

# Reflections of Attention Deficit Hyperactivity Disorder Into Adulthood: Past and Current Symptoms

*Dikkat Eksikliği ve Hiperaktivite Bozukluğu: Yetişkinlere Yansımaları, Belirtilerin Dünü ve Bugünü*

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## ABSTRACT

**Objectives:** Attention deficit hyperactivity disorder (ADHD) is a chronic disorder spanning early childhood, adolescence, and adulthood. While impulsivity, lack of self-control, and opposition to authority are common in children, emotional fluctuations, illegal activities, and alcohol/substance use come to the fore in adults. This study aimed to examine functionality/symptom severity and predictors of short-term outcomes in adolescents diagnosed with ADHD.

**Materials and Methods:** The study included 49 ADHD patients that were aged 15-18 years when diagnosed as ADHD between the years of 2013 and 2017. The severity of ADHD and comorbidities at the time ADHD was diagnosed were recorded. A sociodemographic information form and the Adult ADHD Self-Report Screening Scale for DSM-5 were administered to all participants.

**Results:** There was a positive correlation between socioeconomic status score and age. Compared with males, more females had comorbid diagnoses and depressive disorder, and fewer females received traffic tickets and secured bank loans, whereas more males than females had behavioral problems.

**Conclusion:** It is known that the symptoms of childhood ADHD persist into adulthood. This persistence has a negative effect on academic and professional performance, negatively affects mental and physical health, and increases the risk of substance abuse, antisocial behavior, and illegal activities.

**Keywords:** Attention deficit hyperactivity disorder, young adult, impulsivity, prognosis, comorbidity

## ÖZ

**Amaç:** Dikkat eksikliği hiperaktivite bozukluğu (DEHB), erken çocukluk, ergenlik ve yetişkinlik dönemini kapsayan kronik bir bozuktur. Çocukluk döneminde dürtüsellik, özdenetim eksikliği ve otorite ile mücadele görülebilirken; duygusal dalgalanmalar, yasa dışı eylemler ve alkol-madde kullanımı yetişkinlikte öne çıkmaktadır. Bu çalışmada DEHB tanılı ergenlerdeki geleceğe dönük işlevsellik/semptom şiddeti ve kısa dönem bulguların yordayıcılarını incelemek amaçlanmıştır.

**Gereç ve Yöntem:** Çalışma grubumuz 2013-2017 yılları arasında DEHB tanısı almış 15-18 yaş aralığında 49 genç erişkinden oluşmaktadır. Genç erişkinlerin hasta dosyaları tam anındaki DEHB şiddeti ve komorbidite açısından incelendi. Sosyodemografik Bilgi Formu ve DSM-5 için Yetişkin DEHB Öz-Bildirim Tarama Ölçeği kullanıldı.

**Bulgular:** Sosyoekonomik düzey puanları ile yaş arasında pozitif bir korelasyon bulundu. DEHB'li kadınlarda daha fazla eştanı ve depresif bozukluk, daha az trafik cezası ve bankadan kredi alma oranları saptanırken, erkekler daha fazla davranım sorunu göstermekteydi.

**Sonuç:** Çocukluk çağında DEHB belirtilerinin erişkin yaşamda da devam ettiği bilinmektedir. Bu durum bireylerin akademik ve mesleki işlevselliklerini azaltmakta, ruh ve beden sağlıklarını olumsuz etkilemekte, madde kullanımı, antisosyal ve yasa dışı davranışlar açısından riski artırmaktadır.

**Anahtar Kelimeler:** Dikkat eksikliği hiperaktivite bozukluğu, genç erişkin, dürtüsellik, prognoz, komorbidite

## Introduction

Attention deficit hyperactivity disorder (ADHD) is among the most common and chronic neurodevelopmental disorders; beginning in childhood and affecting adolescence and

adulthood. It is characterized by inattention, hyperactivity, and impulsivity.<sup>1,2</sup> According to the World Health Organization, the worldwide prevalence of ADHD in adults aged 18-44 years is approximately 2.8% (range: 0.6-7.3%).<sup>3</sup> ADHD is commoner

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among males and this preponderance is more dramatic in clinical studies than in population-based studies.<sup>4</sup> In total, 70.0% of ADHD symptoms that are present in childhood persist in adolescence and 66.0% persist in adulthood.<sup>5,6</sup>

The clinical manifestations of ADHD exhibit age- and period-specific differences. These differences, which are considered in the DSM-5, affect daily life. Hyperactivity, which is evident in childhood, leads to attention deficit in adolescence.<sup>7</sup> Unwillingness to study, difficulty making plans, forgetfulness, and poor time management are associated with ADHD in adolescents and young adults.<sup>8</sup> In addition, although the behavioral manifestations of the disorder decrease with age, emotional fluctuations and subjective restlessness continue. Studies have shown that 25.0-45.0% of children with ADHD may have serious emotional problems.<sup>9</sup> Such behaviors as temper tantrums, irritability, impulsive decision making/behaviors regardless of consequences, and loss of self-control can result in long-term negative consequences.<sup>10</sup>

Although not included in the basic diagnostic criteria, emotional problems negatively affect the lives of individuals with ADHD by increasing the severity of ADHD symptoms and increasing burden of comorbidity.<sup>11-14</sup> It has been reported that the two main features of ADHD that cause problems with emotion regulation are impulsivity and insufficient self-control.<sup>14</sup> While individuals with ADHD are hypersensitive to emotional stimuli, they experience difficulty managing intense emotions.<sup>14</sup> This state can manifest as impulsivity, lack of self-control, and opposition to authority during childhood, whereas it can manifest as emotional fluctuations, illegal activities, and alcohol/substance use during adulthood.<sup>15</sup> Individuals who have difficulty monitoring and regulating their behavior tend to act impulsively, react without considering the consequences, and disregard the effects of their behaviors on others.<sup>16</sup> In addition, individuals with a tendency toward high-risk behaviors as potential contributors can face many negative consequences in the long term, such as traffic accidents and delinquency.<sup>16,17</sup>

There are only a limited number of studies on the transition of ADHD from childhood to adolescence and adulthood, and there is a need for guidelines on how to manage this transition effectively.<sup>18</sup> The present study aimed to evaluate the severity of ADHD symptoms and symptomatology in young adults diagnosed with ADHD who were last followed up as adolescents at our outpatient clinic five years earlier. Functionality and ADHD symptom severity were compared between adolescence and early adulthood, and differences according to gender were noted.

It was hypothesized that the frequency of ADHD would decrease with age, whereas deviant behaviors such as cigarette-alcohol-substance use, disobeying traffic laws, traffic accidents, and debt would increase. It was also hypothesized that externalizing symptoms of ADHD would be more common in males and internalizing symptoms would be more common in females.

## Materials and Methods

### Study Design and Sampling

This longitudinal follow-up study was performed between June 1, 2021 and October 1, 2021, at İstanbul Marmara University, Pendik Training and Research Hospital, Child and Adolescent Psychiatry Clinic, İstanbul Turkey. To create the study sample, the medical records of patients who presented to the outpatient clinic between 2013 and 2017 and were aged 15-18 years at the time ADHD was diagnosed (according to DSM-5 criteria) were investigated. The exclusion criteria were mental retardation/intellectual disability, pervasive developmental disorder/autism spectrum disorder, substance abuse, chronic or severe medical conditions, neurologic diseases, such as seizure, and psychosis. In all, files for 203 patients diagnosed with ADHD were found, of which 113 could be contacted by phone, informed about the study, and invited to participate. A sociodemographic questionnaire, the Adult ADHD Self-Report Screening Scale (ASRS-5) for DSM-5, and a study consent form were delivered electronically to the 66 patients who verbally agreed to participate in the study. Among these patients, 12 who improperly completed the forms, 4 with mental retardation based on a Wechsler Intelligence Scale for Children intelligence quotient <70, and one with epilepsy were excluded from the study. The remaining 49 young adults (18 females and 31 males) with a median age of 22.3 years, were included in the study. The study protocol was approved by the Ethics Committee of Marmara University Faculty of Medicine (protocol no: 09.2021.1287, date: 05.11.2021).

### Assessment Tools

#### Sociodemographic Questionnaire

The sociodemographic characteristics of the participants were obtained using a sociodemographic questionnaire developed by the researchers. The questionnaire included data on age, gender, educational level, occupation, monthly income of the participant, number of people living at home, monthly income per person in the family, and parental psychopathology. The items "Do you smoke?", "Do you use alcohol?" and "Do you use substances?" were also included. Data on comorbid diagnoses, history of psychiatric drug use, current psychiatric follow-up, and current psychiatric drug use were collected. If the items "Are you currently taking psychiatric medication?" and "What psychiatric drugs did you use in the past?" were answered "yes," the participants were asked to specify the drugs. Yes/no items were used to evaluate the negative situations that the participants might have encountered as young adults, such as a criminal record, traffic tickets, traffic accidents, fighting, and debt. Examples of the questionnaire items follow. "Do you have a criminal record? If yes, please explain." "Have you ever received a traffic ticket? If yes, please state the number of tickets and the reasons." "Has your driver's license been revoked? If yes, please state the number of times and reasons." "Have you had a traffic accident (that damaged your vehicle, you, or someone else)? If yes, please indicate the number of times it has happened." "Have you ever had a broken bone? If yes, please indicate the number of

times and your age when it happened.” “Have you obtained any loans from a bank?” and “Do you have any outstanding debt? If yes, please specify.” “Do you get into fights often?” In addition, data on parental education level, occupation, marital status, psychiatric history, and whether any siblings were diagnosed with ADHD were collected.

Finally, the socioeconomic status score (SES) for each participant was calculated by evaluating parameters such as education level, occupation, and monthly income obtained from a community-based epidemiological study.<sup>19</sup> In terms of monthly income, the lowest [0 Turkish Liras (TL)] and highest (25.000 TL) were scored between 0 and 1.5. The mean monthly income was 3500 TL, and the median monthly income was 2825 TL. Monthly income per person in the family was scored between 0.25 and 1.5, with the lowest being 600 TL and the highest being 20.000 TL. The mean monthly income per person in the family was 3095 TL, and the median was 2000 TL. The level of education in the participants was scored between 0 and 1.5 as follows: illiterate: 0; literate: 0.3; primary school graduate: 0.6; secondary school graduate: 0.9; high school graduate: 1.2; university graduate: 1. It was rated 0.5. According to the Socioeconomic Status Measurement Tool table, the occupational status codes of the participants were between 1 and 19. The lowest occupation score was 0 [occupational code 19: casual labor (daily worker, babysitter, casual worker in construction, porter, laborer, and piecework)]. The highest occupation score was 1.7 (occupation code 1: medium and large employer; employing >10 people, own account; manufacturing, services, construction, and transportation). In addition, the occupational code of the unemployed participants was 20, and their occupational score was 0. The SES score was calculated by adding a participant's education level score, occupational group score, personal monthly income score, per capita monthly income in the family score, mother's level of education score, mother's occupational group score, father's level of education score, and father's occupational group score as per the original study.<sup>19</sup>

#### **ASRS-5 (Adult ADHD Self-Report Screening Scale for DSM-5)**

ASRS-5 for DSM-5 is an updated version of ASRS v1.1. The validity of the scale was studied by Ustun et al.<sup>20</sup> in 2017, and the validity and reliability of the Turkish version was reported by Genç et al.<sup>21</sup>. ASRS-5's 6 items are answered using a 5-point Likert-type scale (0-4). The scale's total score ranges from 0 to 24, with a threshold score of 11 indicating a probable diagnosis of ADHD. In the present study, ASRS-5 was used to measure the severity of ADHD.

#### **SNAP-IV (Swanson, Nolan, and Pelham Rating Scale-Fourth version)**

The SNAP-IV has 26 items answered using a Likert scale. The SNAP-IV has 3 subscales: attention deficit (AD, 9 items), hyperactivity/impulsivity (H/I, 9 items), and oppositional (ODD, 8 items). Higher scores are indicative of more symptoms. The scale has been used in population-based studies to identify possible ADHD diagnoses in children.<sup>22</sup> In the present study,

SNAP-IV was used to measure the severity of ADHD when patients first presented to the outpatient clinic.

#### **Statistical Analysis**

Data were analyzed using IBM SPSS Statistics for Windows v.21.0 (IBM Corp, Armonk, NY). Descriptive statistics are presented as mean  $\pm$  statistical analysis or frequency (%). The chi-square ( $\chi^2$ ) test and Fisher's exact test were used to compare categorical variables between groups. In bivariate comparisons, the independent sample t-test was used for normally distributed data, and the Mann-Whitney U test was used for non-homogenic data. Odds ratio (OR) values for differences in comorbidity rates and daily functioning between genders were calculated using the Mantel-Haenszel chi-square test while controlling for variables such as SES. The results are presented as ORs with 95.0% CIs. For all analyses, the level of statistical significance was set at  $p < 0.05$ , and all p-values were two-tailed.

#### **Results**

The study included 49 young adults, among whom 18 were females (mean age: 22.6 $\pm$ 0.6 years) and 31 were males (mean age: 22.4 $\pm$ 0.6 years). The sociodemographic characteristics of the participants are summarized in Table 1.

There were no significant correlations between SES and the SNAP teacher-AD score ( $r=0.014$ ,  $p=0.944$ ), between SES and the SNAP teacher-H/I score ( $r=-0.034$ ,  $p=0.867$ ), between SES and the SNAP parent-AD score ( $r=-0.159$ ,  $p=0.309$ ), or between SES and the SNAP parent-H/I score ( $r=-0.018$ ,  $p=0.911$ ). There was a negative correlation between educational level and SNAP teacher-H/I score ( $r=-0.535$ ,  $p=0.005$ ). There were no significant differences in the SNAP and ASRS-5 scores between genders (Table 2).

Psychopathology was present in six of the mothers, of whom three had a mood disorder and four an anxiety disorder. Psychopathology was present in four of the fathers, of whom one had a mood disorder and a comorbid psychotic disorder, two an anxiety disorder, and one obsessive-compulsive disorder (OCD). None of the parents were diagnosed with ADHD. Psychopathology was present in nine of the participants' siblings, of whom two had an anxiety disorder, one had OCD, two had a neurodevelopmental disorder, and four had ADHD.

In all, 18.0% of the participants had  $\geq 1$  comorbid diagnoses, consisting in order of frequency major depression (14.3%), conduct disorder (8.2%), oppositional defiant disorder (6.1%), panic attacks/disorder (6.1%), social phobia (4.1%) and substance abuse (2.0%). Among the participants, rates for generalized anxiety, bipolar disorder, OCD, enuresis, encopresis, and post-traumatic stress disorder were 2.0% for each. In total, 69.4% of participants were taking psychiatric medication during follow-up as adolescents. As young adults, 16.3% of the participants were still taking psychiatric medication. The differences in comorbidity between the sexes are summarized in Table 3.

**Table 1. Sociodemographic characteristics of adolescents diagnosed with ADHD at the study center between 2013-2017**

	Female (n=18) n (%)	Male (n=31) n (%)	Statistical analyses
<b>Level of education</b>			
Secondary school	0 (0)	3 (9.7)	X <sup>2</sup> =2.086, p=0.352
High school	9 (50)	12 (38.7)	
University	9 (50)	16 (51.6)	
<b>Maternal level of education</b>			
Illiterate	2 (11.2)	1 (3.2)	X <sup>2</sup> =4.949, p=0.293
Primary school	6 (33.3)	13 (41.9)	
Secondary school	1 (5.6)	5 (16.1)	
High school	6 (33.3)	11 (35.5)	
University	3 (16.7)	1 (3.2)	
<b>Paternal level of education</b>			
Primary school	6 (33.6)	12 (38.7)	X <sup>2</sup> =0.266, p=0.966
Secondary school	3 (16.7)	5 (16.1)	
High school	7 (38.9)	10 (32.3)	
University	2 (11.1)	4 (12.9)	
Parents living together	17 (94.4)	27 (87.1)	X <sup>2</sup> =1.245, p=0.537
Maternal psychopathology	4 (22.2)	2 (6.5)	X <sup>2</sup> =2.636, p=0.104
Paternal psychopathology	2 (11.1)	2 (6.5)	X <sup>2</sup> =0.330, p=0.566
Unemployed	5 (27.8)	12 (38.7)	X <sup>2</sup> =0.601, p=0.438
	<b>Mean ± SD</b>	<b>Mean ± SD</b>	
Age, years	22.60±0.64	22.43±0.63	t=0.943, p=0.351
Maternal age, years	47.94±6.26	47.29±5.14	t=0.396, p=0.694
Paternal age, years	51.22±5.69	52.13±5.40	t=-0.555, p=0.588
Number of household members	3.56±1.38	3.45±1.28	t=0.265, p=0.792
Monthly income per person (TL)	1984.16±1268.08	3740.68±4476.25	t=-1.621, p=0.112
Monthly personal income (TL)	2302.78±1627.15	4207.45±5349.88	t=-1.466, p=0.073
SES	6.00±1.30	5.92±1.41	t=-0.199, p=0.843

SD: Standard deviation, TL: Turkish Liras, SES: Socioeconomic status score, ADHD: Attention deficit hyperactivity disorder

Among the participants, 34.7% were unemployed. The occupational status of the employed participants was as follows: low-skilled worker (24.5%), unskilled worker (8.2%), small employer (6.1%), casual temporary worker (6.1%), medium-skilled worker (6.1%), unpaid family worker (4.1%), marginal job (4.1%), self-employed professional (2.0%), mid-level civil servant (2.0%), self-employed small trader (2.0%). Low-skilled workers were the most common occupational status in both genders (females: 27.8% vs. males: 22.6%). Outcomes of ADHD in adulthood for the study sample are summarized in Figure 1.

In total, 75.5% of the participants had problems with daily functioning, which were determined according to six different criteria: having a criminal record; having a traffic accident; having a driver's license revoked; having bank debt; getting involved in fights; and substance use. Based on these criteria, overall daily functioning was higher in females than in the

males (Table 3). There were no significant differences in daily functioning between the genders according to the SNAP teacher form-AD, SNAP teacher form-H/I, SNAP parent-AD, or SNAP parent-H/I scores ( $p>0.05$ ). More females had comorbid diagnoses and depressive disorder, and fewer of the females had traffic tickets and bank loans, even after controlling for SES (Table 3).

## Discussion

The present study aimed to determine the outcomes of ADHD among young adults diagnosed in adolescence at a tertiary treatment center. The most striking finding was that more males had problems and criminal activities than females. Based on these findings, daily functioning was considered to be higher among females.

**Table 2. SNAP and ASRS-5 scores of adolescents diagnosed with ADHD at the study center between 2013-2017 according to gender after controlling the effect of SES**

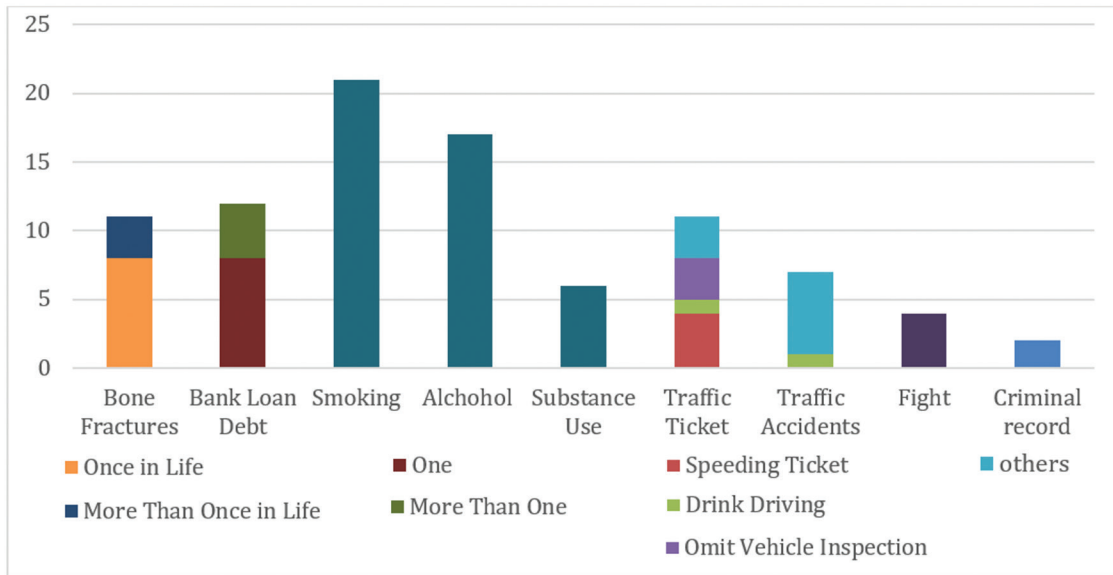
	<b>Female (n=18) Mean ± SD</b>	<b>Male (n=31) Mean ± SD</b>	<b>X<sup>2</sup>/Z</b>	<b>p-value</b>	<b>OR (95% CI) adjusted<sup>a</sup></b>
SNAP total	30.78±9.98	29.84±11.51	-0.457	0.648	
SNAP TF-AD score	10.87±4.79	15.31±7.08	-1.614	0.119	
SNAP TF-H/I score	8.37±8.89	14.50±9.54	-1.540	0.137	
SNAP parent-AD Scores	15.81±6.25	13.81±5.22	1.126	0.267	
SNAP parental H/I score	17.12±5.36	15.92±6.40	0.627	0.534	
ASRS-5 total	9.44±5.17	8.12±4.44	-0.624	0.533	
Cut off (+)	n (%)	n (%)			
ASRS-5 total	7 (38.9)	10 (32.3)	0.221	0.638	
Question 1	4 (22.2)	4 (12.9)	0.724	0.395	
Question 2	4 (22.2)	4 (12.9)	0.724	0.395	
Question 3	6 (33.3)	3 (9.7)	4.250	0.039*	0.20 (0.04-1.00)*
Question 4	5 (27.8)	8 (25.8)	0.023	0.880	
Question 5	6 (33.3)	13 (41.9)	0.355	0.551	
Question 6	5 (27.8)	6 (19.4)	0.464	0.496	

<sup>a</sup>Fisher’s exact test, \*p≤0.05. TF: Teacher form, AD: Attention deficit, H/I: Hyperactivity/impulsivity, ASRS-5: Adult ADHD Self-Report Screening scale, SD: Standard deviation, OR: Odds ratio, CI: Confidence interval, SES: Socioeconomic status score, ADHD: Attention deficit hyperactivity disorder

**Table 3. Comorbidity and daily functioning according to sex among adolescents diagnosed with ADHD at the study center between 2013-2017 after removing the effect of SES**

	<b>Female (n=18) n (%)</b>	<b>Male (n=31) n (%)</b>	<b>X<sup>2</sup></b>	<b>p-value</b>	<b>OR (95% CI) adjusted<sup>a</sup></b>
Comorbidity	10 (55.6)	8 (25.8)	4.337	0.037*	0.28 (0.08-0.95)*
Depression	5 (27.8)	2 (6.5)	4.230	0.040*	0.17 (0.03-1.03)*
Anxiety disorders	3 (16.7)	2 (6.5)	1.297 <sup>a</sup>	0.342	
Externalization disorders	2 (11.1)	3 (9.7)	0.026 <sup>a</sup>	0.873	
History of medication use	14 (77.8)	20 (64.5)	0.943	0.332	
Current medication	5 (27.8)	3 (9.7)	2.731	0.098	
History of methylphenidate use	8 (57.1)	17 (58.6)	0.008	0.927	
Daily functioning	8 (44.4)	17 (54.8)	0.492	0.483	
Criminal offense	0 (0)	2 (6.5)	1.211 <sup>a</sup>	0.526	
A traffic accident	2 (11.1)	4 (12.9)	0.034 <sup>a</sup>	0.854	
Suspension of license	0 (0)	1 (3.2)	0.593	0.441	
Bank debt	3 (16.7)	9 (29)	0.942 <sup>a</sup>	0.494	
Involved in a fight	2 (11.1)	2 (6.5)	0.330	0.618	
Substance use	1 (5.6)	5 (16.1)	1.185	0.393	
Bone fracture	2 (11.1)	10 (32.3)	2.754 <sup>a</sup>	0.168	
Smoking	10 (55.6)	15 (48.4)	0.234	0.628	
Alcohol	6 (33.3)	11 (35.5)	0.023	0.879	
Able to get a bank loan	8 (44.4)	22 (71)	3.375	0.066	
Traffic ticket	0 (0)	11 (35.5)	8.236 <sup>a</sup>	0.004**	NS

<sup>a</sup>Fisher’s exact test, \*p≤0.05, NS: Non-significant, OR: Odds ratio, CI: Confidence interval, SES: Socioeconomic status score, ADHD: Attention deficit hyperactivity disorder



**Figure 1.** Current outcomes of ADHD in adulthood in adolescents diagnosed with ADHD at the study center between 2013-2017  
ADHD: Attention deficit-hyperactivity disorder

### Persistence of ADHD Symptoms

The findings of many longitudinal follow-up studies show that among children diagnosed with ADHD, the diagnosis and symptoms persist into adulthood in a significant number. Although the diagnosis of ADHD persists into adulthood in 5.7-77.0% of cases, the symptoms persist in 60.0-86.0%.<sup>23</sup> It was reported that 66.0% of hyperactive children still exhibited  $\geq 1$  ADHD symptoms as adults and that the persistent symptoms increased in severity.<sup>24</sup> In the present study ~33.0% of the participants were diagnosed with possible ADHD as young adults. Furthermore, ADHD persisted into young adulthood at a higher rate (but not significantly) in females, and compared with males, females had more depressive symptoms and comorbidity. These findings may indicate that the emotional dimensions of ADHD symptoms become more significant during the transition to adulthood in females. It should be kept in mind that only the symptoms of ADHD emphasized in childhood, such as attention, hyperactivity, and impulsiveness, can change form in adults (such as restlessness and explosiveness) and impair daily functioning.

### Academic Performance

Many studies have shown that ADHD adversely affects academic performance in high school and college<sup>25-28</sup>, and these adverse effects are ameliorated with the combination of psychopharmacologic and behavioral interventions.<sup>28-30</sup> When considering treatment protocols for individuals with ADHD comorbid psychiatric diagnoses, consideration should be given to these diagnoses.<sup>30</sup> In Turkey, the percentage of the general population aged >25 years with at least a high school education in 2021 was 45.6% (TurkStat, National Education Statistics Database, 2008-2021).<sup>31</sup> In the present study, 42.9% of the participants were high school graduates and 51.0% were university graduates. Moreover, as the SNAP teachers' H/I

scores increased, the level of education decreased. Although the present study's participants had a higher education level than the Turkish mean, the findings show that their educational level might have been affected by the core symptoms of ADHD, such as hyperactivity. All participants had been followed up as adolescents by a child/adolescent psychiatrist, the majority received pharmacological treatment, and all of their parents underwent detailed psychoeducation. Moreover, the present study population had a lower than expected comorbidity rate.<sup>32</sup> The high rate of treatment maintenance and low comorbidity rate might explain why the participants' education level was higher than the Turkish mean. Establishing comorbid diagnoses and early and accessible treatment may ameliorate emergence of later ADHD-related academic problems.

### Occupational/Economic Functioning

It was reported that patients with ADHD have lower occupational and financial skills than individuals without ADHD and have difficulty managing money.<sup>33-35</sup> In the present study, 27.8% of the women and 38.7% of the men were unemployed. The unemployment rate in Turkey during the study period was 15.8-20.3% for males (lower than in the present study) and 26.1-32.1 for females (similar to the present study) (TURKSTAT, Labor Force Statistics).<sup>36</sup> Considering that the present study found that females had better daily functioning than males and that a higher percentage of males with ADHD had work-related problems than those in the general population, it can be hypothesized that ADHD may adversely affect males to a greater degree than females. Moreover, in the present study, low-skilled worker was the most common occupational status in both genders, which is not surprising considering that the study was conducted at a tertiary general hospital in a community characterized by low/middle SES, and that <50%. Zero of the participants only had a high school education level.

### Antisocial Behaviors and Criminality

Childhood hyperactivity can result in a high rate of emergency room visits, susceptibility to accidents, and being sued.<sup>37-</sup><sup>40</sup> Across multiple cultures, children diagnosed with ADHD exhibit severe antisocial and disruptive behaviors, physically attack others, and violate the law in ways that require police intervention.<sup>41-43</sup> Furthermore, diagnosis of ADHD in childhood is a strong predictor of tobacco, alcohol, and illicit substance use in adulthood.<sup>44</sup> In the present study, more males than females (but not significantly) exhibited problematic behaviors, such as substance use, smoking, alcohol use, traffic infractions, driver's license revocation, fighting, and bone fractures. Regardless of gender, traffic tickets for speeding, drunk driving, and traffic accidents were noted in ~20.0% of participants, and 6 of the participants were engaged in regular substance use. Moreover, ~15.0% of the participants had a comorbid disruptive behavior disorder, such as conduct disorder and oppositional defiant disorder, which can predispose them to antisocial personality disorder in the future. Consistent with the literature, these findings demonstrate that attention deficit and impulsivity can lead to criminality by impairing executive function. Considering that the present study was conducted via an online platform and that some of the investigated behaviors were illegal, such as substance use, some behaviors might have been underreported. Larger scale face-to-face studies are needed to generalize the findings.

### Pharmacotherapy and ADHD severity

Parental psychopathology, ADHD severity, and comorbid diagnoses in childhood are the most prominent factors associated with ADHD severity in adulthood.<sup>45</sup> The severity of ADHD and functional impairment in adults are associated with family-related sociodemographic factors, such as per capita family income and parental education level.<sup>45</sup> The literature includes inconsistent findings related to the relationship between stimulant therapy and daily functioning, including the finding that drug treatment for childhood ADHD is not a predictor of ADHD in adulthood.<sup>46,47</sup> Almost three-quarters of the study participants were receiving drug treatment, especially methylphenidate, during follow-up as adolescents. At the time the present study was conducted, a quarter of the participants were taking ADHD medication, but none were using methylphenidate. Considering that 33.0% of the participants had ADHD symptom scores above the cutoff points, the lack of methylphenidate use is a significant finding. Although the majority of participants received medication for ADHD in adolescence, it is supposed that the diagnosis of ADHD may go unrecognized in adult psychiatric clinics and may remain untreated throughout adulthood.

### Psychopathology

ADHD in adolescents is usually accompanied by various psychopathologies, most commonly disruptive behavior disorders, depression, and anxiety.<sup>32</sup> The present study included young adults, and many diagnoses were not included because of the exclusion criteria; therefore, the rate of comorbid

psychopathologies might be lower than that previously reported. Adult females with ADHD are more likely than adult males to have comorbid psychopathologies, such as depressive disorder and anxiety, which are linked to mood disorders.<sup>48</sup> In contrast, lifetime rates of substance use disorders and alcohol use, as well as antisocial personality disorder and conduct disorder, are higher in males with ADHD.<sup>47</sup> In the present study, the overall comorbidity and depressive disorder rates were higher in female participants than in males during follow-up as adolescents. In addition, more males than females exhibited antisocial behaviors associated with crime. Recently, the complaint of feeling of inner restlessness (ASRS question 3), which can be defined as a depressive symptom, has been more severe in females. The present finding that comorbid mood disorders were more common in females and manifested as subjective impairments, including inner restlessness, is consistent with the literature. Based on these findings, we posit that mood symptoms in adult females with ADHD may cause distorted cognitions and may contribute to ADHD-related impairment more frequently than in adult males.<sup>48</sup>

### Study Limitations

The present study has some limitations. Out of a sample of 203, 90 had missing data, and only 49 young adults could be reached. As the study was performed online and some of the sociodemographic questionnaire items included confidential information, there might have been some instances of reporting/recall bias regarding substance use and other criminal issues, which is a limitation. Another limitation is the small study population limited to one center, which might have been due to the study's longitudinal and online design. This may limit the generalizability of our results to samples from other centers. Furthermore, the longer the time passed, most of the participants were dropped out of hospital follow-up. As a strength, to the best of our knowledge, this study is the first to longitudinally examine daily functioning among Turkish young adults with ADHD. Longer-term and larger-scale studies are needed to more fully understand the daily functioning of adolescents with ADHD as they transition to young adulthood.

### Conclusion

The present study investigated symptom severity, comorbidity, and long-term outcomes of ADHD in young Turkish adults. The findings revealed that ADHD did not have significant longitudinal effects on employment, education, or income; however, it did have a significant negative effect on daily functioning. In addition, more females had comorbidity characterized by internalizing symptoms such as depression, whereas more males had externalizing symptoms related to criminality and daily functioning, such as substance use, bone fractures, and traffic infractions. Moreover, the majority of the participants regularly received treatment and follow-up, which might have been related to their families' higher SES, as compared to earlier relevant studies in the literature that highlighted the importance of appropriate and effective

treatment of ADHD. The findings revealed that clinicians must be aware of the issues facing adolescents with ADHD when transitioning to young adulthood.

### Ethics

**Ethics Committee Approval:** The study protocol was approved by the Ethics Committee of Marmara University Faculty of Medicine (protocol no: 09.2021.1287, date: 05.11.2021).

**Informed Consent:** Study consent form were delivered electronically to the 66 patients who verbally agreed to participate in the study.

### Authorship Contributions

Surgical and Medical Practices: E.A., İ.C.E, A.B.E.Y., Concept: E.A., İ.C.E, A.B.E.Y., Design: E.A., İ.C.E, A.B.E.Y., Data Collection or Processing: E.A., İ.C.E, A.B.E.Y., Analysis or Interpretation: E.A., İ.C.E, A.B.E.Y., Literature Search: İ.C.E, A.B.E.Y., Writing: E.A., İ.C.E, A.B.E.Y.

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