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# Effect of Impairment on the Prevalence and Comorbidities of Attention Deficit Hyperactivity Disorder in a National Survey: Nation-Wide Prevalence and Comorbidities of ADHD

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## Abstract

**Objective:** This study aimed to determine the prevalence and comorbidities of attention-deficit hyperactivity disorder (ADHD) by evaluating a large-scale nation-wide sample of children. **Method:** The inclusion criterion was being enrolled as a 2nd, 3rd, or 4th-grade student. A semi-structured diagnostic interview (K-SADS-PL), DSM-IV-Based Screening Scale for Disruptive Behavior Disorders, and assessment of impairment (by both parents and teachers) were applied to 5,842 participants. **Results:** The prevalence of ADHD was 19.5% without impairment and 12.4% with impairment. Both ADHD with and without impairment groups had similar psychiatric comorbidity rates except for oppositional defiant disorder (ODD) and conduct disorder (CD) diagnoses. Impairment in the ADHD group resulted in significantly higher ODD and CD diagnoses. **Conclusion:** Even when impairment is not described, other psychiatric disorders accompany the diagnosis of ADHD and may cause impairment in the future. Impairment in the diagnosis of ADHD significantly increases the likelihood of ODD and CD. (*J. of Att. Dis.* 2022; 26(5) 674-684)

## Keywords

attention deficit hyperactivity disorder, prevalence, epidemiology, Turkey

## Introduction

Attention-deficit hyperactivity disorder (ADHD) is the most prevalent neurobehavioral disorder of childhood (Durak et al., 2014). Patients generally suffer from academic and social failures, deteriorated peer-interactions, and health problems particularly related with injuries (Biederman & Faraone, 2005). Determining the epidemiological background of this prevalent

disease will direct the efforts to improve its outcomes at population level. Up to now, many studies have been conducted to evaluate the prevalence of childhood psychiatric disorders (Achenbach et al., 2012; Insel, 2014; Whiteford et al., 2013). The main pitfall for estimating the prevalence of these diseases is the utilization of different diagnostic processes, which results with highly variable ranges of prevalence ratios that change according to the methodology of the particular studies. Current

evidence suggests that worldwide prevalence of ADHD ranges between 2.2% and 17.8% (Skounti et al., 2007). Diagnostic and Statistical Manual of Mental Disorders-5th Edition (DSM-5) reported the prevalence of childhood ADHD as 5% (American Psychiatric Association, 2013). Two extensive meta analyses have reported that the pooled prevalence of ADHD was 5.3% and 5.7%, respectively (Polanczyk et al., 2007; Willcutt, 2012). The most recent published data reported that the worldwide prevalence of this common disorder was 3.4% (CI 95% 2.6%–4.5%) (Polanczyk et al., 2015). It is reasonable to think that these figures are prone to over- or underestimate the exact prevalence in different populations. Determining the country-specific prevalence estimates is crucial to take further steps against this disease through public health approaches.

There have been several studies that assessed the prevalence of childhood ADHD in Turkey. In one of those studies our group has conducted a 4-year follow-up trial to determine the prevalence of ADHD and oppositional-defiant disorder with a sample of 1,500 school-aged children, which the diagnoses were based on a “best estimate procedure”;

and found that the prevalence rates of ADHD through assessments at each year were 13.38%, 12.53%, 12.22%, and 12.91%, which also showed a diagnostic stability through the study (Ercan et al., 2013). In this study, the prevalence of the ADHD diagnosis represented a significantly higher prevalence than the literature data, and consequently we have designed a new study with a completely different methodology, which substantially decreased the methodological flaws. In this latter study (Ercan et al., 2015), we have utilized a one-step assessment, which is accepted as gold standard in epidemiologic studies and a strict approach with considering impairment criteria (Cartwright-Hatton et al., 2006). Sample of this study included 417 children that were randomly selected from the same catchment area of the former study. Our results interestingly showed a similar prevalence rate despite methodological differences, which was 12.7% with impairment criteria. Determining these high prevalence rates in both studies underlined this current study by raising the question that whether the prevalence ADHD is really high nationwide, or not?

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This study aimed to determine the exact prevalence of ADHD in a nation-wide sample of children by evaluating a large-scale in a design of a well-structured epidemiology study with a representative sample of Turkish population.

## Methods

This study was part of an epidemiological study that was planned by the Turkish Association of Child and Adolescent Mental Health to evaluate the prevalence of psychopathologies among elementary school students in Turkey. The study protocol was approved by the Institutional Review Board of Bakirkoy Prof. Dr. Mazhar Osman Training and Research Hospital for Nervous and Mental Disorders (Date: 04.11.2014, No: 427).

### Study Population

The present study is a nationwide, representative, cross-sectional study including diagnostic interviews with a total of 5,842 examined children. This study used a randomized, probabilistic sampling strategy with an adequately defined sampling frame. We used sampling frame list from all units of target population and probabilistic sampling strategies that were implicated previously to obtain representative samples (Boyle, 1998; Polanczyk et al., 2015).

Prior to participation, the schools were contacted for student lists according to classes and the students were randomly selected from the prepared lists (Anonymous, 2015). The parent (mostly the mothers) was informed of the study by class teachers as well as the study teams and those providing written informed consent were included in the study.

The use of official records of National Ministry of Education enabled more convenient sampling (Ministry of National Education, 2015). According to data from the Ministry of National Education and Turkish Statistical Institute, the total number of primary school students for the academic year 2014 to 2015 was 5,434,150 (51.2% male), and there were 27,544 primary schools and 255,451 classes (Turkish Statistical Institute, 2015). Our target population was 2nd, 3rd, or 4th grade students in the urban schools assigned to study centers. The sample of children in all urban schools across study centers covered approximately 71.4% of the population of Turkey supporting generalizability (Ministry of National Education, 2015).

According to those results, the sample size (without clustering) to predict a population prevalence of 0.15 at 95% Confidence Interval with an effect size of 0.01 (d) would require 4,898 subjects (Sümbüloğlu & Sümbüloğlu, 2005). On the other hand, 30 clusters of 100 samples each with an Intra-cluster Correlation of 0.002 and a  $p$  value of .05 will achieve 99.8% power to detect a 10.0% difference in proportions (Donner & Klar, 2010). The study coordinators contacted the Ministry of National Education to

randomly assign schools at urban neighborhoods served by study centers to participate in the study. This assignment was weighted to reflect differing population sizes. The study team was required to randomly sample 2nd, 3rd, and 4th grade students of the assigned schools to fulfill their quotas (Legal Gazette, 2014). The quotas were weighted to reflect number of residents in each country (according to number of Country Representatives Selected to the National Assembly in the 2014 legal year, Legal Gazette, 2014) and the sampling quotas were calculated as number of representatives multiplied by 15. Mean and median sample sizes as well as standard deviations and inter-quartile ranges for clusters were; 202.6, 123.5, 257.5, and 111.5; respectively. The D'Agostino-Pearson test revealed that distribution of the samples in clusters was not normal ( $p < .0001$ ). A pilot study to determine the intra-cluster correlation coefficient revealed that it was 0.02 (Ercan et al., 2016). Post-hoc design effect was found to be 1.56 yielding an effective sample size of 3,652.2 (Killip et al., 2004). The final sample was thought to be appropriate for multi-level analysis correcting for clustering of children within classrooms and classrooms within schools (Twisk, 2006).

As defined by the Turkish Association of Statistics for reporting of data at national levels, all geographical regions across the country were included in this study by 29 study centers covering all characteristics across the country such as age, sex, language, ethnicity, income, and residency. In addition, most of the centers have reached the planned number of the children. Only five centers were not able to screen planned numbers of children. Because, we could not reach the parents of some children during the evaluation process. There were not any parents that have declined to participate in the present study. In addition, these centers had also a high screened/planned ratio (94.1%, 95.2%, 97.1%, 97.8%, and 99.1%).

### Measures

*1. Sociodemographic form.* The sociodemographic form was developed by the study coordinators, and included questions on parental education and vocation, physical/mental illnesses in the family, and information about the student.

*2. Kiddie schedule for affective disorders and schizophrenia for school age children-present and lifetime version (K-SADS-PL).* This is a semi-structured interview developed by Kaufman and colleagues to evaluate present and lifetime psychopathology in children and adolescents according to DSM-III-R and DSM-IV criteria (Kaufman et al., 1997). The reliability and validity study of the Turkish translation was conducted (Gökler et al., 2004). The study team was all trained for its use and a video-interview by one of the study general coordinators (GK) was provided to all study centers to be used as a template. K-SADS-PL assessment was conducted via a single informant (i.e., parent) and diagnoses

were done according to a best-estimate procedure (Leckman et al., 1982).

**3. DSM-IV-based screening scale for disruptive behavior disorders in children and adolescents.** This scale evaluates Attention-Deficit/Hyperactivity Disorder, Oppositional Disorder and Conduct Disorder criteria according to DSM-IV. It includes 41 questions (9 each for inattention and hyperactivity/impulsivity, 8 for oppositionality, and 15 for conduct problems). Each question is evaluated on a 4-point Likert-type scale (0=None, 1=Somewhat, 2=High, 3=Very High). The Turkish version was found to be reliable and valid previously (Ercan et al., 2001). Similar with the previous studies, scores of 2 and 3 on the scale were accepted as presence of symptoms for the pertaining domain (Bilaç et al., 2014; Ercan et al., 2015, 2016). For the whole sample (those without Conduct Disorder items,  $n=2,653$ ) Cronbach's alpha was found to be 0.745 (Intra-Class Correlation=.745,  $p=.000$ ) and 0.755 (those with Conduct Disorder items,  $n=2,475$ , Intra-Class Correlation=.755,  $p=.000$ ); respectively. The scales were filled by the parents and the teachers in this study.

In the present study, Cronbach's alpha was found to be 0.896 for parent inattention, 0.879 for parent hyperactivity/impulsivity scale, 0.872 for parent oppositional defiant disorder scale and 0.766 for parent conduct disorder scale. Cronbach's alpha was found to be 0.944 for teacher inattention, 0.907 for teacher hyperactivity/impulsivity scale, 0.933 for teacher oppositional defiant disorder scale and 0.766 for teacher conduct disorder scale. All reliability scores were above 0.70.

**4. Impairment.** In the evaluation of impairment criteria, firstly parents were interviewed about four areas of general functioning of the child: the child's relationships with his/her sibling(s), relationships with friends, ability to do his/her homework, and general adjustment at home. In the interviews with teachers, again four domains were evaluated. In addition, the interviewer searched for information on the interviewee opinion if the patient was problematic or not, his/her general success in different areas of functioning, relationship with the friends and lastly the self-esteem level of the child. These questions were asked in a semi-structured way. All items were rated as no problem at all (0), a little problematic (1), and very problematic (2). The case was considered to be impaired if he/she was rated as very problematic in at least one area or a little problematic in two or more areas. Similar approaches were previously used in epidemiologic studies (Brotman et al., 2006; Ercan et al., 2015, 2016).

Impairment measurements were adapted from Diagnostic Interview Schedule for Children, Version IV (DISC-IV) impairment algorithm that implicates to moderate impairment in at least one area of functioning (Shaffer et al., 2000). Diagnosis specific impairment in the DISC-IV was

used previously in the epidemiological studies (Roberts et al., 2007). Although K-SADS-PL is a reliable diagnostic semi-structured tool to evaluate present and lifetime psychopathology, there is a lack of impairment assessment in the K-SADS-PL. However, DSM criteria require functional impairment to have a diagnosis of ADHD. We used DISC-IV based impairment assessment to obtain diagnosis specific functional impairment including both parents and teachers to strengthen our methodology. Good test-retest reliability of the DISC-IV has been reported. Cronbach's alpha was found to be 0.790 for parent impairment scale, and 0.854 for teacher impairment scale in our analysis.

### Statistical Analyses

Numerical data was presented as mean and standard deviation; categorical data was presented as frequency and percent. Comparisons between independent groups were performed by Student *T* test for numerical variables, and by Chi-square test for categorical variables. Type-I error level for statistical significance was 5%. SPSS 21 (IBM Inc., Armonk, NY, USA) was used for the analyses.

### Results

A total of 5,842 participants have been evaluated regarding prevalence of ADHD in Turkey. Without considering impairment criteria, the overall prevalence of ADHD was 19.5%. The distributions of presentations were as 11.0% for predominantly inattentive presentation (ADHD-I), 1.3% for hyperactive presentation (ADHD-H) and 7.2% for combined presentation (ADHD-C). When the impairment criteria were considered, the overall prevalence of ADHD was found to be 12.4% in the study population, and the distribution of presentations were 6.8% for ADHD-I presentation, 0.7% for ADHD-H presentation, and 4.9% for ADHD-C presentation. Table 1 represents the distribution of presentations in the entire study population, and also according to genders. Accordingly, all presentations of ADHD were significantly higher among boys regardless of considering impairment criteria.

The distribution of ADHD according to the geographical regions in Turkey was shown in Table 2. When the impairment criteria were considered, the prevalence of ADHD ranged between 8.7% and 14.5%, with the lowest and highest rates in Southeastern Anatolia and Marmara regions, respectively. But when impairment criteria were not considered in ADHD diagnosis, the lowest and highest prevalence rates were observed in Southeastern Anatolia (10.3%) and Mediterranean (25.9%) regions, respectively.

The comparisons of T-DSM-IV-TR scale scores between participants with and without ADHD were shown in Table 3. Accordingly, both parent and teacher evaluations of attention-deficit, hyperactivity, oppositional-defiant, and conduct

**Table 1.** The Prevalence of ADHD According to Genders.

|                    | Overall |           | Girls |           | Boys |           | <i>p</i> |
|--------------------|---------|-----------|-------|-----------|------|-----------|----------|
|                    | %       | 95% CI    | %     | 95% CI    | %    | 95% CI    |          |
| Without impairment |         |           |       |           |      |           | <.001    |
| ADHD-I             | 11.0    | 10.2–11.8 | 8.8   | 7.7–9.8   | 13.1 | 11.9–14.3 |          |
| ADHD-H             | 1.3     | 1.0–1.6   | 0.8   | 0.5–1.2   | 1.8  | 1.3–2.3   |          |
| ADHD-C             | 7.2     | 6.5–7.8   | 4.8   | 4.0–5.6   | 9.3  | 8.3–10.3  |          |
| Total              | 19.5    | 18.5–20.5 | 14.4  | 13.1–15.7 | 24.2 | 22.7–25.8 |          |
| With impairment    |         |           |       |           |      |           | <.001    |
| ADHD-I             | 6.8     | 6.2–7.5   | 5.4   | 4.5–6.2   | 8.2  | 7.2–9.2   |          |
| ADHD-H             | 0.7     | 0.5–1.0   | 0.5   | 0.2–0.7   | 1.0  | 0.6–1.4   |          |
| ADHD-C             | 4.9     | 4.3–5.4   | 2.9   | 2.3–3.5   | 6.7  | 5.8–7.6   |          |
| Total              | 12.4    | 11.6–13.3 | 8.8   | 7.7–9.8   | 15.9 | 14.6–17.2 |          |

Note. ADHD-I = attention-deficit/hyperactivity disorder-inattentive presentation; ADHD-H = attention-deficit/hyperactivity disorder-hyperactive/impulsive presentation; ADHD-C = attention-deficit/hyperactivity disorder-combined presentation.

**Table 2.** Prevalence of ADHD According to Impairment Criteria and Geographical Regions.

|                              | ADHD-I         |           |                |          | ADHD-H         |         |                |         | ADHD-C         |          |                |          |
|------------------------------|----------------|-----------|----------------|----------|----------------|---------|----------------|---------|----------------|----------|----------------|----------|
|                              | Impairment (–) |           | Impairment (+) |          | Impairment (–) |         | Impairment (+) |         | Impairment (–) |          | Impairment (+) |          |
|                              | %              | 95% CI    | %              | 95% CI   | %              | 95% CI  | %              | 95% CI  | %              | 95% CI   | %              | 95% CI   |
| Marmara region               | 12.7           | 11.3–14.1 | 8.9            | 7.7–10.2 | 1.6            | 1.0–2.1 | 0.7            | 0.3–1.0 | 7.3            | 6.2–8.4  | 4.9            | 4.0–5.8  |
| Black Sea region             | 11.8           | 7.9–15.6  | 8.1            | 4.8–11.4 | 0.4            | 0–1.1   |                |         | 7.7            | 4.5–10.9 | 5.9            | 3.1–8.7  |
| Aegean region                | 9.2            | 7.2–11.1  | 5.8            | 4.2–7.3  | 0.7            | 0.1–1.3 | 0.4            | 0–0.8   | 10.9           | 8.8–13.0 | 6.5            | 4.8–8.1  |
| Mediterranean region         | 17.7           | 14.7–20.6 | 7.4            | 5.4–9.5  | 1.2            | 0.4–2.1 | 1.1            | 0.3–1.9 | 7              | 5.0–9.0  | 5.3            | 3.5–7.0  |
| Central Anatolia region      | 11             | 9.0–13.0  | 6.5            | 4.9–8.0  | 1.9            | 1.1–2.8 | 1.1            | 0.4–1.7 | 3.1            | 2.0–4.2  | 1.6            | 0.8–2.4  |
| Eastern Anatolia region      | 6.9            | 4.4–9.5   | 4              | 2.0–6.0  | 0.5            | 0–1.3   | 0.3            | 0–0.8   | 11.2           | 8.0–14.4 | 7.7            | 5.0–10.5 |
| Southeastern Anatolia region | 3.6            | 2.2–5.0   | 2.5            | 1.4–3.8  | 1.5            | 0.6–2.4 | 1.2            | 0.4–2.0 | 5.2            | 3.6–6.9  | 4.9            | 3.3–6.6  |

Note. ADHD-I = attention-deficit/hyperactivity disorder-inattentive presentation; ADHD-H = attention-deficit/hyperactivity disorder-hyperactive/impulsive presentation; ADHD-C = attention-deficit/hyperactivity disorder-combined presentation.

**Table 3.** Turgay DSM-IV-TR Scale Scores in Cases with and without ADHD.

|                      | Without impairment |                       |          | With impairment |                       |          |
|----------------------|--------------------|-----------------------|----------|-----------------|-----------------------|----------|
|                      | ADHD (–)           |                       | <i>p</i> | ADHD (–)        |                       | <i>p</i> |
|                      | Mean ± SD          | ADHD (+)<br>Mean ± SD |          | Mean ± SD       | ADHD (+)<br>Mean ± SD |          |
| Parent scale scores  |                    |                       |          |                 |                       |          |
| Attention-deficit    | 4.64 ± 4.22        | 11.52 ± 6.03          | <.001    | 5.03 ± 4.51     | 12.66 ± 6.13          | <.001    |
| Hyperactivity        | 4.58 ± 4.39        | 10.88 ± 6.51          | <.001    | 5 ± 4.77        | 11.51 ± 6.62          | <.001    |
| Oppositional-defiant | 2.06 ± 3.47        | 4.09 ± 5.72           | <.001    | 2.25 ± 3.73     | 3.94 ± 5.84           | <.001    |
| Conduct disorder     | 0.11 ± 0.48        | 0.39 ± 1.31           | <.001    | 0.13 ± 0.59     | 0.41 ± 1.33           | <.001    |
| Teacher scale scores |                    |                       |          |                 |                       |          |
| Attention-deficit    | 0.52 ± 2.27        | 2.02 ± 5.55           | <.001    | 0.58 ± 2.5      | 2.66 ± 6.46           | <.001    |
| Hyperactivity        | 2.77 ± 4.71        | 8.47 ± 8.01           | <.001    | 3.04 ± 5        | 9.81 ± 8.34           | <.001    |
| Oppositional-defiant | 0.95 ± 2.59        | 2.91 ± 5.2            | <.001    | 1.07 ± 2.8      | 3.2 ± 5.62            | <.001    |
| Conduct disorder     | 0.25 ± 1.35        | 1 ± 2.87              | <.001    | 0.29 ± 1.46     | 1.16 ± 3.12           | <.001    |

**Table 4.** Comorbidities in Cases with and without ADHD.

|                                  | ADHD (–)   | ADHD (+)   | p Value |
|----------------------------------|------------|------------|---------|
|                                  | n (%)      | n (%)      |         |
| Anxiety                          | 828 (16.2) | 145 (19.9) | .011    |
| Simple phobia                    | 387 (7.6)  | 57 (7.8)   |         |
| Social anxiety                   | 136 (2.7)  | 23 (3.2)   |         |
| Separation anxiety               | 173 (3.4)  | 44 (6.1)   |         |
| Generalized anxiety              | 105 (2.1)  | 16 (2.2)   |         |
| Post-traumatic stress disorder   | 18 (0.4)   | 0 (0)      |         |
| Anxiety, unspecified             | 9 (0.1)    | 5 (0.7)    |         |
| Depressive disorders             | 113 (2.2)  | 34 (4.7)   | <.01    |
| Dysthymia                        | 10 (0.2)   | 4 (0.6)    |         |
| Major depressive disorder        | 78 (1.5)   | 23 (3.2)   |         |
| Depressive disorder, unspecified | 25 (0.5)   | 7 (1)      |         |
| Nocturnal enuresis               | 403 (7.9)  | 82 (11.3)  | .02     |
| Encopresis                       | 36 (0.7)   | 6 (0.8)    | .717    |
| Specific learning difficulty     | 15 (0.3)   | 14 (2.1)   | <.01    |
| Oppositional defiant disorder    | 92 (1.8)   | 110 (15.1) | <.01    |
| Conduct disorder                 | 6 (0.1)    | 16 (2.2)   | <.01    |
| Intellectual disability (ID)     | 29 (0.6)   | 15 (2.1)   | <.01    |
| Border ID                        | 4 (0.1)    | 2 (0.3)    |         |
| Mild ID                          | 22 (0.4)   | 9 (1.2)    |         |
| Moderate ID                      | 3 (0.1)    | 4 (0.6)    |         |
| Articulation disorder            | 12 (0.2)   | 5 (0.7)    | .033    |

Note. ADHD=attention-deficit/hyperactivity disorder.

disorder subscales were significantly higher in ADHD cases ( $p < .001$  for all domains). Table 4 represents the comorbidities in participants with and without ADHD. The most common psychiatric disorders comorbid to ADHD diagnosis were as follows: Oppositional defiant disorder (15.1%), nocturnal enuresis (11.3%), simple phobia (7.8%), separation anxiety (6.1%), tic disorders (5.2%), social anxiety (3.2%), and major depressive disorder (3.2%). ADHD with impairment group had significantly higher rates in all psychiatric comorbidities except for encopresis (Table 4). When we compared psychiatric comorbidities between ADHD with and without impairment groups, we did not detect any significant differences except for oppositional defiant disorder and conduct disorder. Although ADHD without impairment group had similar psychiatric comorbidity rates, impairment in ADHD group resulted in significantly higher rates of oppositional defiant disorder and conduct disorder diagnosis (Table 5).

## Discussion

The prevalence of psychopathologies, particularly ADHD, has been subject to numerous studies during the last decades worldwide. The current literature includes many single-centers, or population-based research about the epidemiological basis of this disease in different populations and countries.

But there are significant variations in the reported prevalence of ADHD, and debates are continuing whether the ADHD is over-diagnosed (Batstra et al., 2012; Bruchmüller et al., 2012) or underdiagnosed (Cuffe et al., 2005). There have been several efforts to determine the prevalence of ADHD in Turkey, as in many countries around the World (Erol et al., 1998; Karabekiroglu et al., 2013). However, there was a lack of an epidemiological study that may interfere to reflect the national prevalence of this disorder.

On the basis of this scientific background, we have designed this cross-sectional study by applying the state-of-the-art methodology for epidemiological studies, which covers the study design, sample framing, by using validated scales in standardized assessments, and appropriate statistical and inferential interpretation. We have applied the evaluation scales to both children and parents through a one-stage evaluation process, the use of parents and teachers' scales, and independent impairment criteria. Our results revealed that the prevalence of ADHD in Turkey is 12.4% in nationwide representative samples of the Turkish children between the ages of 8 to 10. This prevalence rate is much higher than the pooled prevalence rate of 5.29% and 7.1% of two extensive meta regression analysis studies (Polanczyk et al., 2007; Willcutt, 2012).

Up to date, studies about the prevalence of ADHD have reported an increasing trend over time (Polanczyk et al.,

**Table 5.** Comorbidities in ADHD Cases with and without Impairment.

|                                  | ADHD without impairment | ADHD with impairment | p Value |
|----------------------------------|-------------------------|----------------------|---------|
|                                  | n (%)                   | n (%)                |         |
| Anxiety                          | 69 (16.7)               | 145 (19.9)           | .184    |
| Separation anxiety               | 14 (3.4)                | 44 (6.1)             |         |
| Simple phobia                    | 34 (8.3)                | 57 (7.8)             |         |
| Post-traumatic stress disorder   | 1 (0.2)                 | 0 (0)                |         |
| Social anxiety                   | 9 (2.2)                 | 23 (3.2)             |         |
| Generalized anxiety              | 9 (2.2)                 | 16 (2.2)             |         |
| Anxiety, unspecified             | 2 (0.5)                 | 5 (0.7)              |         |
| Depressive disorders             | 11 (2.7)                | 34 (4.7)             | .096    |
| Dysthymia                        | 0 (0)                   | 4 (0.6)              |         |
| Major depressive disorder        | 10 (2.4)                | 23 (3.2)             |         |
| Depressive disorder, unspecified | 1 (0.2)                 | 7 (1)                |         |
| Tic disorder                     | 12 (2.9)                | 38 (5.2)             | .067    |
| Obsessive-compulsive disorder    | 2 (0.05)                | 13 (1.8)             | .064    |
| Nocturnal enuresis               | 55 (13.3)               | 82 (11.3)            | .302    |
| Specific learning difficulty     | 3 (0.8)                 | 14 (2.1)             | .118    |
| Asperger syndrome                | 0 (0)                   | 4 (0.6)              | .136    |
| Oppositional defiant disorder    | 36 (8.7)                | 110 (15.1)           | .002    |
| Conduct disorder                 | 1 (0.2)                 | 16 (2.2)             | .09     |
| Intellectual disability (ID)     | 5 (1.2)                 | 15 (2.1)             | .294    |
| Border ID                        | 0 (0)                   | 2 (0.3)              |         |
| Mild ID                          | 5 (1.2)                 | 9 (1.2)              |         |
| Moderate ID                      | 0 (0)                   | 4 (0.6)              |         |
| Articulation disorder            | 3 (0.8)                 | 14 (2.1)             | .914    |

Note. ADHD = attention-deficit/hyperactivity disorder.

2014), particularly in each revision made in DSM since the third edition (DSM-III) (Batstra & Frances, 2012; Polanczyk et al., 2007). The changes in diagnostic criteria and the characteristics of sample populations play a major role in this increase. A recent systematic review and meta-analysis has evaluated the published data up to date, including the previous meta regression analyses about the prevalence of ADHD, and reported the overall pooled estimate of the ADHD prevalence as 7.2% (Thomas et al., 2015). Authors noted that their findings were higher than the study conducted by Polanczyk et al. (Polanczyk et al., 2007) but emphasized that Polanczyk et al had implemented a language barrier in their review, which may affect their prevalence rate of ADHD. When this study and comments of authors on the previous studies considered together, our results remain still higher than the most comprehensive reviews of the literature, including a recent meta-analysis which reported the worldwide prevalence of mental disorders in children and adolescents as 13.4% (CI 95% 11.3–15.9), and prevalence rate of attention deficit hyperactivity disorder as 3.4% (CI 95% 2.6–4.5) (Polanczyk et al., 2015).

Nevertheless, our prevalence rate that was higher than the previous reports should be interpreted carefully. Since age is the most important confounding factor for the prevalence of

ADHD, our prevalence rate should be compared with the previous reports after considering the age interval. Doing so, our results were found to be higher than the first meta regression analysis reporting 6.48% for children (Polanczyk et al., 2007) but very similar to the second meta regression analysis study, which Willcutt reported ADHD prevalence of 11.4% for 6 to 12 years old children with a confidence interval of CI: 9.8 to 13.33 (Willcutt, 2012). This confidence interval also includes our prevalence rate of 12.4%. It should also be noted that our ADHD presentation distribution is parallel to the results of Willcutt, which ADHD-I is leading, followed by ADHD-C and ADHD-H presentations. Distribution of presentations in our study was also similar with Willcutt's study.

Our results are also compatible with the previous studies conducted in Turkey. Ercan et al. (2015) conducted a study with 419 randomly selected primary school children in İzmir province and reported the prevalence of ADHD in this representative sample as 12.5% when impairment criteria is considered in assessments. Another study by Ercan et al. (2013) also reported the prevalence of ADHD as 12.7%. Despite both studies by Ercan et al. has used different methodologies and samples, the prevalence rates were similar. But there were also different rates for ADHD prevalence from different

studies in Turkey. One of those studies were conducted by Guler et al. (2017), who reported the prevalence rates as 2.7% to 9.6% for parent-based estimates, and between 2% and 10.1% for teacher-based estimates. As in the continuing debates in the literature, the main reasons for the differences between these studies were the methodologies and scales that have been used. Another example of this is a recent study about the epidemiology of ADHD in Chilean children and adolescents that reported the prevalence of ADHD in 4 to 11 age group as 15.5%, which is a much higher prevalence rate than found in our study (de la Barra et al., 2013).

## Conclusions

To conclude, ADHD prevalence rate of 12.4% found in this study is higher than most of the studies in literature using Best Estimate Procedure for diagnosing ADHD. But our findings are similar with the mean ADHD prevalence rates of 11.4% for the same age group reported by Willcutt (2012) and the mean ADHD prevalence rate of nine South American studies that took part in the worldwide meta-analysis study by Polanczyk et al.<sup>8</sup> Our study and other recent studies from all around the world suggest that ADHD is a very frequent child mental health disorder in different cultures, even outside Western Cultures. We think that our results can be considered as a national prevalence data due to our studies' state-of-the-art methodology.

This study has several limitations. First, the participants were randomly selected from schools in urban areas for ease of access by study centers and did not cover the schools in rural areas. Second, a household sampling could not be performed, which might affect the prevalence rate by not including non-school aged children, and the children who did not attend their schools due to several reasons including ADHD. One of the reasons we included elementary group children as the sample was to reduce the number of children not attending school or children not participating in the study. Because elementary school attendance is obligatory for children under the law and the elementary group is the group that shows the highest school attendance rates. Also, most of the centers have reached the planned number of children. Only five centers were not able to screen planned numbers of children. In addition, these centers had also a high screened/planned ratio (94.1%, 95.2%, 97.1%, 97.8%, and 99.1%)

Despite these limitations, this study has also some strength. The most important feature is the study sample, which covered all geographical regions of Turkey and is shown to represent the population in the country. And, the sample of children in all urban schools across study centers covered approximately 71.4% of the population of Turkey supporting generalizability. Also, standardization of diagnostic processes and interviews has also contributed to the quality of the study. Another strength of the study is the incorporation of impairment criteria into consideration for determining the

prevalence of ADHD. The last, but not the least, the study was conducted without funding from any organization.

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