



Evaluation of depression, anxiety and posttraumatic stress response levels of children and adolescents treated with COVID-19

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Abstract

We aimed to evaluate stress level reactions to depression, anxiety, and posttraumatic stress in paediatric patients' post-COVID-19 infection. A total of two hundred consecutive patients aged 8 to 18 years were prospectively enrolled in the study between March 2020 and June 2021. One hundred patients were diagnosed with a positive COVID-PCR test and had inpatient management. Another hundred patients had positive COVID-PCR results and completed their care and isolation for 14 days at home. We used the child posttraumatic stress reaction index (CPTS-RI), child depression inventory (CDI), and screen for child anxiety-related disorders (SCARED) to evaluate their post-COVID-19 infection mental health state. In the study population, the mean age was 13.4 years, and 50.5% were male. Sixty-seven patients were paediatric, and the rest were adolescents. Based on our scaling system, 10% of patients had depression. Forty-one percent of patients had at least one high subscale of SCARED. Forty-four percent of patients' CPTS-RI was above the normal limit, while 4% had a severe stress reaction level. In the female patient population, SCARED and CPTS-RI were significantly high ($p = 0.01$). There was no significant correlation between hospitalization duration and test scores. The CPTS-RI score was significantly higher in the outpatient group than in the other groups ($p = 0.01$). The inpatient group had significantly higher social phobia, while the outpatient group had significantly higher school phobia ($p = 0.01$ and $p = 0.05$, respectively).

Conclusion: The present study showed that COVID-19 infection is a significant risk factor for psychopathology in children and adolescents.

What is Known:

- COVID-19 causes multiple physical complications in the body along with significant harmful physiologic mental health effects. After being diagnosed with COVID-19, paediatric and adolescent patients have been engaging in social isolation.
- Shutdowns, school closings, minimizing social interaction, and isolating behaviour are some of the measures used to control the pandemic. For kids to develop into healthy individuals, they need social interaction and a safe environment.

What is New:

- The present study showed that COVID-19 infection is a significant risk factor for childhood and adolescent psychopathology. Based on our scaling system, 10% of patients had depression. Forty-four percent of patients' CPTS-RI was above the normal limit, while 4% had a severe stress reaction level. In the female patient population, SCARED and CPTS-RI were significantly high.
- These patients need to be evaluated and monitored by paediatric and adolescent psychiatry clinics simultaneously with paediatric clinics.

Keywords Adolescent · Anxiety · COVID-19 · Depression · Mental health

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Abbreviations

CDI	Child depression inventory
CPTS-RI	Posttraumatic stress reaction index
WHO	World Health Organization
SCARED	Screen for child anxiety-related disorders

Introduction

The World Health Organization (WHO) first declared a health care emergency on January 30, 2020, and declared COVID-19 to be a worldwide pandemic on March 11, 2020. The COVID-19 pandemic has been a substantial ongoing health care problem ever since [1].

COVID-19 patients show clinical symptoms after an average of a 5-day latent period. Some studies have shown that the mean time from symptom onset to death is an average of 14 days, but that timeline can vary between 6 and 41 days [2, 3]. In the current COVID-19 pandemic, the paediatric population experiences less severe disease than adult patients, and asymptomatic paediatric patients play a significant role in spreading the disease [4, 5]. The most common symptoms in paediatric patients are fever, cough, sore throat, nasal congestion, and sneezing [6]. Paediatric patients have less diarrhoea and respiratory symptoms than adult patients. Paediatric patients rarely need intensive care units and mechanical ventilation [7].

Shutdown operations and quarantine prevented the spread of COVID-19 in the population, but in later months, its long-term negative effect on the psychology of the paediatric population was observed. The traumatic process involved in these preventive measures can cause comorbid conditions in children and adolescents. There are limited data about paediatric patients with a history of COVID-19 infection and its effect on their mental health. The majority of studies have investigated the effect of the COVID-19 pandemic on healthy paediatric and adolescent populations [8–12]. Therefore, in the present study, we conducted one of the first studies on the effect of COVID-19 infection on mental health in paediatric and adolescent patients under 18 years old.

Methods

This prospective study enrolled patients from the COVID-19 infection section of the Dicle University Paediatric services between March 2020 and June 2021. One hundred patients were diagnosed with positive COVID-PCR testing and inpatient management. Another hundred patients had positive COVID-PCR results and completed their care and isolation for 14 days at home. The paediatric patient group comprised patients who were 10 years old or younger,

and patients > 10 years old were included in the adolescent patient population. We compared depression and anxiety levels of inpatients versus outpatients. We used the child post-traumatic stress reaction index (CPTS-RI), child depression inventory (CDI), and screen for child anxiety-related disorders (SCARED). All of the scales were evaluated according to the participants' self-reports. The testing scales were completed in person or through a web survey 4 to 6 weeks after a positive COVID-19 test. Patients between 8 and 18 years old with COVID-19 infection and optimal capacity to understand the risk and benefit of the study were included after they provided informed consent. The exclusion criteria were patients aged < 8 and > 18 years and an inability to provide informed consent.

Screen for child anxiety-related disorders (SCARED)

We used the screen for child anxiety-related disorders (SCARED) form for parents and children, which was developed by Birmaher et al. and validated in Turkey by Cakmakci. A score of 25 and above points to a significant level of anxiety disorder. Subgroups for the scaling system indicate risk for the following disorders: a score of 7 indicates panic/somatization disorder; a score of 9 indicates diffuse anxiety disorder; a score of 5 or above indicates separation anxiety; a score of 8 indicates social phobia; and a score of 3 or above indicates school phobia [13, 14].

Child depression inventory (CDI)

The child depression inventory (CDI) was developed for use mostly in populations aged 6 and 17 years and provides a self-evaluation of depression. The CDI scale contains 27 points, each of which has three subgroups of statements. Each statement has a score of 0 to 2, and the total score can vary between 0 and 54. A score of 19 or above is indicative of paediatric patient depression. The higher the score is, the higher the depression risk. The scale was validated in Turkey by Oy [15, 16].

Child posttraumatic stress reaction index (CPTS-RI)

The child posttraumatic stress reaction index (CPTS-RI) was first used by Pynoos et al. in 1987 and validated in Turkey by Erden et al. This scale contains 20 questions, and the total score varies between 0 and 80. Scores from 7 to 10 points indicate mild, from 10 to 12 moderate, and > 12 severe post-traumatic stress disorder [17, 18].

Statistical analysis

SPSS IBM 25 was used for statistical analysis. Student's *t* test was used to compare quantitative variables, and

continuous data are presented as the mean \pm SD (median, minimum, and maximum). The chi-square test or Mann–Whitney *U* test was used to compare qualitative variables, and categorical variables were summarized as percentages. A *p* value of <0.05 was considered statistically significant.

Results

A total of two hundred consecutive patients with a median age of 13.3 ± 2.8 years were prospectively enrolled in the study; 50.5% of the study population was male, and 66.5% were adolescents. Sixty-seven percent of patients were living in the city. When we analysed patients' parents' education level, 76% of fathers and 60% of mothers had basic education and were able to read and write. Half of the patients received inpatient treatment for COVID-19 infection, and the other half received outpatient treatment and follow-up. Tables 1 and 2 present the patients' population sociodemographic and physiologic data analysis.

We compared psychometric scales between genders. CPTS-RI, SCARED, separation anxiety, and panic/somatization disorder subscale scores were significantly higher in female patients ($p=0.01$). CDI measurement was not different between genders ($p=0.57$) (Table 3).

CDI, SCARED, and CPTS-RI were higher in the adolescent patient group than in the paediatric patient group. Panic/somatization and school phobia subscale scores were statistically higher in adolescents than in paediatric patients ($p=0.03$, $p=0.04$, respectively) (Table 4).

In our study population, 10% ($n=20$) of patients had depression, 17% ($n=34$) had panic/somatization symptoms, 34% ($n=68$) had separation anxiety, 19.5% ($n=39$) had social phobia, and 6% ($n=12$) had school phobia. None of the patients included in the study had a history of antidepressant use. Forty-four percent of patients ($n=88$) had high posttraumatic stress disorder scores, and these scores were much higher in 4% ($n=8$) of the study population (Fig. 1) (Table 5).

When we compared the subgroup of patients who received inpatient treatment and the follow-up isolation time at home versus the outpatient treatment group, the mean posttraumatic stress reaction score and school phobia score were significantly higher in the outpatient treatment group ($p=0.01$ and $p=0.04$, respectively); in contrast, the outpatient group had a significantly lower social phobia score ($p=0.01$) (Table 6).

When we examined the correlation between hospital stay and psychological test results, we found that there was a positive correlation with the posttraumatic stress response

Table 1 Patients' sociodemographic data

	Inpatient treatment ($n=100$) n (%)	Outpatient treatment ($n=100$) n (%)	<i>p</i> *
<i>Gender</i>			
Female ($n=99$)	49 (%49)	50 (%50,5)	0,89
Male ($n=101$)	51 (%51)	50 (%49,5)	
<i>Residency</i>			
Urban ($n=134$)	61 (%61)	73 (%54,5)	0,07
Rural ($n=66$)	39 (%39)	27 (%40,9)	
<i>Mother's education level ($n=189$)</i>			
Read and write ($n=119$)	55 (%61,8)	64 (%64)	0,75
Cannot read or write ($n=70$)	34 (%38,2)	36 (%36)	
<i>Father's education level ($n=198$)</i>			
Can read and write ($n=152$)	74 (%75,5)	78 (%78)	0,33
Cannot read or write ($n=46$)	24 (%24,5)	22 (%22)	
<i>Second hand smoking exposure</i>			
Yes ($n=80$)	30 (%30)	50 (%50)	0,01
No ($n=120$)	70 (%70)	50 (%50)	
<i>Comorbid disease</i>			
Yes ($n=35$)	13 (%13)	22 (%22)	0,09
No ($n=165$)	87 (%87)	78 (%78)	
<i>Sibling number</i>			
No sibling ($n=29$)	5 (%5)	24 (%82,8)	0,01
Has sibling ($n=171$)	95 (%95)	76 (%76)	

*Chi square

Table 2 Results of psychometric scales (*n*: 200)

	<i>Minimum</i>	<i>Maximum</i>	<i>Mean ± SD*</i>
<i>Child depression inventory</i>	0	51	8.73 ± 7.97
<i>Child posttraumatic stress reaction</i>	0	56	13.66 ± 12.36
<i>Panic/somatization</i>	0	22	4.31 ± 4.17
<i>Separation anxiety</i>	0	13	4.54 ± 3.28
<i>Social phobia</i>	0	14	5.34 ± 3.65
<i>School phobia</i>	0	7	1.03 ± 1.43
<i>Screen for child anxiety-related disorders</i>	0	48	15.22 ± 10.40

*SD** standard deviation

scale ($p=0.02$, $r=0.22$) and no correlation with other test parameters.

Discussion

Coronavirus disease started in Wuhan, China, on December 29, 2019. COVID-19 infection has since become a global pandemic and has affected 100 million people to date, making it the largest pandemic in this century. Multiple studies have investigated the effects of previous pandemics on people's mental health [19–21].

Multiple unusual approaches have been implemented to control the COVID-19 pandemic. COVID-19 causes multiple physical complications in the body along with significant harmful mental health effects. Many studies have been conducted worldwide regarding the clinical features of COVID-19 in children. In our studies conducted in our country and in our region, it has been determined that COVID-19 generally causes asymptomatic and mild clinical symptoms [22].

Table 3 Comparison of the psychometric scales results between genders

	<i>Sex</i>	<i>Mean ± SD*</i>	<i>p**</i>
<i>Child depression inventory</i>	Female	9.06 ± 7.17	0.57
	Male	8.42 ± 8.71	
<i>Child posttraumatic stress reaction</i>	Female	16.35 ± 14.27	0.01
	Male	11.03 ± 9.5	
<i>Panic/somatization</i>	Female	5.16 ± 4.95	0.01
	Male	3.48 ± 3.04	
<i>Separation anxiety</i>	Female	5.18 ± 3.48	0.01
	Male	3.91 ± 2.96	
<i>Social phobia</i>	Female	5.78 ± 3.62	0.09
	Male	4.91 ± 3.66	
<i>School phobia</i>	Female	1.14 ± 1.65	0.28
	Male	0.92 ± 1.19	
<i>Screen for child anxiety-related disorders</i>	Female	17.26 ± 11.38	0.01
	Male	13.22 ± 8.95	

*SD** standard deviation; ****Independent sample-*T* test

However, studies on its psychological effects are very limited. Shutdowns, school closings, minimized social interaction, and isolation are some of the measures used to control the pandemic. Unfortunately, while these measures help to control the pandemic, they cause psychological problems in the adult and paediatric populations. For children to develop into healthy individuals, they need social interaction and a safe environment. After being diagnosed with COVID-19, paediatric and adolescent patients have been kept in social isolation. Interruptions of social development in the paediatric population, including interactions with parents, classmates, and friends, may have a significant impact on mental health. The present study investigated other harmful effects of COVID-19 infection by using well-known psychometric tests.

Xie et al. investigated depression and anxiety in 1784 students aged 7–18 years while they were in quarantine [8]. A total of 22.6% of students had depression symptoms, and 18.9% had anxiety symptoms. In that study, the authors also showed that increasing age was positively correlated with more depression symptoms, while there was no significant correlation between anxiety and age. Zhou et al. investigated anxiety and depression in 8140 adolescent COVID-19 patients between 12 and 18 years old. Their study showed higher depression and anxiety symptoms in this adolescent patient population [9].

Chen et al. investigated depression and anxiety incidence in 1036 paediatric patients aged between 6 and 15 years [10]. Of their study population, 11.8% of patients had depression, 8.9% had anxiety, and 6.56% had both depression and anxiety [10]. They also found that the 13–15 year age group of adolescents was affected more than other age groups. Liu et al. compared elementary school and high school individuals' quarantine reactions in China [11]. High school adolescents had significantly higher somatization disorder, anxiety, and depression scores. In the adolescent population, 34.8% had somatization symptoms compared to 2.3% in the elementary school population [11].

Duan et al. showed a higher mean anxiety score in adolescents with COVID-19 infection than in paediatric patients [12]. They also showed that patients with higher depression

Table 4 Comparison of paediatric and adolescent psychometric scales results

	Childhood (<i>n</i> = 67) mean ± SD*	Adolescent (<i>n</i> = 133) mean ± SD*	<i>p</i> **
Child depression inventory	7.83 ± 7.90	9.18 ± 7.99	0.26
Child posttraumatic stress reaction	11.88 ± 8.89	14.56 ± 13.72	0.15
Panic/somatization	3.38 ± 2.97	4.77 ± 4.60	0.03
Separation anxiety	4.92 ± 3.72	4.34 ± 3.02	0.24
Social phobia	5.46 ± 3.76	5.27 ± 3.61	0.74
School phobia	0.73 ± 1.06	1.18 ± 1.57	0.04
Screen for child anxiety-related disorders	14.50 ± 9.77	15.57 ± 10.72	0.49

SD* standard deviation; **Independent sample-*T* test

symptoms also had higher anxiety scores [12]. Wang et al. conducted a study on 6435 adolescent patients with COVID-19 infection during their quarantine time and showed that 17.7% of adolescent patients demonstrated depression symptoms [23].

Paediatric patients were the majority in our study population, accounting for 66.5% (*n* = 133); 10% (*n* = 20) of patients had depression, 17% (*n* = 34) had panic/somatization symptoms, 34% (*n* = 68) had separation anxiety, 19.5% (*n* = 39) had social phobia, and 6% (*n* = 12) had school phobia.

In the present study, 44% (*n* = 88/200) of the patient population had a high posttraumatic stress disorder score, and 4% (*n* = 8/200) of the study population had a very high score (Fig. 1) (Table 5). There was no significant difference between the paediatric and adolescent groups in terms of CDI and CPTS-RI. Further detailed measurements showed that panic/somatization symptoms and school phobia were significantly high in the adolescent patient population.

In the literature, depression and anxiety scores have been shown to be higher in adolescent patients with COVID-19 infection during quarantine than in paediatric patients in general [11, 12, 23]. In the present study, CDI and CPTS-RI

scores were higher in the adolescent group, but the difference did not reach statistical significance. Our study is unique because it is the first time that these psychological evaluation scoring systems have been used in COVID-19 patients, while previous studies mostly involved relatively healthy individuals. Elevated CDI scores in adolescence in the present study were concordant with the literature. The SCARED score was also elevated in the adolescent group, but the difference was not statistically significant. Separation anxiety and social phobia were higher in the paediatric group than in the adolescent group. We think that COVID-19 may lead to increased stress due to many factors, including the effect of the disease, the isolation process, the length of stay in the hospital, and the negative discourses related to the disease from the press and the environment.

Chen et al. found a higher level of depression and anxiety in the female paediatric population in his study [10]. Xie et al. did not show any significant relationship between gender, demographics, and depression or anxiety level [8]. Another study in China showed a significantly higher level of anxiety and depression in the female paediatric population than in the male population [9]. Duan et al. found a

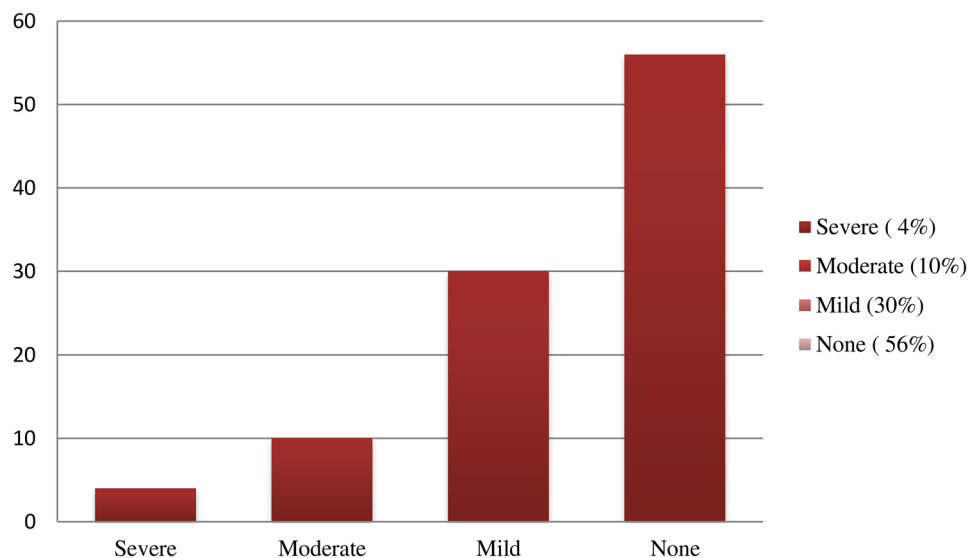
Fig. 1 Child posttraumatic stress reaction index (CPTS-RI)

Table 5 Depression and anxiety data (total n:200)

	Inpatient treatment (n = 100) n (%)	Outpatient treatment (n = 100) n (%)	p*
Depression (n = 20, %10)	7 (%7)	13 (%13)	0,16
Panic/somatization (n = 34, %17)	14 (%14)	20 (%20)	0,26
Separation anxiety (n = 68, %34)	37 (%37)	31 (%31)	0,37
Social phobia (n = 39, %19.5)	26 (%26)	13 (%13)	0,20
School phobia (n = 12, %6)	5 (%5)	7 (%7)	0,55

*Chi square

higher level of anxiety in the female paediatric and adolescent population than in males [12]. In our study, 101 of 200 patients were male. There was a higher psychological score in female patients than in male patients, but the difference was not statistically significant. The CPTS-RI score was significantly higher in female patients than in male patients. The SCARED score and scores of other subclasses were significantly higher in female patients. The difference was particularly prominent in panic/somatization and separation anxiety scores. Our finding accords with the literature regarding the higher risk of depression and anxiety in the female population than in the male population. Studies independent of COVID-19 disease have shown that the frequency of depression and anxiety is higher in girls than in boys [24, 25]. Depression is more common in girls, which has been explained by hormonal changes in some studies [26]. In addition, the effect of environmental factors on anxiety has been shown to be greater in girls [27]. This difference may be related to the greater importance girls attach to their social status and peer relationships during the adolescence period.

There is no study in the literature that examines the relation between treatment methods and anxiety scores. Testing psychometric scale scores on the mental health of the COVID-19-infected paediatric population will provide unique data and information to the field. In the present study, half the study population received inpatient treatment. The outpatient treatment group had significantly higher CPTS-RI scores and school phobia than the inpatient group and lower scores for social phobia. There were no significant differences in other psychometric testing scores between the inpatient and outpatient treatment groups.

The present study investigated psychometric testing scales on mental health in paediatric and adolescent patients with COVID-19 infection. While there are many studies in the literature investigating the effects of the pandemic on the general mental well-being of the paediatric and adolescent populations, we conducted the first study on post-COVID-19 infection mental health in that group. Our study is also unique in comparing depression and anxiety in different treatment groups and different age groups in post-COVID-19 paediatric patients.

Table 6 Treatment method and conducted psychometric scales result comparison between groups

	Treatment method	Ort ± SS*	p
Child depression inventory	Inpatient	7.34 ± 7.49	0.13
	Outpatient	10.13 ± 8.23	
Child posttraumatic stress reaction	Inpatient	10.7 ± 9.91	0.01
	Outpatient	16.63 ± 13.83	
Panic/somatization	Inpatient	3.82 ± 3.2	0.10
	Outpatient	4.8 ± 4.93	
Separation anxiety	Inpatient	4.97 ± 3.65	0.06
	Outpatient	4.11 ± 2.81	
Social phobia	Inpatient	6.02 ± 3.91	0.01
	Outpatient	4.66 ± 3.27	
School phobia	Inpatient	0.83 ± 1.27	0.04
	Outpatient	1.23 ± 1.56	
Screen for child anxiety-related disorders	Inpatient	15.64 ± 10.24	0.57
	Outpatient	14.8 ± 10.6	

Mean ± SD* mean ± standard deviation; **Independent sample-T test

Conclusions

COVID-19 infection can have psychopathological effects on the paediatric and adolescent population. Early diagnosis and follow-up are important in this vulnerable population. These patients need to be evaluated and monitored by paediatric and adolescent psychiatry clinics simultaneously with paediatric clinics. Large-scale multicentre studies can provide more data about the effect of COVID-19 infection on paediatric patients' mental health and its treatment.

Limitation

Our study was a single-centre cross-sectional study. There was no control group, and data were collected by self-reporting. This method of data collection can produce bias and influence responses. The follow-up period was relatively short. We did not evaluate the current or past psychiatric diagnoses of the cases using a structured method. We were not able to evaluate patients in normally structured psychiatric consultation environments due to the ongoing pandemic.

Authors' contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Kamil Yılmaz, Bekir Taskesen, and Omer Kardas. The first draft of the manuscript was written by Kamil Yılmaz, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Availability of data and material N/A.

Code availability N/A.

Declarations

Ethics approval Approval was obtained from the ethics committee of Dicle University, Faculty of Medicine. The study was conducted in accordance with the Helsinki Declaration.

Consent to participate N/A.

Consent for publication N/A.

Conflict of interest N/A.

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