

# The Impact of the Hybrid Education Model on Medical Students with Attention-Deficit/Hyperactivity Disorder Symptoms During the COVID-19 Pandemic

Abdullah Yıldırım<sup>1</sup>, Şakir Gıca<sup>2</sup>, Erhan Kaya<sup>3</sup>, Aybike Nur Sağır<sup>4</sup>, Hayat Gaye Alkış<sup>4</sup>, Selma Demir<sup>4</sup>

<sup>1</sup>Department of Psychiatry, Kahramanmaraş Sütçü İmam University, School of Medicine, Kahramanmaraş, Türkiye

<sup>2</sup>Department of Psychiatry, Necmettin Erbakan University, School of Medicine, Konya, Türkiye

<sup>3</sup>Department of Public Health, Kahramanmaraş Sütçü İmam University, School of Medicine, Kahramanmaraş, Türkiye

<sup>4</sup>Kahramanmaraş Sütçü İmam University, School of Medicine, Kahramanmaraş, Türkiye

## ABSTRACT

**Objective:** The aim of this study is to evaluate the effects and outcomes of the hybrid education model, which became widespread during the pandemic period, on medical students with attention-deficit/hyperactivity disorder (ADHD) symptoms.

**Methods:** A thorough sociodemographic data form and the Adult ADHD Self-Report Scale (ASRS) were distributed to 531 medical students for this cross-sectional study. The students were contacted via online platforms and offered to complete the form using a Google Forms survey application.

**Results:** It was shown that the individuals in the group with probable ADHD were less motivated outside of the university ( $P=.002$ ), experienced greater difficulty focusing and paying attention ( $P<.001$ ), and spent more time in front of screens outside of the classroom ( $P=.001$ ). Similarly, negative affect scores related to eating habits were higher in the group with probable ADHD ( $P=.005$ ). Moreover, physical complaints were found to be more frequent in the probable ADHD group ( $P<.001$ ).

**Conclusion:** The findings of the present study corroborate the strong negative correlation that existed during the COVID-19 pandemic between ADHD symptoms and satisfaction with the educational system. Low motivation, concentration problems, poor eating habits, physical complaints, and more screen time have all been linked to symptoms of ADHD.

**Keywords:** Attention deficit-hyperactivity disorder, COVID-19 pandemic, hybrid education model

**Corresponding author:**

Abdullah Yıldırım

**E-mail:**

yldrmabdullah@yahoo.com

**Received:** June 19, 2024

**Revision Requested:** July 8, 2024

**Last Revision Received:** July 31, 2024

**Accepted:** August 2, 2024

**Publication Date:** September 20, 2024

## INTRODUCTION

The closure of schools during the coronavirus outbreak, which started at the end of 2019 and spread in the spring of 2020, was seen as one of the effective ways to prevent the spread of the epidemic, especially among students. Schools around the world paused face-to-face education. Teachers and

Cite this article as: Yıldırım A, Gıca Ş, Kaya E, Sağır AN, Alkış HG, Demir S. The impact of the hybrid education model on medical students with attention-deficit/hyperactivity disorder (ADHD) symptoms during the COVID-19 pandemic. *Neuropsychiatr Invest.* 2024;62(3):82-87.



Copyright©Author(s) - Available online at neuropsychiatricinvestigation.org.

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

students, who had designed and prepared their lessons for in-person education, had to adapt to distance learning in a short period of time.<sup>1,2</sup>

Online and face-to-face education constitute the components of hybrid learning.<sup>3</sup> Although the distance education system offers the opportunity for students to learn simultaneously or asynchronously, either individually or in groups, and reaches a large number of people in different locations, the rapid transition to this educational model during sudden events such as epidemics has led to several negative consequences. These include difficulties in the adaptation of students and teachers, insufficient physical infrastructure, unsatisfactory digital content, and the inability to establish effective communication networks between students and teachers.<sup>4-7</sup>

The novel coronavirus disease (COVID-19) has had many effects, including persistent and widespread psychosocial problems globally.<sup>8</sup> Some studies in this field have shown that ADHD symptoms have increased in individuals who contracted COVID-19. A systematic review of research conducted up to November 2022, which included 18 studies, reported an increase in attention deficit/hyperactivity disorder (ADHD) symptoms among many children during the COVID-19 pandemic.<sup>9,10</sup>

Attention deficit hyperactivity disorder is defined as a neuropsychiatric disorder that occurs in childhood and is characterized by attention deficit, hyperactivity, and impulsivity that are not appropriate for child development (APA 2013).<sup>11</sup> Physical activity, exercise, and regular sports participation are known to have a positive effect on behavioral and cognitive development in patients with ADHD. Therefore, restrictions in daily life may exacerbate some symptoms in children and adolescents with ADHD.<sup>12</sup>

The current study is designed based on the hypothesis that the hybrid education model implemented during the pandemic affects the academic performance of medical students with ADHD symptoms, resulting in decreased productivity and a relatively more negative psychological impact. This study investigates the effects of the COVID-19 pandemic on medical students with ADHD symptoms, including how they are impacted during this period, their perspectives and concerns regarding the educational process, and the influence of the education and examination system implemented in schools on these individuals.

## MATERIAL AND METHODS

### Participants and Procedure

The study was planned as a cross-sectional study. The population of the study consisted of university students studying at medical faculties in Türkiye. At the time the study was designed, the number of students studying medicine at universities in Türkiye was 32 985. In the reference study (Uysal Özsanlı & Bilaç, 2015), the prevalence of attention deficit and hyperactivity disorder was found to be 5.29%.<sup>13</sup> Power analysis was used to determine the sample size. Based on the prevalence rate in the reference study,  $\alpha$ : 0.05 first type error rate,  $\beta$ : 0.20 second type error rate, and 0.80 power of the test for a sampling error of 0.05, it was decided to include at least 236 students in the study.<sup>13</sup>

The announcement of the study was made through online platforms. Non-medical students were not accepted into the study. At

this stage, 531 medical students who volunteered between April 03, 2021, and June 03, 2021, were included in the study. Medical students over the age of 30, those known to have severe psychiatric illnesses such as schizophrenia and bipolar disorder, those with uncontrolled medical conditions that would negatively impact their overall health, those currently taking psychiatric medications other than methylphenidate, and students diagnosed with alcohol or substance use disorders were not included in the study.

Ethics committee approval was obtained from the Kahramanmaraş Sütçü İmam University Faculty of Medicine Non-Pharmaceutical Clinical Research Ethics Committee (Approval no: 6, Date: March 8, 2021).

Participants in the study were contacted individually via the Internet and given a Google Forms survey application, which was used to conduct the study. The individuals' informed consent was acquired.

### Measures

**Sociodemographic Data Form:** In the form prepared by the researchers to evaluate the sociodemographic and clinical characteristics of the participants, there are fields for age, gender, past medical history related to COVID-19, and other relevant information.

**Online Education Satisfaction Survey:** Attention functions, eating habits, screen time and experiences, expectations as well as satisfaction levels with the current education system, including physical complaints, were evaluated in the form by the researchers. This survey consists of 20 questions. The questions are scored between 0 and 10, with "0" indicating "strongly disagree" and "10" indicating "strongly agree." There is no total score or any subscale for the survey; instead, the responses to each question are evaluated separately.

**Adult ADHD Self-Report Scale (ASRS):** The ASRS is a self-rating scale with 18 items designed to assess present ADHD symptoms. It consists of two subscales, each with nine items: inattention and hyperactivity-impulsivity. It is a five-point Likert scale (0 = never/seldom, 4 = very often). Kessler et al designed the scale, while Doğan et al tested its validity and reliability in Turkish. Principal component analysis identified two factors (inattention and hyperactivity/impulsivity) that accounted for 41.6% of the total variance. Reliability analysis indicated that the Turkish version of the ASRS exhibits a high level of internal consistency (Cronbach's  $\alpha$  = 0.88). Cronbach's  $\alpha$  coefficients for the "inattention" and "hyperactivity/impulsivity" subscales were also high, at 0.82 and 0.78, respectively.<sup>14,15</sup> Based on a previous study that utilized the ASRS scale with university students, we defined the probable ADHD group as individuals who scored 24 points or more on either the A or B section of the scale.<sup>16</sup>

### Statistical Analysis

Statistical analyses were carried out using the Statistical Package for Social Sciences, version 15.0 software (SPSS Inc.; Chicago, IL, USA). Statistical parameters are described as number (n), percentage (%), median (Q1-Q3) (25th quartile-75th quartile). The normal distribution of variables was examined through visual graphics (histograms and probability plots) and analytical tests (Kolmogorov-Smirnov and Shapiro-Wilk tests). A comparison of categorical variables between the two independent groups was performed using the chi-square test. The independent sample *t*-test was used to compare numerical

data that conformed to a normal distribution between two independent groups. The Mann–Whitney U-test was used to compare numerical data that did not conform to a normal distribution. If both variables exhibited a normal distribution, the relationship between numerical variables was assessed using Pearson Correlation Analysis. If at least one of the variables did not follow a normal distribution, Spearman Correlation Analysis was used. A total Type-1 error level of 5% was used for statistical significance.

## RESULTS

### Descriptive Statistics

Examination of the sociodemographic and COVID-19 related data of the participants included in the study is shown in Table 1. While 209 (39.4%) of the participants included in the study were male, 322 (60.6%) were female. The majority of the participants were in the first 4 academic years of medical school. The majority of the participants did not have a history of previous COVID-19 infection, comorbid psychiatric, or other medical disorders. A significant portion of the participants (75%) preferred the online education system.

### Comparison of the Sociodemographic Variables and Data on COVID-19 Infection Between Group with Probable ADHD and Without Probable ADHD

A comparison of the sociodemographic variables and data on COVID-19 infection between groups with probable ADHD and without probable ADHD is shown in Table 2. The rate of female gender ( $n = 58$  (71.6%)) was higher in the group with probable ADHD than in the group without probable ADHD ( $n = 264$  (58.7%)) ( $X^2 = 4.814$ ,  $P = .028$ ). Similarly, the rate of presence of comorbid psychiatric disorder was higher in the group with probable ADHD ( $n = 20$  (24.7%)) than in the group without probable ADHD ( $n = 59$  (13.1%)) ( $X^2 = 7.269$ ,  $P = .007$ ). No significant difference was found in the comparison of the groups in terms of other data.

**Table 1. Examination of the Sociodemographic and COVID-19 Related Data of the Participants Included in the Study**

Age		Mean $\pm$ SD	21.10	2.90
Gender	Male	n (%)	209	39.4%
	Female	n (%)	322	60.6%
Grade	Grade 1	n (%)	126	23.7%
	Grade 2	n (%)	136	25.6%
	Grade 3	n (%)	152	28.6%
	Grade 4	n (%)	59	11.1%
	Grade 5	n (%)	45	8.5%
	Grade 6	n (%)	13	2.4%
Previous history of COVID-19 infection	Yes	n (%)	133	25.0%
	No	n (%)	398	75.0%
Previous history of COVID-19 Infection in close relatives	Yes	n (%)	413	77.8%
	No	n (%)	118	22.2%
Presence of psychiatric disorder	Yes	n (%)	79	14.9%
	No	n (%)	452	85.1%
Presence of medical disorder	Yes	n (%)	64	12.1%
	No	n (%)	467	87.9%
What is your preferred education system preference during the pandemic process?	Hybrid	n (%)	96	18.1%
	Online	n (%)	396	74.6%
	Face to face	n (%)	39	7.3%

### Comparison of Satisfaction Survey Scores Related to the Education System Between Group with Probable ADHD and Without Probable ADHD

A comparison of satisfaction survey scores related to the education system between groups with probable ADHD and without probable ADHD is shown in Table 3. It was determined that the participants in the group with probable ADHD were less motivated in the environment outside the university ( $P = .002$ ), had more problems in maintaining attention and focusing ( $P < .001$ ), and the time spent in front of the screen outside of the classroom was longer ( $P = .001$ ). Similarly, negative affect scores related to eating habits were higher in the group with probable ADHD ( $P = .005$ ). Moreover, physical complaints were found to be more frequent in the probable ADHD group ( $P = < .001$ ).

### Relationship Between the ASRS Scores of the Participants Included in the Study and the Satisfaction Survey Scores Related to the Education System

The relationship between the ASRS scores of the participants included in the study and the satisfaction survey scores related to the education system is shown in Table 4. Statistically significant relationships were found between the ASRS total, the attention deficit subscale, hyperactivity subscale scores, and the various field scores in the satisfaction survey designed by the researchers.

## DISCUSSION

Online distance learning emerged as a solution to continue education and training during the COVID-19 pandemic. In the first quarter of 2020, due to the impact of COVID-19, educational activities were abruptly halted in institutions worldwide, and online distance education was adopted, initiating an unfamiliar mode of learning.<sup>2,17</sup> In our study, a significant proportion (75%) of the participating students adapted to the online education system. Considering the importance of face-to-face education for medical students, the high number of students receiving online education is notable. These students were predominantly in their fourth year, when clinical courses began. From this perspective, online distance education may not be sufficient for medical students to gain the necessary professional experience. However, students in the probable ADHD group believed they would compensate for their deficiencies in applied courses, according to satisfaction survey scores.

The majority of participating students did not have a prior COVID-19 infection or any concomitant psychiatric or medical disorder at the time of the study. Over 60% of the students were female, with a significantly higher proportion of females in the probable ADHD group (71.6%). Although ADHD is typically seen in children, it is known to persist into adulthood.<sup>18</sup> Attention-Deficit/Hyperactivity Disorder is reported at a rate of 3% in adults.<sup>19</sup> The estimated prevalence of higher education students diagnosed with ADHD ranges from 2% to 8%.<sup>20</sup> In our target group, 81 out of 531 students (15.2%) were in the probable ADHD group. Although our study group, with an average age of 21 years, represents young adults who have recently emerged from adolescence, we think the relatively high percentage of possible ADHD cases is due to our preliminary evaluation rather than a definitive diagnosis.

Among the studies included in a meta-analysis of adult age groups, ADHD was more commonly observed in males.<sup>18</sup> However, in the data groups of some studies, it may be more prevalent in females.<sup>21</sup>

**Table 2. Comparison of the Sociodemographic Variables and Data on COVID-19 Infection Between Groups with Probable ADHD and Without Probable ADHD**

		Group with Probable ADHD (n = 81)	Group Without Probable ADHD (n = 450)	t / X <sup>2</sup>	P
Age		20.58 ± 2.07	21.17 ± 3.01	1.703	.089
Gender (%)	Male:	23 (28.4%)	186 (41.3%)	4.814	.028*
	Female:	58 (71.6%)	264 (58.7%)		
Previous history of COVID-19 Infection	Yes:	19 (23.5%)	114 (25.3%)	0.129	.720
Previous history of COVID-19 Infection in close relatives	Yes:	64 (79%)	349 (77.6%)	0.084	.722
Presence of psychiatric disorder	Yes:	20 (24.7%)	59 (13.1%)	7.269	.007*
Presence of medical disorder	Yes:	12 (14.8%)	52 (11.6%)	0.688	.407

ADHD, Attention Deficit Hyperactivity Disorder. Chi-square and Independent Sample t-test were used. \*P ≤ .05.

Williamson and Johnston also mentioned comorbidity in addition to these gender differences in their review study.<sup>22</sup>

In the digitalized world, online learning and distance education pedagogy have rapidly advanced learning processes in various fields and levels of knowledge.<sup>23</sup> However, not all individuals may effectively use online materials for their education. Our study, conducted with the hypothesis that ADHD symptoms could worsen due to restrictions and affect education, found that students in the

probable ADHD group were less motivated and had attention issues in non-university settings. Supporting this, students in the probable ADHD group reported a statistically significant tendency to browse non-class-related pages during remote learning. Additionally, these students noted that they paid more attention to their bodies and experienced more physical complaints during this period. During remote education, students might focus on looking at themselves on the online camera instead of the lesson. Recent studies have reported that COVID-19 and its accompanying measures have

**Table 3. Comparison of Satisfaction Survey Scores Related to the Education System Between Group with Probable ADHD and Without Probable ADHD (Median and Interquartile Range (IR))**

	Group with Probable ADHD (n = 81)	Group Without Probable ADHD (n = 450)	Z	P
Due to changes during the pandemic period, I am able to access the information faster and easier	6 (10)	5 (10)	-0.377	.706
Attending classes outside the university environment has generally reduced my motivation	10 (10)	8 (10)	-3.031	.002*
I am able to attend the classes without any technical issues	7 (10)	7 (10)	-0.705	.481
I have been experiencing more attention and focus problems during the remote learning process	10 (10)	8 (10)	-4.951	<.001*
While learning remotely, I am able to ask my questions more easily during the lesson than in face-to-face education	5 (10)	4 (10)	-0.716	.474
In general, I am satisfied with the changes to exams during the pandemic period	6 (10)	5 (10)	-1.346	.178
I believe that the university I attend has managed the remote learning successfully	5 (10)	6 (10)	-0.540	.589
I am able to access the records of the classes I could not attend later	10 (10)	9 (10)	-1.689	.091
Being able to access the course records later reduced my attendance and increased my delay in studying	9 (10)	7 (10)	-3.858	<.001*
During remote learning, I sometimes find myself browsing extracurricular pages	9 (10)	8 (10)	-4.576	<.001*
My ability to maintain my attention has increased during remote learning	1 (10)	3 (10)	-4.894	<.001*
During remote learning, I can spare more time for myself, my hobbies, and social relationships	6 (10)	6 (10)	-1.163	.245
During the pandemic period, my time spent with electronic devices such as the telephone, TV, and computer increased compared to the time spent on lessons	10 (9)	9 (10)	-4.232	<.001*
I believe that the time I spend on the screen outside of class does not negatively affect my study hours	2 (10)	4 (10)	-3.278	.001*
During the distance education process, the time I spent on my prayers increased	3 (10)	4 (10)	-0.844	.399
I believe that changes in education and training during the pandemic process will negatively affect my professional life	8 (10)	7 (10)	-1.637	.102
I sleep adequately and efficiently during the pandemic process	7 (10)	7 (10)	-0.029	.977
I believe the pandemic has had a negative impact on my eating habits	7 (10)	5 (10)	-2.833	.005*
In the distance education process, I believe that I cannot make up for my deficiencies in practical lessons	8 (10)	6 (10)	-2.666	.008*
During the pandemic process, I was more interested in my body, and I noticed that I had more physical complaints	7 (10)	6 (10)	-4.214	<.001*

ADHD, Attention Deficit Hyperactivity Disorder. Mann-Whitney U-test was used. \*P ≤ .05



Table 4. Examining the Relationship Between the ASRS Scores of the Participants Included in the Study and the Satisfaction Survey Scores Related to the Education System

	1	2	3	4	5	6	7	8	9	10	11	12
ASRS Tot	0.16***	0.24***	0.21***	0.30***	-0.23***	-0.10*	0.16***	-0.22***	-0.11**	0.15***	0.14***	0.29***
ASRS AD	0.12**	0.22***	0.20***	0.29***	-0.22***	-0.14**	0.18***	-0.24***	-0.10*	0.13**	0.16***	0.26***
ASRS HA	0.18***	0.19***	0.16***	0.22***	-0.16***	-0.04	0.08	-0.15***	-0.11**	0.14**	0.09*	0.24***

Spearman Correlation Test was used. ASRS, Adult Attention Deficit Hyperactivity Disorder Self-report Scale; ASRSTot, Adult Attention Deficit Hyperactivity Disorder Self-report Scale Total; ASRSAD, Adult Attention Deficit Hyperactivity Disorder Self-report Scale Attention Deficit subscale; ASRSHA, Adult Attention Deficit Hyperactivity Disorder Self-report Scale Hyperactivity subscale. \* $P \leq .05$ . \*\* $P \leq .01$ . \*\*\* $P \leq .001$ . 1. Attending classes outside the university environment has generally reduced my motivation. 2. I have been experiencing more attention and focus problems during the remote learning process. 3. Being able to access the course records later reduced my attendance and increased my delay in studying. 4. During remote learning, I sometimes find myself browsing extracurricular pages. 5. My ability to maintain my attention has increased during remote learning. 6. During remote learning, I can spare more time for myself, my hobbies, and social relationships. 7. During the pandemic period, my time spent with electronic devices such as the telephone, TV, and computer increased compared to the time spent on lessons. 8. I believe that the time I spend on the screen outside of class does not negatively affect my study hours. 9. I sleep adequately and efficiently during the pandemic process. 10. I believe the pandemic has had a negative impact on my eating habits. 11. In the distance education process, I believe that I cannot make up for my deficiencies in practical lessons. 12. During the pandemic process, I was more interested in my body, and I noticed that I had more physical complaints.

negatively impacted ADHD patients academically. Teachers collaborating with ADHD students in online classes find it challenging to manage them due to their easily distracted nature. Children struggled to adapt to both remote education and the subsequent return to face-to-face education, experiencing performance anxiety and behavioral disorders,<sup>24,25</sup> during distance education. Attention-Deficit/Hyperactivity Disorder students should receive sustainable, effective, disciplined additional pedagogical support in distance education, just as in face-to-face education.<sup>26</sup> Attention-Deficit/Hyperactivity Disorder students should receive sustainable, effective, disciplined additional pedagogical support in distance education, just as in face-to-face education.

During the pandemic, we found that screen time outside of classroom hours increased. Probable ADHD students reported spending significantly more time on devices such as phones, televisions, and computers compared to the non-ADHD group. The increase in smartphone and screen time during childhood, especially during the COVID-19 pandemic, poses a great risk of screen addiction.<sup>27,28</sup> The co-occurrence of ADHD, screen, and internet addiction deepens the danger we face.<sup>29,30</sup> In our study, prolonged screen time may constitute both an educational barrier for ADHD individuals and a challenge for managing the disorder.

This study has some limitations. The sample size was relatively small. A self-report scale was used to assess ADHD symptoms, and detailed psychiatric examinations to confirm the clinical diagnosis of ADHD were not performed. Additionally, no further evaluation was conducted for possible accompanying mental problems. To enable the findings of future studies to be generalized to larger populations beyond medical students, the sample selection should not be restricted to medical students.

CONCLUSION

The results of the current study support the significant relationship between ADHD symptoms and satisfaction with the education system during the COVID-19 pandemic. It demonstrates that the hybrid education model implemented during the pandemic particularly adversely affected the educational processes of students with ADHD and indicates that ADHD symptoms are associated with various negative outcomes. ADHD symptoms have been found to be associated with low motivation, attention deficits, negative eating habits,

physical complaints, and increased screen time. These findings contribute significantly to understanding the impact of the COVID-19 pandemic on students exhibiting ADHD symptoms and to developing appropriate support mechanisms.

**Availability of Data and Materials:** The data that support the findings of this study are available on request from the corresponding author.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of Kahramanmaraş Sütçü İmam University (Approval no: 6, Date: March 8, 2021).

**Informed Consent:** Written informed consent was obtained from participants who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – A.Y.; Design – A.Y.; Supervision – A.Y.; Resource – Ş.G.; Materials – A.N.S., H.G.A., S.D.; Data Collection and/or Processing – S.D.; Analysis and/or Interpretation – A.Y.; Literature Search – E.K.; Writing Manuscript – E.K.; Critical Reviews – A.Y.; Other – Ş.G.

**Declaration of Interests:** The authors have no conflict of interest to declare.

**Funding:** The authors declared that this study has received no financial support.

REFERENCES

1. Azhari B, Fajri I. Distance learning during the COVID-19 pandemic: school closure in Indonesia. *Int J Math Educ Sci Technol*. 2022;53(7):1934-1954. [CrossRef]

2. Petzold AM. Letter to the Editor: Resources and recommendations for a quick transition to online instruction in physiology. *Adv Physiol Educ*. 2020;44(2):217-219. [CrossRef]

3. Joseph S, Tahir A, Bibi F, et al. A review analysis on using “AIED” to Improve Student Engagement in Hybrid Education. *Bulletin of Business and Economics (BBE)*. 2024;13(2):424-435.

4. Ferraro FV, Ambra FI, Aruta L, Iavarone ML. Distance learning in the Covid-19 era: perceptions in Southern Italy. *Educ Sci*. 2020;10(12):355. [CrossRef]

5. Liguori E, Winkler C. From Offline to Online: Challenges and opportunities for entrepreneurship education following the COVID-19 pandemic. *Entrep Educ Pedagogy*. 2020;3(4):346-351. [CrossRef]

6. Khalaf Z. Corona virus and digital equality in tele-teaching in emergency situations. *New Education Blog*. Available at: <https://www.neweduc.com/> (accessed on 17 May 2020). 2020.
7. Goudeau S, Sanrey C, Stanczak A, Manstead A, Darnon C. Why lockdown and distance learning during the COVID-19 pandemic are likely to increase the social class achievement gap. *Nat Hum Behav*. 2021;5(10):1273-1281. [\[CrossRef\]](#)
8. He S, Shuai L, Wang Z, et al. Online learning performances of children and adolescents with attention deficit hyperactivity disorder during the COVID-19 pandemic. *Inq J Health Care Organ Provision Financ*. 2021;58:469580211049065. [\[CrossRef\]](#)
9. Rogers MA, MacLean J. DEHB semptomları Covid-19 salgını sırasında arttı: bir meta-analiz. *Dikkat Bozuklukları Derg*. 2023;27(8):800-811.
10. Sibley MH, Ortiz M, Gaias LM, et al. Top problems of adolescents and young adults with ADHD during the COVID-19 pandemic. *J Psychiatry Res*. 2021;136:190-197. [\[CrossRef\]](#)
11. Association AP. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington DC: American Psychiatric Publishing; 2013.
12. Kuygun Karci C, Arici Gurbuz A. Challenges of children and adolescents with attention-deficit/hyperactivity disorder during the COVID-19 pandemic. *Nord J Psychiatry*. 2022;76(5):372-379. [\[CrossRef\]](#)
13. Uysal Öztaşlan T, Bilaç Ö. Dikkat eksikliği hiperaktivite bozukluğu epidemiyolojisi. *Türk Klin J Child Psychiatry-Spec Top*. 2015;1(1):1-5.
14. Kessler RC, Adler L, Ames M, et al. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. *Psychol Med*. 2005;35(2):245-256. [\[CrossRef\]](#)
15. Doğan S, Öncü B, Saraçoğlu Varol G, Kucukgoncu S. Validity and reliability of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1. 1). *Anadolu Psikiyatr Derg Anatol J Psychiatry*. 2009;10(2):77-87.
16. Doğan S, Öncü B, Varol-Saraçoğlu G, Küçüköncü S. Üniversite öğrencilerinde dikkat eksikliği hiperaktivite bozukluğu belirti sıklığı ve belirti düzeyi ile ilişkili gelişimsel, akademik ve psikolojik etmenler. *Türkiye'de psikiatri*. 2008;10(3):109-115.
17. Hodges CB, Moore S, Lockee BB, Trust T, Bond MA. *The Difference between Emergency Remote Teaching and Online Learning*. 2020.
18. Simon V, Czobor P, Bálint S, Mészáros A, Bitter I. Prevalence and correlates of adult attention-deficit hyperactivity disorder: meta-analysis. *Br J Psychiatry*. 2009;194(3):204-211. [\[CrossRef\]](#)
19. American Psychiatric Association. D, Association AP. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. Washington, DC: American Psychiatric Association; 2013;5.
20. Sarid M, Lipka O. Students with learning disabilities/attention-deficit/hyperactivity disorder in higher education dealing with remote learning: lessons learned from COVID-19 era. *Front Psychol*. 2023;14:1172771. [\[CrossRef\]](#)
21. Bitter I, Simon V, Bálint S, Mészáros A, Czobor P. How do different diagnostic criteria, age and gender affect the prevalence of attention deficit hyperactivity disorder in adults? An epidemiological study in a Hungarian community sample. *Eur Arch Psychiatry Clin Neurosci*. 2010;260(4):287-296. [\[CrossRef\]](#)
22. Williamson D, Johnston C. Gender differences in adults with attention-deficit/hyperactivity disorder: a narrative review. *Clin Psychol Rev*. 2015;40:15-27. [\[CrossRef\]](#)
23. Yokoyama S. Academic self-efficacy and academic performance in online learning: A mini review. *Front Psychol*. 2018;9:2794. [\[CrossRef\]](#)
24. Rentzi A. The impact of distance education, due to COVID-19 on children with attention deficit hyperactivity disorder (ADHD): practicing effective inclusive pedagogical approaches in Greece. *Med Res Arch*. 2023;11(4). [\[CrossRef\]](#)
25. Khusheim SM. Challenges faced by classroom teachers in distance learning for students with attention deficit hyperactivity disorder during COVID-19 pandemic. *J Educ Learn*. 2022;11(5):113-123. [\[CrossRef\]](#)
26. Putra AS, Warnars HLHS, Abbas BS, Trisettyarso A, Suparta W, Kang C-H. Gamification in the e-learning Process for children with attention deficit hyperactivity disorder (ADHD). Paper presented at: 2018 Indonesian Association for Pattern Recognition International Conference (INAPR). 2018. [\[CrossRef\]](#)
27. Duan L, He J, Li M, et al. Based on a decision tree model for exploring the risk factors of smartphone addiction among children and adolescents in China during the COVID-19 pandemic. *Front Psychiatry*. 2021;12:652356. [\[CrossRef\]](#)
28. Moitra P, Madan J. Impact of screen time during COVID-19 on eating habits, physical activity, sleep, and depression symptoms: a cross-sectional study in Indian adolescents. *PLoS One*. 2022;17(3):e0264951. [\[CrossRef\]](#)
29. Tateno M, Tateno Y, Kamikobe C, et al. Internet addiction and attention-deficit/hyperactivity disorder traits among female college students in Japan. *Soa Chongsonyon Chongsin Uihak*. 2018;29(3):144-148. [\[CrossRef\]](#)
30. Kahraman Ö, Demirci EÖ. Internet addiction and attention-deficit-hyperactivity disorder: effects of anxiety, depression and self-esteem. *Pediatr Int*. 2018;60(6):529-534. [\[CrossRef\]](#)