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B – Data Collection
C – Statistical Analysis
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Is ADHD under-diagnosed in Bosnia and Herzegovina? Comparison of clinically confirmed cases vs. parent-reported prevalence of ADHD

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SUMMARY

Background: Attention Deficit Hyperactivity Disorder (ADHD) is a frequent neurodevelopmental disorder characterized by hyperactivity, inattention, and impulsivity. The issue of whether ADHD is a socially constructed disorder has received much attention. The goal of the present study was to examine the clinical prevalence of ADHD in Bosnia and Herzegovina (BIH). An additional goal was to investigate the prevalence of school-aged children who fulfill the criteria for the condition but do not have a clinical diagnosis. For the first research goal, the sample consisted of five University Clinical Centers in BIH that provided data on the prevalence. For the second goal, the sample consisted of 1935 parents of children aged 6 to 15 years.

Material/ Methods: Parents of 1935 school-aged children from the Federation BIH completed the questionnaire regarding ADHD symptoms. Children ranged in age from 6 to 15 years. The mean age of children was 10.2 years (SD- 2.1 years). There were 1061 girls and 874 boys in the sample. Five hospitals in the Federation BIH (4 University Clinical Centers and 1 Cantonal Hospital) were sent a questionnaire to provide us with information on how many school-aged children were diagnosed with ADHD and their basic demographic data. In addition, the Clinical Centers were asked to provide information on what treatment they provide to children with ADHD.

Results: The results of this study indicated that clinical diagnosis of ADHD is infrequent. The number of clinically confirmed cases of ADHD in the Federation BIH was 138 or less than 0.001%. On the other hand, according to survey data, there is a prevalence rate of ADHD indicated like that observed in western countries. According to the parents' reports, there were 97 children or 5% who fulfilled the criteria for ADHD diagnosis. In relation to gender distribution of ADHD, there were more boys (88 boys) than girls (50 girls) with a clinically confirmed diagnosis of ADHD and boys were 1.76 times more likely to have a ADHD diagnosis than were girls. On the other hand there were more girls than boys who had ADHD according to parents' reports, but this difference, according to the Chi square test, was not statistically significant ($\chi^2 = 0.14$; $p = ,70$).

Conclusions: The results of this study have clearly shown that ADHD is underdiagnozed in Bosnia and Herzegovina. There is a huge discrepancy between the clinically diagnosed children and the parent-reported symptoms of ADHD. Given the burden that ADHD has on children and their families it should be of the utmost importance to provide timely diagnosis and proper treatment. One way to improve the current situation is through a better cooperation between school staff (psychologists, teachers), parents, and medical professionals.

Key words: Attention Deficit Hyperactivity Disorder, prevalence, diagnosis, children, Bosnia and Herzegovina

INTRODUCTION

According to the *Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5),* Attention Deficit Hyperactivity Disorder (ADHD) is characterized by a persistent pattern of inattention and/or hyperactivity-impulsivity that significantly interferes with daily functioning and development (American Psychiatric Association, 2013). The prevalence rates are similar across countries and are reported to be around 5% or 1 in 20 children (Faraone et al., 2003). The disorder affects more boys than girls, with estimates that it affects 4 to 9 boys for every girl (Brown & La Rosa, 2002). However, recent reports suggest upward trends in ADHD diagnosis in females (Fairman et al., 2017), so the ratio between males and females might have changed as well.ADHD is related to numerous behavioral (Retz et al., 2021; Stoppelbein et al., 2020) and academic difficulties(Daley & Birchwood, 2010; Loe & Feldman, 2007). ADHD is often comorbid with other neurodevelopmental disorders. Thus, ADHD is more frequent in children with intellectual disabilities (Memišević & Sinanović, 2015), autism (Stevens et al., 2016), and learning disabilities (Mayes et al., 2000) than in typically developing children.

ADHD symptoms are also related to dysfunctional emotional regulation and lower social competence (Wåhlstedt et al., 2008). There is a large burden on families raising children with ADHD in both economic domain (Zhao et al., 2019) and psychological well-being (Harborne et al., 2004). A plethora of research indicates that parents of children with ADHD experience a great deal of stress (Parand et al., 2010). Given the severity of ADHD in affecting the lives of children and their families, it is of utmost importance to early diagnose the condition and provide adequate treatment. Studies have shown a significant effect of medications on health-related quality of life in children with ADHD (Flapper & Schoemaker, 2008).

However, many people having ADHD remain undiagnosed. The issue of ADHD underdiagnosis has been widely reported in adult populations (Ginsberg et al., 2014; Lamberg, 2003). In addition to this, there is also a gender effect, with females having a greater risk of being underdiagnosed. It is estimated that half to three-quarters of females with ADHD are undiagnosed (Walters, 2018).Lastly, many children with ADHD remain undiagnosed and untreated for this condition as well. Even if diagnosed with ADHD, not all children receive adequate treatment. This is even the case in developed countries where the treatment rates are not optimal,and there are significant obstacles to achieving treatment adherence (Barkley, 2008).

In this study, we wanted to examine the differences in the prevalence rate of clinically confirmed ADHD cases and parent-reported ADHD casesin a large sample of children in Bosnia and Herzegovina (BIH). In addition, we examined whether there are differences in ADHD prevalence in relation to child's gender.

METHOD

Participants

Parents of 1935 school-aged children from Federation BIH completed the questionnaire regarding the ADHD symptoms. Children ranged in age from 6 to 15 years. The mean age of children was 10.2 years (SD- 2.1 years). There were 1061 girls and 874 boys in the sample.

Fivehospitals in Federation BIH (4 University Clinical Centers and 1 Cantonal Hospital) were sent a questionnaire to provide us with information on how many school-aged children were diagnosed with ADHD and their basic demographic data. In addition, the Clinical Centers were asked to provide information on what treatment they provide to children with ADHD.

Procedure

The participants were from the five largest Cantons in Federation BIH (Sarajevo Canton, Tuzla Canton, Zenica-Doboj Canton, Hercegovina-Neretva Canton, and Bihac Canton). These Cantons comprise around 75% of the total Federation BIH and around 50% of the entire population in BIH. The approximate population in these five Cantons is around 1.6 million. We sent questionnaires to 100 schools in these Cantons, which further distributed these questionnaires to the parents. Participation was on a voluntary basis and contained no identifiable data, making the survey fully anonymized. Parents were asked to complete demographic data surveys regarding their child's behavior with CBCL and ADHD questionnaires. Additionally, we sent a questionnaire to five major hospitals in these Cantons to ask them about the prevalence of ADHD in these Cantons, that is how many school-aged children, aged 6 to 15 years old, they have registered with a confirmed medical diagnosis of ADHD and what treatment these children were receiving.

Instrument

Symptoms of ADHD were examined with Attention Deficit/Hyperactivity Disorder Test (ADHDT; Gilliam, 1995). The test consists of 36 items divided into three subtests: hyperactivity subtest, impulsivity subtest, and inattention subtest. The items are based on the Diagnostic and Statistical Manual of Mental Disorders-IV Edition (American Psychiatric Association, 1994). Each item is rated on a three-level Likert-based scale ranging from 0- not a problem to 3- serious problem. The test has very good psychometric properties, with reported internal consistency of Cronbach's alpha being 0.92 (Becker-Blease & Freyd, 2008).

Statistical Analysis

We reported descriptive statistics on the prevalence of ADHD according to parents' reports. These diagnoses were not clinically confirmed. In addition, we also reported the number of children with official medical diagnosis of ADHD. We also presented both statistical data in relation to child's gender. An alpha

Table 1. Prevalence of ADHD according to parents' reports in relation to child's gender

	With ADHD		*Without ADHD*	
	N	*%*	*N*	*%*
Boys	42	4.8	832	95.2
Girls	55	5.2	1006	94.8

level of .05 was considered as a threshold for statistical significance. We used a computer program SPSS v 27 for all statistical analysis (IBM, 2020).

RESULTS

Out of 1935 children, 97 of them or 5% had ADHDT scores that were indicative of ADHD. In relation to gender distribution, these data are shown in Table 1.

As can be seen from Table 1, slightly more girls than boys had ADHD according to parents' reports, but this difference, according to the Chi square test, was not statistically significant ($\chi^2 = 0.14$; $p = ,70$).

We next present data for children who had a clinical diagnosis of ADHD confirmed at one of five Clinical Centers in Bosnia and Herzegovina. There were only 138 children aged 6 to 15 with a clinical (medical) diagnosis of ADHD. According to these data, the prevalence of ADHD is less than 0.001% taking into account just the population in this age group. It is possible that the number is slightly higher, given that we did not obtain information from the local (municipal) health centers that might have diagnosed children with ADHD. However we believe this option to be unlikely, as only the Cantonal Clinical Centers can provide advanced neuroimaging techniques (MRI, CT), we believe these children would be referred to the clinical centers to rule out possible brain injury/organic disorder. Thus, the Clinical Centers would very likely have the data on the prevalence of ADHD from the whole region.

In relation to gender distribution of clinically confirmed ADHD cases, there were 88 boys (63.8%) and 50 girls (36.2%). Boys were 1.76 times more likely to have an ADHD diagnosis. In addition, none of the children clinically diagnosed with ADHD was prescribed a psychostimulant medication for the treatment of their condition.

DISCUSSION

The goal of the present paper was to examine the prevalence rate of ADHD in children in BiH and to investigate whether there are differences in the rate of clinically diagnosed cases of ADHD and parent-reported cases of suspected ADHD. This study clearly showed the extremely low rate (less than 0.001%) of clinically diagnosed cases of ADHD in children in Bosnia and Herzegovina. This is in stark contrast with epidemiological studies of ADHD conducted in other countries. For example, the prevalence rate of ADHD in the UK is reported to be around 4% (Russell et al., 2019) and in Germany between 5% and 6% in children aged 0-17 (Bachmann et al., 2017). Obviously, this discrepancy in clinical diagnosis of ADHD in BIH indicates a lack of attention given to this condition. This can also be illustrated with children's medications for their condition. Out of 138 children diagnosed with ADHD, none of them received any medications for that

condition. This is, again, in stark contrast with the other countries where many more children are prescribed medication for this condition. It is important to note that ADHD medication use appears not to be associated with an increased rate of substance abuse (Chang et al., 2014).

The data on the prevalence of ADHD from the field and parent-reported symptoms of ADHD reveal a different picture. It is obvious that the rate of parent-reported cases of ADHD do not differ much from other countries. According to the ADHDT, there were 5% of children with ADHD in this sample, a rate similar to those in other studies(Mohammadi et al., 2019; Scahill & Schwab-Stone, 2000), although some studies have reported an even higher prevalence, of up to 15.5% (Rowland et al., 2013). Obviously, ADHD is quite frequent but under-diagnosed clinical condition in BIH.

Concerning the ADHD prevalence in relation to the gender, contrary to our expectations, we found no statistically significant differences between boys and girls. Most of the studies examining the epidemiology of ADHD have found that boys have a much higher prevalence of the condition than girls (Bener et al., 2006). However, there are also some studies that found no statistically significant differences in the prevalence of ADHD in relation to gender (de la Barra et al., 2013). We already mentioned that girls might be underdiagnosed for ADHD. The girls were often overshadowed by hyperactive and impulsive boys (Staller & Faraone, 2006). This study has shown that parent-reported cases of ADHD were equally distributed in boys and girls. It might be the case that parents are more aware now of the ADHD manifestations in girls. However, we did not collect data on the type of ADHD and distribution of ADHD types in relation to gender. Common perception of ADHD is that girls have more inattentive type of ADHD, while the boys have hyperactive/impulsive type more often (Quinn & Wigal, 2004). This public perception is supported by the research data. There are clearly gender differences in the behavioral expression of ADHD symptoms (Loyer Carbonneau et al., 2020).

It is important to mention some limitations of the present study. The first limitation is related to the reliability of data obtained from the Clinical hospitals. It is possible there were some children living in these five Cantons in Federation BIH with an ADHD diagnosis but were not registered by these hospitals. We also do not know which criteria were used in making clinical diagnosis (whether is it made according to ICD or DSM criteria). Next issue is related to parent-reports of their children's ADHD symptoms. Again, we do not know how reliable these reports were. Studies have shown that parental reports of ADHD are much more reliable and accurate than reports for other psychiatric diagnoses (Faraone et al., 1995). Finally, we did not examine how often psychoeducational interventions were used in the treatment of children with ADHD. This is an important information as it has been shown that such treatment are very efficacious in treating the condition (Dort et al., 2020).

This study has several important implications. Given that only medical professionals (psychiatrists) can make a clinical diagnosis of ADHD and provide med-

ical treatment, it is obvious that many children with this condition do not receive proper medical treatment. Thus, there should be greater awareness among medical professionals regarding this issue. It seems that medical professionals are reluctant to give an ADHD diagnosis to children. However, only with a clinically confirmed diagnosis, children can be provided with an adequate treatment. One way to improve the current situation is to enhance the cooperation between various stakeholders: parents, school staff (psychologists, teachers), and medical professionals. It is worth adding that the accuracy of clinical diagnosis could be improved if it will be based on functional neuromarkers (Pąchalska & Nowaczyk 2021), especially since these neuromarkers for ADHD were already found (Kropotov 2016; Kiiski et al. 2020; Kaiser et al. 2020).

CONCLUSIONS

The results of this study have clearly shown that ADHD is underdiagnosed in Bosnia and Herzegovina. There is a huge discrepancy between clinically diagnosed children and the parent-reported symptoms of ADHD. Given the burden that ADHD has on children and their families it should be of utmost importance to provide timely diagnosis and proper treatment. One way to improve the current situation is through a better cooperation of school staff (psychologists, teachers), parents, and medical professionals.

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