) definition of ADHD, and consists of 36 items distributed into three subtests: the hyperactivity subtest (13 items), the impulsivity subtest (10 items) and the inattention subtest (13 items). The task of the participants is to determine for each of these behaviours the degree to which it is problematic in assessment of the individual (0 – no problem, 1 – mild problem, and 2 – serious problem). The ADHDT is easy to complete so it can be used by various estimators and examiners, such as teachers, parents or psychologists. In our research the assessment of the child's behaviour was undertaken by the parents. When categorizing participants with symptoms of ADHD, on the basis of the instructions in the test, the results were converted into standardized measures, and then a value was taken when the result was above the 65th percentile. Participants were divided into five subgroups: groups without symptoms of ADHD, combined subtype of ADHD, impulsivity subtype of ADHD, hyperactivity subtype of ADHD and inattention subtype of ADHD.

In our research, the alpha coefficients for each scale showed satisfactory reliability in a range of 0.856 to 0.910. The alpha coefficient established for the entire scale was 0.950. The Child Behaviour Check List (CBCL/4-18) (31) is used to assess the internalized and externalized psychological problems of children. It is one of the most frequently used instruments in child and adolescent psychiatry. It is used to assess the child's development profile, and it detects emotional problems and behavioural problems in children and adolescents. The questionnaire consists of two basic parts: the Competencies and Adaptive Scales and Empirically Based-Syndrome and Total Problem Scales. In the first part the behaviour and adaptation capacities of the child are assessed. On this basis four separate

scales are created – activity, social capacity, school capacity and overall capacity. The second part has 118 items relating to the child's behaviour. In this research we used the second part of the scale for assessment.

For each of the items in the questionnaire there is a scale with three degrees for reply (0- not true or almost never, 1 – sometimes or partially true, 2 – completely true or this often relates to him/her).

The Total Problem scale can be divided into 9 syndrome subscales: anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviour (delinquent behaviour), and aggressive behaviour. The scales of wider problems indicate internalizing and externalizing behaviour. The dimension of internalized problems comprises the scales of anxiety/depression, withdrawal/depression, and somatic complaints.

The dimension of externalized problems comprises the scales of maladjusted behaviour in various situations, which creates problems for others in the child's environment, or has a negative effect on the child's environment. This includes the scales of aggressive behaviour, and the scale of rule-breaking behaviour (delinquent behaviour). The assessments in our research were obtained from the child's parents. In categorizing the participants with psychological difficulties, the value was taken whose result was above the 65th percentile.

In our research the alpha coefficients of reliability established for individual subscales were in a range from 0.61 to 0.87, and indicate the satisfactory reliability of the type of internal consistency. The alpha coefficient for the entire scale was 0.94.

The research procedure

The research was conducted in accordance with the ethical standards of psychological research. It was conducted during April 2013. At parents' meetings, organized for that pur-

pose in the schools where the research was undertaken, the basic aims of the research were explained in detail to the parents, and they were acquainted with the structure of the questionnaire and how it should be completed. They were guaranteed data confidentiality. The questionnaires were placed in a self-adhesive envelope and distributed to the parents so they could complete them at home in privacy. When they had completed them, they were instructed to place them in the envelope, seal it and give it to the teacher. The conduct of the research was approved by the Ministry of Education and Sport of the County of Western Herzegovina and the head teachers of the First and Second Elementary Schools in Široki Brijeg.

Statistical analysis

The results for all subscales of the ADHDT and the CBCL/4-18 were formed as a simple linear combination. In order to verify the normality of distribution of the results on these subscales, the Kolmogorov-Smirnov test was used. The distribution of all results deviated significantly from normal, so non-parametric statistical methods were used. These methods are aimed at testing hypotheses about the form, dispersion or median of a population from which research data originate. Therefore, for presentation of the mean values and dispersion measures of the tested variables, the median and dispersion of the lower (25%) and upper (75%) quartiles were used. Differences in the prevalence of ADHD with regard to gender were tested with Mann-Whitney non-parametric test for two independent samples. Kruskal Wallis non-parameter variance analysis was used (ANOVA) for testing the differences in comorbid disorders according to the subtype of ADHD. The statistical analyses were conducted using the computer program StatSoft, Inc. (2004), STATISTICA (data analysis software system), version 7. www.statsoft.com.

Results

According to the criteria described above, in the total sample of subjects, ADHD symptoms were found in 27.2% children (Table 1). The analysis of the results in terms of the gender of the subjects showed that ADHD was found in 15% of girls and 12.1% of boys. However, if the results are analysed in terms of ADHD subtype, from the results given in Table 1 it is clear that the combined subtype of ADHD was found in 8.7% of girls and 3.5% of boys.

Statistically significant gender differences in the subscales of ADHD were obtained only for the subscale of hyperactivity ($Z=-2.075$, $p=0.038$). Boys had more pronounced symptoms of hyperactivity compared to girls. There was no statistically significant gender difference for the subscale of impulsivity ($Z=1.422$, $p=0.155$) and inattention ($Z=-0.234$, $p=0.815$).

The differences in the frequency of different subtypes of ADHD in terms of the gender of the participants were tested using the χ^2 test. The differences obtained showed statistical significance (χ^2 test=11.758; $df=3$; $p=0.019$). The combined subtype of ADHD was more frequent in girls than in boys. On the other hand, the hyperactivity subtype was more frequent in boys.

By analysis of the results on the assessment scale, according to the criteria described

above, for the whole sample, some form of psychological difficulty was found in 276 subjects (68%), whilst in 128 subjects (32%) no psychological difficulties were found.

Further, by analysis of the results, the expression of the psychological difficulties was established in terms of the specific ADHD subtype. The frequency of psychological difficulties with the combined subtype of ADHD is shown in Table 2. The highest percentage of girls with the combined subtype of ADHD had difficulties related to aggressive behaviour, anxiety/depression, attention problems, social problems and thought problems. In boys, the largest percentage had problems with aggressive behaviour, attention problems, rule-breaking behaviour, social problems, withdrawal/depression and anxiety/depression.

In Table 2 the results are shown of the analysis of the comorbid disorders in children in whom the hyperactivity subtype was found. From these results it is clear that the girls found to have this subtype have a higher frequency of comorbid disorders, such as aggressive behaviour, attention problems and anxiety/depression, in comparison with girls with no symptoms. The comorbid disorders which are more frequent in boys in whom the hyperactivity subtype was established in comparison with boys without symptoms are: aggressive behaviour, anxiety/depression, attention problems and thought problems.

Table1 Prevalence of Attention-deficit/hyperactivity disorder

Attention-deficit/hyperactivity disorder	Girls	Boys	Total
	n (%)	n (%)	n (%)
Without symptoms	148 (36.7)	146 (36.1)	294 (72.8)
Hyperactivity	6 (1.4)	13 (3.2)	19 (4.7)
Impulsivity	14 (3.5)	13 (3.2)	27 (6.7)
Inattention	6 (1.4)	9 (2.2)	15 (3.7)
Hyperactivity, impulsivity, and inattention	35 (8.7)	14 (3.5)	49 (12.1)
Total	209 (51.7)	195 (48.2)	404 (100)

χ^2 test=11.758; $df=3$; $p=0.019$.

Table 2 Prevalence of associated disorders in combined, hyperactive, impulsivity and inattention subtype of ADHD

Child Behaviour Check List		ADHD subtypes																							
		Combined						Hyperactivity						Impulsivity						Inattention					
		Girls			Boys			Girls			Boys			Girls			Boys			Girls			Boys		
		n	M	IQR	n	M	IQR	n	M	IQR	n	M	IQR	n	M	IQR	n	M	IQR	n	M	IQR	n	M	IQR
Anxious/Depressed	No	10	1	2	7	1	1	3	0	2	8	0	1	5	1	2	8	2	1	3	0	1	7	2	2
	Yes	25	8	5	7	5	7	3	6	4	5	5	5	9	4	1	5	3	1	3	2	2	2	5	5
Withdrawn/Depressed	No	16	1	1	6	0	1	4	0	1	10	0	1	9	0	1	12	1	1	2	0	0	3	1	1
	Yes	19	2	2	8	5	4	2	3	2	3	4	3	5	2	0	1	2	2	4	4	2	6	3	2
Somatic complaints	No	11	0	0	5	0	0	3	0	0	8	0	0	4	0	0	5	0	0	3	0	0	2	0	0
	Yes	24	1	2	9	1	1	3	1	4	5	3	1	10	2	2	8	1	1	3	2	3	7	1	3
Social problems	No	9	0	1	4	1	1	3	0	1	11	0	1	9	0	0	5	0	0	4	0	0	4	1	1
	Yes	26	4	3	10	3	6	3	3	2	2	2	1	5	2	0	8	2	1	2	4	5	5	2	2
Thought problems	No	14	0	1	7	0	1	4	0	1	10	0	1	11	0	1	8	0	1	3	0	0	4	0	1
	Yes	21	3	4	7	2	2	2	2	1	3	3	2	3	4	3	5	2	2	3	1	1	5	2	1
Attention problems	No	7	1	2	1	0	0	3	3	3	9	1	2	11	2	1	10	2	2	5	0	2	2	2	2
	Yes	28	6	3	13	6	2	3	5	1	4	5	1	3	6	2	3	5	4	1	10	0	7	8	5
Rule-breaking behaviour	No	11	0	0	4	0	0	4	0	0	7	0	0	10	0	0	4	0	0	5	0	0	3	0	0
	Yes	24	1	1	10	3	3	2	2	1	6	1	1	4	1	1	9	1	2	1	0	0	6	2	2
Aggressive behaviour	No	12	2	3	2	2	4	4	3	2	7	2	3	5	2	2	4	4	1	4	2	2	6	3	2
	Yes	23	10	4	12	9	7	2	12	1	6	10	3	9	9	6	9	7	3	2	6	1	3	2	3

ADHD=Attention deficit/hyperactivity disorder; M=Median; IQR=Interquartile range.

The frequency of the comorbid disorders in girls and boys with and without symptoms of impulsivity are shown in Table 2. Girls with the subtype impulsivity more frequently have clinically significant symptoms of aggressive behaviour, attention problems, thought problems, and anxiety/depression in comparison with girls without symptoms of impulsivity. In contrast to the girls, boys with symptoms of impulsivity more often have clinically significant aggressive behaviour, attention problems and anxiety/depression.

Attention problems, aggressive behaviour, social problems and withdrawal/depression are the most frequent associated psychological problems in children with the identified inattentive subtype. In boys the most frequent comorbid disorders, in relation to boys without attention problems, are anxiety/de-

pression, withdrawal/depression and attention problems (Table 2).

Statistically significant differences were found in the comorbid disorders for all forms of ADHD subtype (Table 3). Children with the combined subtype have statistically significantly more problems with anxiety/depression, withdrawal/depression, somatic complaints, social problems, thought problems, attention problems, rule breaking behaviour and aggressive behaviour than children without symptoms of ADHD. Also, children with the combined subtype have statistically significantly more social problems and attention problems than children in whom the hyperactivity subtype was found, and children with the impulsivity subtype (Table 3). Anxiety/depression, aggressive behaviour, social problems, somatic complaints and thought

Table 3 Prevalence of associated disorders according to the subtype of ADHD for whole sample

Child Behaviour Check List	ADHD subtypes										K-W χ^2	Post Hoc (Tukey test)	
	NS		H		I		IA		CT				
	M	IQR	M	IQR	M	IQR	M	IQR	M	IQR			
Anxious/Depressed	1	2	2	5	3	2	1	2	4	7	76.272*	I>NS	p<0.001
												CT>NS	p<0.001
Withdrawn/Depressed	0	1	1	2	1	1	3	4	2	3	74.192*	IA>NS	p<0.001
												CT>NS	p<0.001
Somatic complaints	0	0	0	2	1	2	1	2	1	2	43.842*	I>NS	p=0.004
												IA>NS	p=0.031
												CT>NS	p<0.001
Social problems	0	1	1	1	1	2	1	2	3	4	84.007*	I>NS	p=0.032
												CT>NS	p<0.001
												CT>H	p=0.012
												CT>I	p=0.032
Thought problems	0	1	1	2	1	2	1	2	1	3	46.685*	CT>NS	p<0.001
												I>NS	p=0.032
												IA>NS	p=0.012
Attention problems	2	3	3	4	3	1	5	7	5	3	83.652*	CT>NS	p<0.001
												CT>H	p=0.006
												CT>I	p=0.036
Rule-breaking behaviour	0	0	0	1	0	1	0	2	1	2	50.369*	CT>NS	p<0.001
Aggressive behaviour	3	2	5	9	6	5	5	5	7	7	66.645*	I>NS	p<0.001
												CT>NS	p<0.001

ADHD=Attention deficit/hyperactivity disorder; NS=no symptoms; H=hyperactivity; I=impulsivity; IA=inattention; CT=combined subtype; M=Median; IQR=Interquartile range; *p<0.001.

problems were found statistically significantly more often in children with the impulsivity subtype than in children without ADHD symptoms. Children in whom the inattentive subtype was found have statistically significantly more symptoms of withdrawal/depression, somatic complaints and thought problems than children without symptoms.

The analysis of the results obtained for girls with the combined subtype of ADHD showed statistically significantly more symptoms of anxiety/depression, symptoms of withdrawal/depression, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviours and

aggressive behaviour than in girls without symptoms of ADHD. Moreover, girls with the combined subtype also have a statistically significantly higher level of problems with attention than girls with the inattentive subtype (Table 4). A clinically significant, higher level of symptoms of anxiety/depression, somatic complaints and aggressive behaviour was found in girls with the impulsivity subtype in comparison with girls without symptoms of ADHD.

The analysis of the results obtained for boys shows that statistically significant differences were found for anxiety/depression, withdrawal/depression, social problems, thought

Table 4 Prevalence of associated disorders according to the subtype of ADHD for girls and boys

Child Behaviour Check List	Sex	ADHD subtypes										K-W χ^2	Post Hoc (Tukey test)	
		NS		H		I		IA		CT			I>NS	p=0.003
		M	IQR	M	IQR	M	IQR	M	IQR	M	IQR			
Anxious/ Depressed	Girls	1	1	3	6	4	3	1	2	5	7	52.780*	CT>NS	p<0.001
	Boys	1	2	2	4	2	1	2	1	2	4	22.694*	CT>NS	p=0.004
Withdrawn/ Depressed	Girls	0	1	1	2	1	2	3	5	2	2	44.137*	CT>NS	p<0.001
	Boys	0	1	1	1	1	1	3	2	2	6	30.407*	IA>NS	p=0.003
Somatic complaints	Girls	0	0	0	1	1	1	0	2	1	2	30.881*	CT>NS	p<0.001
	Boys	0	1	0	2	1	1	1	1	0	2	15.072**	ns	
Social problems	Girls	0	1	1	3	1	2	0	2	3	4	49.256*	CT>NS	p<0.001
	Boys	0	1	1	1	2	2	2	1	2	3	36.508*	IA>NS	p=0.044
Thought problems	Girls	0	1	1	2	1	1	0	1	2	3	32.336*	CT>NS	p<0.001
	Boys	0	1	1	1	1	2	2	1	1	2	17.668***	ns	
Attention problems	Girls	2	2	3	2	3	1	1	3	5	3	57.231*	CT>NS	p<0.001
		CT>IA	p=0.003											
	Boys	2	3	2	3	3	1	6	3	6	2	37.549*	IA>NS	p=0.001
		CT>NS	p<0.001											
											CT>H	p=0.014		
Rule-breaking behaviour	Girls	0	0	0	2	0	1	0	0	1	2	40.737*	CT>NS	p<0.001
	Boys	0	1	0	1	1	2	1	2	1	4	24.249*	CT>NS	p=0.016
Aggressive behaviour	Girls	3	2	4	9	6	5	3	4	7	7	38.359*	I>NS	p=0.002
		CT>NS	p<0.001											
	Boys	3	3	5	8	7	4	5	4	7	6	29.708*	I>NS	p=0.009
												CT>NS	p<0.001	

ADHD=Attention deficit/hyperactivity disorder; NS=no symptoms; H=hyperactivity; I=impulsivity; IA=inattention; CT=combined subtype; M=Median; IQR=Interquartile range; *p=0.001; **p=0.490; ***p=0.511.

problems, attention problems, rule-breaking behaviours and aggressive behaviour in terms of the subtype of ADHD. Boys with a combined subtype have a statistically significantly higher level of problems with anxiety/depression, withdrawal/depression, social problems, attention problems, rule-breaking behaviour and aggressive behaviour than children without symptoms of ADHD (Table 4). Boys with a combined subtype also have

statistically significantly more problems with attention than boys with the hyperactivity subtype. Boys with the inattentive subtype have a significantly higher level of withdrawal/depression, somatic complaints and attention problems. The level of aggressive behaviour is statistically significantly higher in boys who have been found to have the impulsivity subtype, in comparison with boys without symptoms of ADHD.

Discussion

Over the past few decades, researchers around the world have been trying to establish the frequency of ADHD. Several of the studies reviewed in this field have established a highly variable frequency of this disorder, which range from 1% right up to 20% in school children (3, 36). According to some other research (4-7, 37-38), the frequency of ADHD ranges from 3-12% in school age children, whilst at the same time other authors mention that only 3-4% of children demonstrate the full picture of the disorder (39-40). In our research it was established that 12% of the tested children met the criteria for the combined subtype of ADHD. The results obtained are in line with the results of research by Brown et al. (2), who state that in the general population of children aged from 6 to 12 years, the frequency of this disorder is from 4% to 12%. However, comparing our results with the results of some other researchers (39-40), we noticed that there are significant differences in the frequencies established. According to Planczyk et al. (5), the differences in the established frequency of ADHD in the research undertaken are the result of methodological differences, such as the diagnostic criteria for ADHD, and the differences in assessment amongst the parents, teachers and professionals. Polanczyk et al. (5) believe that these methodological differences in the research explain more of the variations in frequency than the geographical location where the research was conducted. Moreover, Huss et al. (41) state that research conducted on a large number of subjects ($n > 1000$) and research conducted on a representative sample of subjects have a slightly lower level of frequency, which ranges from 5% to 6.8% in comparison with non-representative research (like ours, which was conducted on a convenience sample of 404 subjects), which shows greater heterogeneity and tends to report higher levels of frequency.

According to Farranone et al. (3) there is general agreement that the frequency of ADHD is statistically significantly higher in boys than in girls, especially in cases of research on children. However, our research established that 8.7% of girls and 3.5% of boys met the criteria for a combined subtype of ADHD. These results are in contrast to most research conducted so far (1, 42). An explanation for these results may be found in the report by Cantwell (40). According to him, the reason for the differences in frequencies regarding gender partially lies in the fact that girls primarily have attention disorder and cognitive problems, and more rarely symptomatology of aggressive and impulsive behaviour, which usually prompts the parents of boys to take them for testing earlier, and in this way boys take part in clinical testing more often. Moreover, there is general agreement that girls with ADHD have less hyperactivity than boys (43). However, it is still necessary to investigate whether hyperactivity is manifest in the same way in boys and girls. For example, clinical observations suggest that hyperactivity in girls may be manifest through hyper-verbalization and emotional excitability, which is much harder to measure and quantify than motoric hyperactivity, and is not a characteristic that is assessed in research, which may therefore affect the results of the research conducted. Ramtekkerisur (44) also believes that ADHD in girls is often left undiagnosed. Farranone et al. (3) point to the fact that most of the research they included in their review of research was undertaken only on boys, or that boys comprised the majority in the test sample, which may naturally have a strong influence on the results of frequency of ADHD in terms of gender, since according to these data, girls are clearly included more rarely and to a lesser extent in research into this problem, if they are included in research at all.

The results of the research undertaken confirm the results of much clinical and epi-

demioleological research conducted so far, in which a high level of comorbidity has been documented between ADHD and various forms of comorbid disorders (14-15, 18, 20, 45-48). According to the results of our research, in 2/3 of the children in our sample it was established that, alongside clinically significantly expressed symptoms of attention problems and hyperactivity/impulsivity, there was also some form of comorbid disorder. The high level of comorbid disorders is in line with the results of research by Jensen et al. (48) who also found that 2/3 children with ADHD in their research had one of the comorbid disorders. Similar results were also found in the research by Takeda et al. (49). In contrast to the results of our research, and the research mentioned above, in some other research lower levels of comorbid disorders were found (2, 17, 19-20, 50). The differences in the frequency of comorbid disorders may be explained by the methodological differences in the research undertaken, or the sample on which the research was undertaken.

Examination of the results of research (21-24) dealing with analysing the forms of comorbid disorders regarding the subtype of ADHD shows that there are variations in comorbidities in terms of the subtype of ADHD.

According to the results of our research, children with the combined subtype of ADHD had statistically significantly more internalizing and externalizing psychological problems than children without symptoms of ADHD. Also, children with the combined subtype of ADHD also had statistically significantly more social problems and attention problems than children with symptoms of hyperactivity and children with problems with impulsivity, which is in line with the results of some other research undertaken so far (11-12, 42, 51-52).

A reason for the high level of frequency of attention problems, as an associated dis-

order of ADHD, may be found in the writings of a large number of authors (53-57), who believe that behaviour disorders, as an associated condition linked with ADHD have a hereditary component, that is, they share the same genetic basis for the development of these disorders. Bi-variant genetic analyses show that the genetic contribution to behaviour problems is explained by the same genes that cause behaviour related to ADHD. The comorbidity between these two categories is mostly explained by these shared genetic factors, as well as by similar environmental factors, which contribute to the phenotype overlap (58). The stance on the environmental component shared by ADHD and behaviour disorders is based on epidemiological and clinical research, which consistently indicates that various forms of behaviour problems are strongly connected with an unfavourable social and family environment (59). When talking about externalized psychological problems and ADHD, it is certainly important to consider the results of the research by Kadesjö et al. (60), which was undertaken on children with sub-clinical levels of ADHD. In their research, behaviour problems as an associated disorder with ADHD fell to a level which does not differ statistically significantly from the children in the general population. The results obtained indicate the possibility that behaviour disorders may be an indicator or marker of the severity of symptoms of ADHD (51, 60).

Apart from various forms of behaviour disorders and social problems, according to the results of our research, children with the combined subtype of ADHD have a statistically significantly high frequency of internalized psychological problems and somatic complaints than children without symptoms of ADHD. These results are in line with the results of other research conducted so far (42, 49).

Researchers who examined the frequency of internalized psychological problems, as

comorbid disorders, examined the differences between ADHD subtypes, but mainly without including the hyperactivity subtype. However, by a review of the available results of research we found several studies which included the hyperactivity subtype in research, and according to the results of that research a higher level of anxiety was found in children with symptoms of hyperactivity, in comparison with children without symptoms of hyperactivity (26). Power et al. (61), using dimensional analysis, also established that internalized difficulties are more connected with hyperactivity than with attention problems. However, the results of this research were not confirmed by our research. A possible explanation of the differences in the results of our research and the research by other authors, relating to the hyperactivity subtype, may be found in the characteristics of the test sample (the age of the subjects) and the research instruments (self-assessment compared with assessment by parents and teachers). Internalized psychological problems as comorbid disorders, according to our results, were also found in children identified with the impulsivity subtype and the inattentive subtype, which is in line with the results of research conducted so far (28, 52).

Angold (62) believes that internalizing psychological problems usually occurs in young people with ADHD as an associated disorder several years after the beginning of ADHD disorder. Depression may be a reaction to unpredictable environmental stressors, such as rejection by peers, mocking by peers, or the opinion that school is a negative or unpleasant place. It is presumed that the anxiety linked with ADHD is the product of the inability to function in everyday life, due to the social and cognitive limitations related to ADHD, rather than being a matter of a typical behaviour characteristic of phobias or fears.

By analysis of the results aimed at establishing the type of comorbid disorders, in

terms of gender and subtype of ADHD, it was established that girls with the combined type of ADHD had a wider range of comorbid disorders than boys with this subtype of ADHD. The results obtained differ from the results of the research by Newcorn et al. (27), who established that girls with ADHD have a smaller range of comorbid disorders than boys. However, in contrast to our research, in their research the subjects were children aged from 7 to 9 years, whilst in our research children aged from 6 to 13 years took part. If we consider the results of the research by Angold (62), who states that internalized psychological difficulties in young people with ADHD usually occur as an associated disorder several years after the onset of ADHD disorder, this may be the reason why the number of comorbid disorders in our research in girls is higher than in their research, particularly if we know that internalized psychological disorders are more frequent in girls than in boys anyway.

Limitations and recommendations for future research

In the end, it is necessary to refer to the methodological limitations of our study. This study was conducted on a convenience sample of a population in the territory of one municipality. For that reason, eventual generalization of the results on the rest territory is not possible. Also, the obtained results could be affected by the fact that the authors of the study did not have details of the parents for 33% of the children.

Further, the results of our research are based on the results of assessment by parents, which may affect the results established regarding establishing the subtypes of ADHD, but also in establishing the comorbid disorders (63, 64). Although using a scale for assessment in research has many advantages (psychometric characteristics), in future research it would be good to use other research approaches, such as observation, and inter-

views with parents, teachers and children. Gathering data from different sources would enable researchers and clinicians to create a more complete picture of the child's development. In this way more reliable identification would be obtained of ADHD subtypes and also comorbid disorders.

Also, it would be good to conduct longitudinal research, to make it possible to monitor the intensity of ADHD symptoms, but also the period in which different forms of comorbid disorders appear. Finally, the question arises how far the results of our research may be compared and/or applied to children who have been diagnosed ADHD by professionals, since in some of the research conducted so far, different frequencies have been found of comorbid disorders in boys and girls, in relation to whether the research was conducted on a clinical sample or the general population (28).

Conclusion

In the end we can conclude that the frequency of ADHD symptoms in our sample is in line with most research conducted so far. Also, the results of the research conducted confirm the results of many pieces of clinical and epidemiological research conducted to date, in which a high level of comorbid disorders was documented in children established to have symptoms of ADHD. The results obtained indicate the importance of differentiating ADHD without comorbid disorders and ADHD with comorbid disorders.

Authors' contributions: Conception and design: KS, AD, DS; Acquisition, analysis and interpretation of data: KS, AD, DS; Drafting the article KS, AD; Revising it critically for important intellectual content: KS, AD, DS.

Conflict of interest: The authors declare that they have no conflict of interest.

References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing; 2013.
2. Brown RT, Freeman WS, Perrin JM, Stein MT, Ambler RW, Feldman HM, et al. Prevalence and assessment of attention-deficit/hyperactivity disorder in primary care settings. *Pediatrics*. 2001;107:43-54.
3. Faraone SV, Sergeant J, Gillberg C, Biederman J. The worldwide prevalence of ADHD: is it an American condition? *World Psychiatry*. 2003; 2(2):104-13.
4. Lee HD, Oakland T, Jackson G, Glutting J. Estimated prevalence of attention deficit/hyperactivity disorder symptoms among college freshmen: Gender, race, and rater effects. *J Learn Disabil*. 2008;41:371-84.
5. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: a systematic review and metaregression analysis. *Am J Psychiatry*. 2007;164(6):942-8.
6. Scahill L, Schwab-Stone M. Epidemiology of ADHD in school-age children. *Child Adolesc Psychiatr Clin N Am*. 2000; 9(3):541-55.
7. Weyandt L, DuPaul G. ADHD in college students. *J Atten Disord*. 2006;10:9-19.
8. Cohen MJ, Riccio CA, Gonzalez JJ. Methodological differences in the diagnosis of Attention Deficit Hyperactivity Disorder: Impact on prevalence. *J Emot Behav Disord*. 1994;2:31-38.
9. Lahey BB, Loeber R. Framework for a developmental model of oppositional defiant disorder and conduct disorder. In D.K. Routh (Ed.). *Disruptive behavior disorders in childhood*. New York: Plenum; 1994.
10. Wolraich ML, Felice ME, Drotar D, editors. *The Classification of Child and Adolescent Mental Diagnoses in Primary Care: Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*. Elk Grove Village, IL: American Academy of Pediatrics; 1996.
11. Eiraldi RB, Power TJ, Nezu C M. Patterns of comorbidity associated with subtypes of attention-deficit/hyperactivity disorder among 6-12 year old children. *J Am Acad Child Adolesc Psychiatry*. 1997;36:503-14.
12. Faraone SV, Biederman J, Weber W, Russell RL. Psychiatric, neuropsychological, and psychosocial

- features of DSM-IV subtypes of attention-deficit/hyperactivity disorder: Results from a clinically referred sample. *J Am Acad Child Adolesc Psychiatry.* 1998;37:185-93.
13. Barkley RA, Fischer M, Smallish L, Fletcher K. Young adult outcome of hyperactive children: adaptive functioning in major life activities. *J Am Acad Child Adolesc Psychiatry.* 2006; 45(2):192-202.
 14. Biederman J, Petty CR, Fried R, Kaiser R, Dolan CR, Schoenfeld S, et al. Educational and occupational underattainment in adults with attention-deficit/hyperactivity disorder: a controlled study. *J Clin Psychiatry.* 2008;69(8):1217-22.
 15. Kessler RC, Adler L, Barkley R, Biederman J, Conners CK, Demler O, et al. The prevalence and correlates of adult ADHD in the United States: results from the National Comorbidity Survey Replication. *Am J Psychiatry.* 2006;163(4):716-23.
 16. Costello EJ, Foley DL, Angold A. 10-year research update review: the epidemiology of child and adolescent psychiatric disorders: II. Developmental epidemiology. *J Am Acad Child Adolesc Psychiatry.* 2006; 45(1):8-25.
 17. Elia J, Ambrosini P, Berrettini W. ADHD characteristics: I. Concurrent co-morbidity patterns in children & adolescents. *Child and Adolescent Psychiatry and Mental Health.* 2008;2:15.
 18. Pliszka SR. Psychiatric comorbidities in children with attention deficit hyperactivity disorder: Implications for management. *Paediatric Drugs.* 2003;5:741-50.
 19. Schatz DB, Rostain AL. ADHD with comorbid anxiety: a review of the current literature. *J Atten Disord.* 2006;10(2):141-9.
 20. Spencer TJ, Faraone SV, Michelson D, Adler LA, Reimherr FW, Glar SJ, et al. Atomoxetine and adult attention-deficit/hyperactivity disorder: the effects of comorbidity. *J Clin Psychiatry.* 2006;67:415-20.
 21. Neuman R, Heath AC, Reich W, Bucholz KK, Madden PAF, Sun L, et al. Latent class analysis of ADHD and comorbid symptoms in a population sample of adolescent female twins. *J Child Psychol Psychiatry.* 2001;42:933-42.
 22. Volk H, Neuman R, Todd R. A systematic evaluation of ADHD and comorbid psychopathology in a population-based twin sample. *J Am Acad Child Adolesc Psychiatry.* 2005;44:768-75.
 23. de Nijs PF, Ferdinand RF, Verhulst FC. No hyperactive-impulsive subtype in teacher-rated attention-deficit/hyperactivity problems. *Eur Child Adolesc Psychiatry.* 2007;16:25-32.
 24. Jensen PS, Martin D, Cantwell DP. Comorbidity in ADHD: implications for research, practice and DSM—V. *J Am Acad Child Adolesc Psychiatry.* 1997;36:1065-79.
 25. August GJ, Realmuto GM, MacDonald AW 3rd, Nugent SM, Crosby R. Prevalence of ADHD and comorbid disorders among elementary school children screened for disruptive behavior. *J Abnorm Child Psychol.* 1996; 24(5):571-95.
 26. Lahey BB, Schaugency EA, Hynd GW, Carlson C L, Nieves N. Attention deficit disorder with and without hyperactivity: Comparison of behavioral characteristics of clinic referred children. *J Am Acad Child Adolesc Psychiatry.* 1987;26:718-23.
 27. Newcorn JH, Halperin JM, Jensen PS, Abikoff HB, Arnold LE, Cantwell DP, et al. Symptom profiles in children with ADHD: Effects of comorbidity and gender. *J Am Acad Child Adolesc Psychiatry.* 2001; 40(2):137-45.
 28. Gaub M, Carlson CL. Gender differences in ADHD: a meta-analysis and critical review. *J Am Acad Child Adolesc Psychiatry.* 1997; 36(8):1036-45.
 29. Biederman J, Faraone S, Mick E, Williamson S, Wilens TE, Spencer TJ, et al. Clinical correlates of ADHD in females: Findings from a large group of girls ascertained from pediatric and psychiatric referral services. *J Am Acad Child Adolesc Psychiatry.* 1999; 38(8):966-75.
 30. Biederman J, Newcorn J, Sprich S. Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *Am J Psychiatry.* 1991;148:564-77.
 31. Achenbach TM. Manual for the Child behavior checklist / 4 – 18 and 1991 Profile. Burlington, VT: University of Vermont, Department of Psychiatry; 1991.
 32. Kroes G, Veerman JW, De Bruyn E EJ. Bias in parental reports? Maternal psychopathology and the reporting of problem behavior in clinic-referred children. *Eur J Psychol Assess.* 2003;19:195-203.
 33. Verhulst FC, Althaus M. Persistence and change in behavioral/emotional problems reported by parents of children aged 4 – 14. *Acta Psychiatr Scand.* 1988;77:1-28.
 34. McConaughy SH, Stanger C, Achenbach TM. Three Year Course of Behavioral/Emotional Problems in a National Sample of 4 – to 16 – Year –

- Olds: I. Agreement among Informants. *J Am Acad Child Adolesc Psychiatry*. 1992;31(5):932-40.
35. Gilliam JE. Examiners manual for the Attention-Deficit/Hyperactivity Disorder Test: A method for identifying individuals with ADHD. Austin, TX: pro-Ed; 1995.
 36. Bird HR. The diagnostic classification, epidemiology and crosscultural validity of ADHD, In: Jensen PCJ, editor. *Attention Deficit Hyperactivity Disorder: State of the Science: Best Practices*. Kingston, NJ: Civic Research Institute; 2002.
 37. Woodruff TJ, Axelrad DA, Kyle AD, Nweke ON, Miller G, Hurley BJ. Trends in environmentally related childhood illnesses. *Pediatrics*. 2004;113:1133-40.
 38. Barbaresi WJ, Katusic SK, Colligan RC, Pankratz VS, Weaver AL, Weber KJ, et al. How common is attention-deficit/hyperactivity disorder? Incidence in a population-based birth cohort in Rochester, Minn. *Arch Pediatr Adolesc Med*. 2002;156(3):217-24.
 39. Knölker U, Mattejat F, Schulte-Markwort M. *Kinder- und Jugendpsychiatrie und psychiatrie, systematisch*. 2. Auflage. Bremen: Uni-Med Verlag; 2000.
 40. Cantwell DP. Attention deficit disorder: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry*. 1996;35:978-87.
 41. Huss M, Holling H, Kurth BM, Schlack R. How often are German children and adolescents diagnosed with ADHD? Prevalence based on the judgment of health care professionals: results of the German health and examination survey (KiGGS). *Eur Child Adolesc Psychiatry*. 2008;17:52-8.
 42. Mugnaini D, Masi G, Brovedani P, Chelazzi C, Matas M, Romagnoli C, et al. Teacher reports of ADHD symptoms in Italian children at the end of first grade. *Eur Psychiatry*. 2006; 21(6):419-26.
 43. Arnold LE. Sex differences in ADHD: Conference summary. *J Abnorm Child Psychol*. 1996;24(5):555-68.
 44. Ramtekkar UP, Reiersen AM, Todorov AA, Todd RD. Sex and age differences in attention-deficit/hyperactivity disorder symptoms and diagnoses: implications for DSM-V and ICD-11. *J Am Acad Child Adolesc Psychiatry*. 2010;49:217-28.
 45. Biederman J, Fried R, Hammerness P, Surman C, Mehler B, Petty CR, et al. The effects of lisdexamfetamine dimesylate on the driving performance of young adults with ADHD: a randomized, double-blind, placebo-controlled study using a validated driving simulator paradigm. *J Psychiat Res*. 2012;46:484-91.
 46. Angold A, Costello EJ, Erkanli A. Comorbidity. *J Child Psychol Psychiatry*. 1999;40:57-87.
 47. Braaten EB, Beiderman J, Monuteaux MC, Mick E, Calhoun E, Cattan G, et al. Revisiting the association between attention-deficit/hyperactivity disorder and anxiety disorders: a familial risk analysis. *Biol Psychiatry*. 2003;53(1):93-9.
 48. Jensen PS, Hinshaw SP, Kraemer HC, Lenora N, Newcorn JH, Abikoff HB, et al. ADHD comorbidity findings from the MTA study: Comparing comorbid subgroups. *J Am Acad Child Adolesc Psychiatry*. 2001;40:147-58.
 49. Takeda T, Ambrosini PJ, deBerardinis R, Elia J. What can ADHD without comorbidity teach us about comorbidity? *Res Dev Disabil*. 2012;33:419-25.
 50. Wilens TE, Spencer TJ, Biederman J. Attention deficit/hyperactivity disorder across the life span. *Ann Rev Med*. 2002;53:113-31.
 51. Gillberg C, Gillberg IC, Rasmussen P, Kadesjö B, Söderström H, Råstam M, et al. Co-existing disorders in ADHD—implications for diagnosis and intervention. *Eur J Child Adolesc Psychiatry*. 2004;13:80-92.
 52. Wählstedt C, Thorell LB, Bohlin, G. Heterogeneity in ADHD: Neuropsychological Pathways, Comorbidity and Symptom Domains. *J Abnorm Child Psychol*. 2009;37:551-64.
 53. Coolidge FL, Thede LL, Young SE. Heritability and the comorbidity of attention deficit hyperactivity disorder with behavioral disorders and executive function deficits: A preliminary investigation. *Dev Neuropsych*. 2000;17:273-87.
 54. Gelhorn HL, Stallings MC, Young SE, Corley RP, Rhee SH, Hewitt JK. Genetic and environmental influences on conduct disorder: Symptom, domain and full-scale analyses. *J Child Psychol Psychiatry*. 2005;46:580-91.
 55. Goldstein RB, Prescott CA, Kendler KS. Genetic and environmental factors in conduct problems and adult antisocial behavior among adult female twins. *J Nerv Ment Dis*. 2001;189:201-9.
 56. Hicks B, Krueger R, Iacono W, McGue M, Patrick C. Family transmission and heritability of externalizing disorders: A twin-family study. *Arch Gen Psychiatry*. 2004;61:922-8.

57. Jain M, Palacio LG, Castellanos FX, Palacio JD, Pineda D, Restrepo MI, et al. Attention-deficit/hyperactivity disorder and comorbid disruptive behavior disorders: evidence of pleiotropy and new susceptibility loci. *Biol Psychiatry*. 2007;61:1329-39.
58. Thapar A, Harrington R, McGuffin P. Examining the comorbidity of ADHD-related behaviours and conduct problems using a twin study design. *Br J Psychiatry*. 2001;179:224-9.
59. Rutter M, English and Romanian Adoptees (ERA) Study Team. Developmental catch-up, and deficit, following adoption after severe early privation. *J Child Psychol Psychiatry*. 1998;39:465-76.
60. Kadesjö C, Kadesjö B, Hägglöf B, Gillberg C. ADHD in Swedish 3- to 7-year-old children. *J Am Acad Child Adolesc Psychiatry*. 2001;40:1021-8.
61. Power TJ, Costigan T, Eiraldi R, Leff S. Variations in anxiety and depression as a function of ADHD subtypes defined by DSM-IV: do subtype differences exist or not? *J Abnorm Child Psychol*. 2004;32:27-37.
62. Angold A, Erklani A, Egger H, Costell E. Stimulant treatment for children: A community perspective. *J Am Acad Child Adolesc Psychiatry*. 2000;39:975-84.
63. Nietzel M, Bernstein D, Milich R. Introduction to clinical psychology (5th ed.). Upper Saddle River, NJ: Prentice Hall;1998.
64. Webster-Stratton C. Mothers' and fathers' perceptions of child deviance. *J Consult Clin Psychol*. 1988;56(6):909-15.