

# Functional Impairments and Related Factors in Adolescents with Attention Deficit Hyperactivity Disorder During the COVID-19 Normalization Stage

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## ABSTRACT

**Background:** Attention deficit hyperactivity disorder is a disorder associated with significant functional impairments that can have important consequences for the individual and the society. Those with attention deficit hyperactivity disorder were reported to be more vulnerable in the face of difficulties and experience more psychological problems during the coronavirus disease 2019 pandemic. It was shown that the psychological problems experienced during the pandemic could persist during the normalization stage. We aimed to assess functional impairment in adolescents with attention deficit hyperactivity disorder and the related factors during the normalization stage which involved the initiation of fully face-to-face schooling practices.

**Methods:** This is a cross-sectional study including attention deficit hyperactivity disorder (n=52) and a healthy control group (n=52). Functional impairment was assessed using the Weiss functional impairment rating scale self and parent forms. We also examined the factors associated with functional impairment (internalizing-externalizing problems, parenting strategies, and perceived expressed emotion).

**Results:** Adolescents with attention deficit hyperactivity disorder had higher functional impairment scores on Weiss functional impairment rating scale self and parent in all sub-domains and total. Weiss functional impairment rating scale self and parent total mean score had a positive correlation with negative parenting and externalizing-internalizing scores and a negative correlation with the positive parenting score. Weiss functional impairment rating scale-self total mean score was positively correlated with negative parenting and externalizing-internalizing scores and perceived expressed emotion scores.

**Conclusion:** Our results suggest that the effects of the pandemic on children's functioning may persist in the normalization stage. For a comprehensive evaluation and effective intervention, it is important that comorbid symptoms, parenting strategies, and the perceived family climate are evaluated from the perspectives of both the parent and the adolescent.

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## INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that is characterized by attention deficit, hyperactivity, and impulsivity at levels that are inconsistent with the child's developmental level.<sup>1</sup> Previous meta-analyses have shown that the prevalence of ADHD in children and adolescents varies between 5.3% (95% CI: 5.01-5.56) and 7.2% (95% CI: 5.01-5.56).<sup>2,3</sup> The disorder is associated with significant impairment in academics, family, and social functioning and may have serious consequences. More importantly, the primary cause of presentation to a clinic is likely to be functional impairment rather than the symptoms. Accordingly, Barkley

et al<sup>4</sup> have described these impairments in functioning as the "real-world consequences" of ADHD symptoms.

The coronavirus disease 2019 (COVID-19) pandemic has had negative effects on the daily lives of people all around the world. The guidelines concerning the management of ADHD during the COVID-19 pandemic described that individuals diagnosed with neurodevelopmental disorders such as ADHD were particularly more vulnerable in the face of difficulties during the pandemic and experienced more behavioral problems. It was also stated that the group with ADHD, especially adolescents, needed to be designated as a high-priority group in follow-up due to their disorganization

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and high levels of risk.<sup>5</sup> Various changes such as lockdown practices and online classes have posed new challenges for children with ADHD and their families. Studies have shown that children with ADHD had an increase in their ADHD symptoms and were commonly affected by emotional dysregulation, sleep disorders, and behavioral problems during the period when schools were closed as a part of pandemic measures.<sup>6-9</sup> In a study that evaluated the major problems of children and young adults with ADHD during the pandemic, social isolation, problems related to online learning, motivational problems, and boredom were reported to be the most common problems.<sup>10</sup> Moreover, disruptions to daily life activities due to the pandemic were found to significantly increase the severity of preexisting functional impairment in those with ADHD as they are particularly more sensitive to changes in their routines.<sup>11</sup>

These studies have also investigated the factors associated with the negative consequences that were introduced to the daily lives of those with ADHD during the pandemic. In a study that assessed the mental health of children with ADHD and their parents during the lockdown, the presence of an overall pathological psychological state (total difficulties score), disruption of psychiatric follow-up, and parental depression were shown to be significantly associated with the worsening of behavior.<sup>12</sup> In a study conducted on the learning and emotional outcomes in ADHD during the pandemic, parental factors including parenting strategies were identified. These factors were found to predict the learning and emotional outcomes in ADHD.<sup>13</sup> However, these studies were generally performed during the early stages of the pandemic, while lockdown practices and remote learning were in effect and did not involve the normalization stage during which the measures were lifted.

With the control of the pandemic, the normalization stage began, during which the measures were revised. In Turkey, the gradual normalization process was initiated on May 17, 2021, and the measures were amended. In this context, full-time face-to-face education was resumed at all levels of education on September 6, 2021 (approximately 540

days after March 16, 2020, which marked the closure of schools as part of pandemic measures). Although it was stated that it was important to attend the psychological states and demands of individuals and to reinforce psychological interventions during the normalization stage in the same way as in the pandemic period, information about the mental health status of individuals from this period is very scarce.<sup>14</sup> Almost all of these few studies that were conducted with a focus on this period concentrated on depressive symptoms and the associated factors in a population sample. These studies, which reported prevalence rates for depressive symptoms that varied depending on the methodological structure and sample characteristics, as well as certain associated risk factors, suggested in consensus that the permanent negative psychological effects could persist even after complete control of the pandemic and that interventions aimed at ameliorating these effects were important.<sup>14-17</sup> To our knowledge, there are no studies evaluating the mental health of those with ADHD during the normalization stage.

As shown above, there are no studies assessing the functioning of children with ADHD during the normalization stage. Moreover, studies that were conducted on children with ADHD during the early stages of the pandemic did not employ tools that specifically assessed functional impairment in ADHD. In order to fill this gap, this study aimed to evaluate functional impairment in adolescents with ADHD during the normalization stage and the associated factors (internalizing-externalizing problems, parenting strategies, and perceived expressed emotion).

In this context, our main hypotheses were as follows:

During the COVID-19 normalization stage,

- Adolescents with ADHD have a higher functional impairment.
- Functional impairment in children with ADHD is associated with internalization and externalization symptoms.
- Functional impairment in children with ADHD is associated with positive and negative parenting strategies.
- Functional impairment in children with ADHD is associated with perceived expressed emotion.

#### MAIN POINTS

- Adolescents with attention deficit hyperactivity disorder experience more functional impairment during the normalization stage.
- Internalizing-externalizing problems, negative parenting strategies, and perceived expressed emotion (perceive their family climates as less emotionally supportive, more intrusive, and more irritable) likely contribute to the risk of functional impairment among adolescents with this disorder.
- For a comprehensive evaluation and effective intervention, it is important that comorbid symptoms, parenting strategies, and the perceived family climate are evaluated from the perspectives of both the parent and the adolescent.

#### MATERIAL AND METHODS

##### Participants and Procedure

This study included 52 children aged between 12 and 17 years who were diagnosed with ADHD in the Child and Adolescent Psychiatry Clinic, 52 healthy children, and their parents. Cases included in the study were adolescents diagnosed with ADHD through clinical interviews based on *Diagnostic and Statistical Manual-5 (DSM-5)* and semi-structured interviews [K-SADS-PL (*Kiddie-Schedule for Affective Disorders and Schizophrenia for School Age*

Children-Present and Lifetime Version)] who were either newly diagnosed or had not received medication for 6 months. The exclusion criteria for the case group in this study included the presence of psychiatric comorbidities other than oppositional defiant disorder and conduct disorder, a history of head trauma, neurological disorders, and other serious medical disorders. For children in the control group, the exclusion criteria included the presence of lifelong psychopathology in addition to the criteria specified above. The control group consisted of healthy children matched by age, gender, and socioeconomic status who applied to our hospital for a routine check-up. Five participants were excluded from the study because 3 participants in the ADHD group did not fill out the self-report scales, while the parents of 2 participants did not complete the parent scales. In the control group, a total of 3 participants were excluded from the study because 1 patient had a history of epilepsy and the scales of 2 participants were not filled. This study was conducted between October, 2021, and December, 2021. Written consent was obtained from the children and their parents who agreed to participate in the study. The study was approved by the Erzurum Regional Training and Research Hospital Clinical Researches Ethics Committee (Approval number: 2021/01-10).

Functional impairment in adolescents was assessed using the parent- and self-report forms of Weiss Functional Impairment Rating Scale (WFIRS). In order to determine the factors associated with functional impairment and its predictors in children with ADHD, the adolescents were asked to complete the Expressed Emotion Scale, and the parents were asked to complete the Strengths and Difficulties Questionnaire (SDQ) and the Alabama Parenting Questionnaire (APQ). Additionally, the demographic data of the participants were recorded.

## Measures

**Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version:** Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version is a semi-structured diagnostic interview tool that probes the current and past stages of childhood and adolescent psychiatric disorders.<sup>18</sup> The Turkish version of K-SADS-PL was reported to show good test-retest and interrater reliability.<sup>19</sup> The present study used K-SADS-PL to diagnose ADHD and to exclude comorbid psychiatric diagnoses.

**Weiss Functional Impairment Rating Scale-Parent- and Self-Report:** This scale was developed by Weiss to enable the assessment of ADHD-specific functioning problems. It was included in the guidelines of the Canadian ADHD Resource Alliance (CADDRA).<sup>20</sup> The parent form includes the domains of family, school, life skills, child's self-concept, social activities, and risky activities.<sup>21,22</sup> The self-report form also includes the work domain in addition to

these domains.<sup>23,24</sup> A total score from all WFIRS items is calculated in addition to the scores on the individual domains. Higher scores on each of the WFIRS domains and a high total score indicate more severe functional impairment. In our study, mean scores on all WFIRS self-report domains other than "Work" were used as dependent variables since not many of the adolescents were employed and the domain involved excessive missing data. The analyses also used the mean total score (considered the missing sub-scales as well).

**Strengths and Difficulties Questionnaire:** Strengths and Difficulties Questionnaire was developed by Goodman<sup>25</sup> for use in the screening of children and youth for mental problems. The domains of the scale consist of ADHD, behavioral problems, emotional problems, peer problems, and prosocial behavior. It is possible to evaluate each domain individually to obtain separate scores as well as obtain a total difficulties score (emotional, peer, behavioral, and hyperactivity subscales) and internalizing (emotional problems and peer problems) and externalizing scores (ADHD and behavioral problems). The validity and reliability of the Turkish version were studied by Taner et al.<sup>26</sup>

**Alabama Parenting Questionnaire:** The scale developed by Frick assesses the parent behavior exhibit toward their APQ and is composed of a total of 42 items and consists of 5 domains. These include parental involvement (PI), positive parenting (PP), poor supervision (PS), inconsistent discipline (ID), and corporal punishment (CP). The PI and PP domains assess positive parenting behaviors, while the PS, ID, and CP domains measure negative parenting behaviors.<sup>27</sup> The validity and reliability of the Turkish version were established by Cekic et al.<sup>28</sup> The overall positive domain includes PI and PP strategies, while the overall negative domain comprises poor supervision, inconsistent discipline, and corporal punishment. A higher score on the overall negative parenting domain is associated with more negative parenting behaviors, while a higher score on the overall positive domain is associated with more positive parenting behaviors.

**Shortened Level of Expressed Emotion Scale in Adolescents:** The scale developed by Nelis et al.<sup>29</sup> consists of 33 items in total. The self-administered scale aims to assess the participants' level of perceived expressed emotion from their interactions with the most influential person in their life in the last 3 months. Expressed emotion includes the attitudes of the patient's relatives such as criticism toward the patient, hostile attitudes, and intrusiveness. In a sense, it is a measure of the emotional climate at home. On the other hand, perceived expressed emotion refers to how the characteristics of the family members and the family climate are perceived by the adolescent. The scale is composed of 3 domains assessing the lack of emotional support, irritability, and intrusiveness. High scores indicate high expressed emotion levels. The

validity and reliability of the Turkish version of the scale were studied by Vural et al in 2013.<sup>30</sup>

**Sociodemographic Data Form:** Sociodemographic Data Form is a form developed by the authors in order to obtain information such as the child’s age, gender, number of siblings, parental education level, employment status, and the economic status of the family.

**Statistical Analysis**

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM SPSS Corp.; Armonk, NY, USA) software. Categorical data were presented as numbers and frequencies, numeric data were presented as mean and SD values. In cases where data are not normally distributed, the median (min-max) is given as descriptive statistics. All variables were analyzed using the Kolmogorov-Smirnov test in order to assess the normality of distribution. Cross-group comparisons were performed using the chi-square tests and Fisher’s exact test for categorical variables and using the student *t*-test or Mann-Whitney *U* test for numeric data depending on their distribution. Correlations between the variables were determined using Pearson’s or Spearman’s rank correlation coefficient. Predictors of functional impairment were analyzed using multiple linear regression (enter method). *P* < .05 was considered statistically significant.

**RESULTS**

This is a cross-sectional study including ADHD (n=52) and a healthy control group (n=52) aged between 12 and 17 years. The mean age of the ADHD group was 13.83 ± 1.42 years, and the mean age of the healthy control group was 13.33 ± 1.43 years (*P* = .078). Males constituted 54.8% (n=40) of the ADHD group and 45.2% (n=33) of the control group (*P* = .133). Sociodemographic characteristics of the participants are presented in Table 1.

In the comparison of functional impairment scores between the groups, both the total mean scores on the parent- and self-report forms of WFIRS and the individual scores on all subscales were higher in the ADHD group. On the SDQ, the total difficulties score, internalizing-externalizing scores, and scores on all subscales except for the social behavior subscale were significantly higher in the ADHD group. The prosocial behavior subscore on SDQ was significantly higher in the control group compared to the ADHD group. Scores on all subscales of the Shortened Level of Expressed Emotion Scale in Adolescents (SLEES) were significantly higher in the ADHD group. On the APQ, the score on the overall negative parenting dimension was significantly higher in the ADHD group. Differences in the scores on the scales between the groups are presented in Table 2.

Correlations Between Functional Impairment and Internalizing-Externalizing Problems, Parenting Strategies, and

**Table 1.** Participant Sociodemographic Characteristics

		ADHD Group n (%) / Mean ± SD	Control Group n (%) / Mean ± SD	<i>P</i>
Gender	Male	40 (76.9%)	33 (63.5%)	.133 <sup>a</sup>
	Female	12 (23.1%)	19 (36.5%)	
Age	Mean ± SD	13.83 ± 1.42	13.33 ± 1.43	.078 <sup>b</sup>
Family income level	Low	8 (15.4%)	6 (11.5%)	.669 <sup>a</sup>
	Middle	16 (30.8%)	20 (38.5%)	
	High	28 (53.8%)	26 (50.0%)	
Maternal education (years)	Mean ± SD	9.02 ± 4.70	9.00 ± 5.13	.984 <sup>b</sup>
Paternal education (years)	Mean ± SD	11.56 ± 3.72	10.75 ± 4.10	.296 <sup>b</sup>
Maternal psychiatric illness	Yes	7 (86.5%)	2 (3.8%)	.160 <sup>c</sup>
	No	45 (13.5%)	50 (96.2)	
Paternal psychiatric illness	Yes	2 (3.8%)	6 (11.5)	.269 <sup>c</sup>
	No	50 (96.2)	46 (88.5)	

ADHD, attention deficit hyperactivity disorder; SD, standard deviation. <sup>a</sup>Chi-square test; <sup>b</sup>Student *t*-test; <sup>c</sup>Fisher’s exact test.

Perceived Expressed Emotion: Weiss functional impairment rating scale–parent (WFIRS-P) total score was positively correlated with negative parenting and externalizing-internalizing scores and negatively correlated with the positive parenting score.

Weiss functional impairment rating scale-self (WFIRS-S) total score was positively correlated with negative parenting and externalizing-internalizing scores and expressed emotion, irritability, and intrusiveness scores. Correlations between functional impairment and internalizing-externalizing problems, parenting strategies, and perceived expressed emotions are presented in Table 3.

Predictors of Functional Impairment in Children with Attention Deficit Hyperactivity Disorder: The child’s age, gender, parental involvement, positive parenting, negative parenting, internalizing and externalizing problems, intrusiveness, and irritability were included as predictors.

The model was statistically significant for WFIRS-P (*F* [8, 43] = 6.433. *P* < .001) and could explain 46% of the variance (Durbin Watson 1.998). The model was also significant for WFIRS-S (*F* [8, 43] = 5.804. *P* < .001) and could explain 43% of the variance (Durbin Watson 2.310). Variance inflation values ranged between 1.40 and 1.759. Linear regression analyses revealed externalizing and internalizing problems as significant predictors of the WFIRS-P total score, while internalizing problems, irritability, and intrusiveness predicted the WFIRS-S total score (Table 4).

**DISCUSSION**

The results of this study indicated significantly higher levels of functional impairment in children with ADHD

**Table 2.** Scores of the Attention Deficit Hyperactivity Disorder and Control Group on the Scales

		ADHD	Control	P
Weiss functional impairment rating scale parent form	Family (median; min-max)	0.65; 0.00-3.00	0.20; 0.00-1.30	<.001 <sup>a</sup>
	School (mean ± SD)	0.85 ± 0.49	0.24 ± 0.30	<.001 <sup>b</sup>
	Life skills (mean ± SD)	1.12 ± 0.63	0.51 ± 0.31	<.001 <sup>b</sup>
	Child's self-concept (mean ± SD)	1.30 ± 0.94	0.39 ± 0.50	<.001 <sup>b</sup>
	Social activities (mean ± SD)	0.71 ± 0.59	0.17 ± 0.28	<.001 <sup>b</sup>
	Risky activities (median; min-max)	0.20; 0.00-1.20	0.01; 0.00-1.40	<.001 <sup>a</sup>
	Total (mean ± SD)	0.79±0.40	0.26±0.22	<.001 <sup>b</sup>
Weiss functional impairment rating scale self-report form	Family (mean ± SD)	0.87 ± 0.58	0.60 ± 0.38	.006 <sup>b</sup>
	School (mean ± SD)	0.97 ± 0.64	0.34 ± 0.33	<.001 <sup>b</sup>
	Life skills (mean ± SD)	0.76 ± 0.57	0.45 ± 0.40	.002 <sup>b</sup>
	Child's self-concept (mean ± SD)	1.12 ± 0.97	0.72 ± 0.62	.015 <sup>b</sup>
	Social activities (median; min-max)	0.55; 0.00-3.00	0.22; 0.00-1.33	.021 <sup>a</sup>
	Risky activities (median; min-max)	0.00; 0.00-1.57	0.00; 0.00-0.29	.002 <sup>a</sup>
	Total (mean ± SD)	0.70 ± 0.42	0.44 ± 0.30	.001 <sup>b</sup>
Strengths and difficulties questionnaire	Emotional problems (mean ± SD)	4.23 ± 2.40	1.63 ± 1.78	<.001 <sup>b</sup>
	Conduct problems (mean ± SD)	2.88 ± 1.71	0.90 ± 1.07	<.001 <sup>b</sup>
	Hyperactivity scale (mean ± SD)	6.31 ± 2.04	2.63 ± 1.83	<.001 <sup>b</sup>
	Peer problems scale (mean ± SD)	3.75 ± 1.75	2.12 ± 1.18	<.001 <sup>b</sup>
	Prosocial scale (mean ± SD)	7.63 ± 2.15	8.50 ± 1.47	.019 <sup>b</sup>
	Total difficulties score (mean ± SD)	17.17 ± 5.06	7.29 ± 4.01	<.001 <sup>b</sup>
	Externalizing score (mean ± SD)	9.19 ± 3.26	3.54 ± 2.42	<.001 <sup>b</sup>
	Internalizing score (mean ± SD)	7.98 ± 3.23	3.75 ± 2.51	<.001 <sup>b</sup>
Alabama parenting scale	Positive parenting (median; min-max)	66.00; 37-80	64.00; 26-80	.935 <sup>a</sup>
	Negative parenting (mean ± SD)	40.02 ± 7.10	35.25 ± 6.43	.001 <sup>b</sup>
Shortened level of expressed emotion scale	Lack of emotional support (mean ± SD)	29.29 ± 9.32	24.63 ± 7.17	.005 <sup>b</sup>
	Irritability (median; min-max)	17.50; 12-43	16.00; 12-31	.022 <sup>a</sup>
	Intrusiveness (mean ± SD)	44.52 ± 10.99	37.48 ± 8.04	<.001 <sup>b</sup>

ADHD, attention deficit hyperactivity disorder; max, maximum; min, minimum; SD, standard deviation.

<sup>a</sup>Mann-Whitney *U* test; <sup>b</sup>Student's *t*-test.

in all domains of functioning on both parent- and self-report scales. Moreover, parent-reported functional impairment was positively correlated with negative parenting and externalizing-internalizing scores and negatively correlated with positive parenting scores. Self-reported functional impairment was positively correlated with negative parenting and externalizing-internalizing scores and all perceived expressed emotion scores (lack of emotional support, irritability, and intrusiveness). Lastly, externalizing and internalizing problems were found to predict parent-reported functional impairment, while internalizing problems and irritable and intrusive perceptions of the family climate were found to predict self-reported functional impairment. To our knowledge, our study is the first that has evaluated the functioning of children with ADHD during the normalization stage.

The primary purpose of our study was to evaluate functional impairment in adolescents with and without ADHD in the specified period. We determined significantly higher

functional impairment scores for adolescents with ADHD on both the parent- and self-report forms of WFIRS in all sub-categories (family, school, life skills, child's self-concept, social activities, and risky activities) as well as the total scores. Several studies have shown that the pandemic had negative behavioral (i.e., symptoms of increased hyperactivity, inattention, and impulsivity), psychological (i.e., depression and anxiety), and social (i.e., problems in relationships with parents and peers) consequences as well as negative consequences such as poor sleep quality, reduced physical activity, and excess Internet use.<sup>6,7,10,11</sup> It was reported that individuals with ADHD were more likely to experience difficulties with both the core characteristics of ADHD and the accompanying mental health problems and that these difficulties tended to be more severe compared to those experienced by peers without ADHD.<sup>31</sup> However, these studies in the literature assessed functioning with non-specific tools that examined daily routines rather than functional assessment tools specific to ADHD. The functional assessment scale used in our study is specific to

**Table 3.** Correlations between Functional Impairment and Internalizing-Externalizing Problems, Parenting Strategies, Perceived Expressed Emotion in the Attention Deficit Hyperactivity Disorder Group

Scales		Alabama Positive Parenting	Alabama Negative Parenting	SDQ Externalizing Score	SDQ Internalizing Score	SLEES Lack of Emotional Support	SLEES Irritability	SLEES Intrusiveness	WFIRS-P Total	WFIRS-S Total
Alabama positive parenting	rho	–								
	P									
Alabama negative parenting	r	–0.068	–							
	P	.632								
SDQ externalizing score	r	–0.460	0.337	–						
	P	.001	.015							
SDQ internalizing score	r	–0.359	0.021	0.214	–					
	P	.009	.880	.128						
SLEES lack of emotional support	r	–0.179	–0.055	0.153	0.163	–				
	P	.203	.698	.280	.249					
SLEES irritability	rho	–0.015	0.137	0.206	0.228	0.328	–			
	P	.915	.333	.142	.103	.018				
SLEES intrusiveness	r	–0.055	0.057	0.116	0.118	0.907	0.502	–		
	P	.699	.689	.414	.406	<.001	<.001			
WFIRS-P total	r	–0.349	0.364	0.619	0.462	0.263	0.240	0.186	–	
	P	.011	.008	<.001	.001	.060	.087	.187		
WFIRS-S total	r	–0.161	0.325	0.319	0.352	0.373	0.543	0.474	0.543	–
	P	.253	.019	.021	.011	.007	<.001	<.001	<.001	

ADHD, attention deficit hyperactivity disorder; SDQ, strengths and difficulties questionnaire; SLEES, shortened level of expressed emotion scale; WFIRS-P, Weiss functional impairment rating scale-parent report; WFIRS-S, Weiss functional impairment rating scale-self-report. *r*, Pearson correlation coefficient; rho, Spearman’s rank correlation coefficient.

ADHD and is a tool that is found in guidelines concerning ADHD.<sup>32</sup> Moreover, there are no studies that have assessed the mental health of children with ADHD during the normalization stage. Very few studies assessing the mental health of individuals during normalization described that the negative psychological effects of the pandemic could persist in the period following the end of the pandemic.<sup>14,15</sup> The Collaborative Outcomes study on Health and Functioning during Infection Times project investigating the impact of the COVID-19 pandemic on health and functionality in a community sample in multi-waves aimed to identify risk factors to inform prevention/intervention programs to improve social/health outcomes in the general population/vulnerable subgroup during/after the pandemic. It has been reported that representative results of these studies, in which psychopathology, functionality and quality of life, family, coping strategies, and service use factors were evaluated separately in child-adolescent and adult populations, will be available in the near future. It is stated that these results will provide information on evidence-based interventions and health policies in the acute and long-term by providing an international estimate of the impact of the pandemic on the mental health, functioning, and quality of life of individuals.<sup>33-35</sup> Our results may indicate that the negative effects of the pandemic on the functioning of children with ADHD persist during

the normalization stage. This referred children with ADHD may need additional interventions in the long term as well as in the pandemic period, and holistic and longitudinal assessments may be required in order to identify risks and develop appropriate intervention strategies.

Our study demonstrated that the ADHD group had more problems with regard to emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, internalizing-externalizing problems, total difficulties, and prosocial behavior. This result is consistent with the result reported by Nonweiler et al (2020) suggesting that children and youth with neurodevelopmental disorders experienced more emotional and behavioral difficulties during the COVID-19 pandemic.<sup>7</sup> In addition, we determined that the internalizing-externalizing problems in children with ADHD were associated with both parent-reported and self-reported functioning. In a study that assessed the mental health of children with ADHD during the lockdown period, the total difficulties score was shown to be associated with poorer behavior in ADHD.<sup>12</sup> Similarly, a study conducted before the pandemic reported that children with ADHD and co-occurring internalizing-externalizing comorbidities were particularly more vulnerable to poorer functioning, which involved more peer problems, poorer quality of life, and poorer daily functioning over 12 months of follow-up.<sup>36</sup> Our result, which was consistent

**Table 4.** Significant Predictors of Weiss Functional Impairment Rating Parent- and Self-Report Total Scores in Children with Attention Deficit Hyperactivity Disorder Based on Linear Regression

WFIRS-P total scores	Unstandardized Coefficients		Standardized Coefficients			95% CI Lower and Upper Bound		VIF
	B	SE	Beta	t	P			
Gender	-0.080	0.103	-0.085	-0.778	.441	-2.594	0.637	1.130
Age	0.018	0.033	0.064	0.542	.591	-.288	0.128	1.298
SDQ externalizing problems	0.062	0.017	0.507	3.718	.001	0.029	0.096	1.759
SDQ internalizing problems	0.045	0.014	0.363	3.137	.003	0.016	0.074	1.264
SLEES irritability	-0.001	0.006	-0.019	-0.153	.879	0.049	0.085	1.519
SLEES intrusiveness	0.003	0.004	0.095	0.782	.439	-0.014	0.012	1.404
Alabama positive parenting	0.002	0.007	0.048	0.364	.717	-0.005	0.012	1.631
Alabama negative parenting	0.010	0.006	0.178	1.581	.121	-0.011	0.016	1.194
<b>WFIRS-S total scores</b>								
Gender	-0.201	0.113	-0.199	-1.771	.084	-0.429	0.028	1.130
Age	0.042	0.036	0.138	1.144	.259	-0.032	0.115	1.298
SDQ externalizing problems	0.021	0.018	0.161	1.146	.258	-0.016	0.058	1.759
SDQ internalizing problems	0.032	0.016	0.244	2.052	.046	0.001	0.064	1.264
SLEES irritability	0.015	0.007	0.280	2.152	.037	0.001	0.029	1.519
SLEES Intrusiveness	0.012	0.005	0.296	2.364	.023	0.002	0.021	1.404
Alabama positive parenting	0.003	0.007	0.062	0.458	.649	-0.011	0.018	1.631
Alabama negative parenting	0.012	0.007	0.196	1.696	.097	-0.002	0.026	1.194

WFIRS-P, the model was significant for WFIRS-P ( $F [8, 43] = 6.433$ ,  $P < .001$ ) and could explain 46% of the variance (adjusted  $R^2 = 0.460$ ). Constant ( $B: -0.979$ ,  $SE: 0.801$ ).

WFIRS-S, the model was significant for WFIRS-S ( $F [8, 43] = 5.804$ ,  $P < .001$ ) and could explain 43% of the variance (adjusted  $R^2 = 0.430$ ). Constant ( $B: -1.598$ ,  $SE: 0.879$ ).

ADHD, attention deficit hyperactivity disorder; B, unstandardized coefficient; Beta, standardized regression coefficient; SDQ, strengths and difficulties questionnaire; SE, standard error; SLEES, shortened level of expressed emotion scale; VIF, variance inflation factor; WFIRS-P, Weiss functional impairment rating scale-parent report; WFIRS-S, Weiss functional impairment rating scale-self-report. Linear regression with enter method

with the literature, emphasized the need for the systematic assessment of comorbid problems in order to help clinicians develop interventions targeting the specific comorbid symptoms that exacerbate functional impairment in ADHD. The disruption of routine daily activities and the critical lifestyle changes resulting from the pandemic have generated important problems for parents as well as for children and adolescents with ADHD. In addition to the personal difficulties related to the pandemic, the parents of children with ADHD also had to cope with the difficulties caused by the worsening behavior of their children. They were faced with the risk of exhibiting poor parenting strategies such as coercive and ineffective discipline as they struggled to maintain consistent rules during this period.<sup>15-17</sup> Although the effects of parenting strategies on functioning in ADHD were not studied directly during this period, they were investigated in various contexts. In a study that evaluated the effects of parent-related factors on the learning and emotional outcomes in children with ADHD during the pandemic, parental risk (a single risk factor comprising parent's internalizing symptoms, stress, and negative parenting styles) and resilience (parent's confidence, positive parenting, and involved parenting

style as 3 separate factors) factors were defined. It was shown that the risk factor predicted both the emotional and learning outcomes; however, that positive parenting and involved parenting style had no effect on the outcomes.<sup>14</sup> In a study conducted by Oliveira et al<sup>37</sup> (2022) in which the authors reached a population sample via social media platforms, frequent use of negative strategies by the parents was shown to be a risk factor for negative outcomes in children such as mental health problems, ADHD symptoms, internalizing-externalizing problems, video game addiction, and sleep disorder. In our study, parent-reported functional impairment was positively correlated with negative parenting and negatively correlated with positive parenting. Self-reported functional impairment was also positively correlated with negative parenting. Thus, reinforcement of parenting strategies may represent an effective intervention to shield children with ADHD from the negative psychological effects of the pandemic. The association of negative parenting strategies both with negative outcomes in previous studies and with functional impairment in our study, which was derived from 2 sources, may suggest that they should be given precedence in the intervention programs that will be planned.

Another important factor besides parental attitude is how adolescents perceive their parents and the family climate. Although it has been reported that evaluating the levels of expressed emotion and the psychosocial factors related to the family is important in the follow-up of the clinical course of ADHD, studies that specifically assess perceived expressed emotion in ADHD are quite limited.<sup>38</sup> In a study that investigated this matter before the pandemic, adolescents with ADHD were found to perceive their family climates as less emotionally supportive, more intrusive, and more irritable. Moreover, adolescents who perceived their parents to be less emotionally supportive and more irritable were shown to have lower self-esteem. Thus, this study highlighted the importance of family relationships and social support in chronic disorders such as ADHD that predispose individuals and especially adolescents to psychopathologies.<sup>39</sup> However, there are no studies that have investigated EE in those with ADHD during the pandemic. In line with these results from the pre-pandemic literature, in our study, children with ADHD perceived their family climates as less emotionally supportive, more intrusive, and more irritating. However, the perception of the family climate as less emotionally supportive, more intrusive, and more irritable by the adolescents was only associated with self-reported functional impairment. This result demonstrates the need for a holistic approach in which family interactions are also evaluated and included in the intervention plan.

Lastly, we investigated the predictors of functional impairment in ADHD during the normalization stage. We determined that externalizing-internalizing problems predicted parent-reported functional impairment and that internalizing problems, as well as a more irritable and intrusive perception of the family climate, predicted self-reported functional impairment. Results from the parent report support that interventions targeting functioning in ADHD should also target the comorbid internalizing-externalizing problems in parallel to the results of studies from the pre-pandemic period and the pandemic period.<sup>12</sup> The fact that self-report outcomes were only predicted by internalizing problems and perceived expressed emotion may be attributed to the difficulty of the observation of internalized problems and their effects by others.<sup>40</sup> As such, this means that self-report of these problems may have particular importance. Greater knowledge of the association between functional impairment and self-reported factors may bring us one step closer to more effective interventions.<sup>41</sup> Therefore, we would like to recommend that both self and parent reports be taken into consideration in the assessment of functioning in children with ADHD, both in clinical practice and in research.

### Limitation

This study has certain limitations. The first is the cross-sectional design. Due to this, the investigated variables

could not go beyond potential predictors and a direct causal relationship could not be discussed. The second was that the state of having been infected with COVID-19 could not be investigated for adolescents and parents participating in the study. This may be considered acceptable since our study focused on the normalization stage rather than the acute pandemic period. The third was that variables such as socioeconomic status and the psychiatric diagnoses of the parents could not be objectively evaluated. The fourth was that ADHD subtypes could not be analyzed separately due to the relatively small sample size. Due to the single-center, cross-sectional, case-control design of the study and the sample size, our results cannot be generalized to other centers. In order to demonstrate the effect of the pandemic on functioning in ADHD, follow-up studies with larger samples, multicenter, and focusing on the long-term consequences of the pandemic are needed.

Despite these limitations, this study contributes greatly to the understanding of functional impairment in adolescents with and without ADHD during the COVID-19 normalization stage. Our results demonstrated that functional impairment in ADHD was more severe during this period and that it was associated with internalizing-externalizing problems, parenting strategies, and the perceived family climate. These results show that the negative effects of the pandemic period may persist during the normalization stage and that it is necessary to consider accompanying symptoms, parenting strategies, and the family climate in the evaluation of functioning and the planning of relevant treatment interventions. Moreover, taking into account both parent report and the perspectives of the adolescents in the assessment of functioning may contribute to a more complete evaluation. Another limitation was that we did not have information about the effect of other comorbidities and depressive symptoms on functionality since comorbid conditions were not included in our study (except for oppositional defiant disorder and behavioral disorder) and depressive symptoms were not evaluated.

**Ethics Committee Approval:** This study was approved by the Ethics Committee of Erzurum Region Training and Research Hospital Ethical Committee (Approval Number: 2021/01-10).

**Informed Consent:** Written informed consent was obtained from the children and their parents who agreed to take part in the study.

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