




Original Article

The effect of coronavirus disease 2019 on anxiety levels of children with cystic fibrosis and healthy peers

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Abstract **Background:** Cystic fibrosis (CF) is a chronic disease causing recurrent respiratory tract infections. Viral respiratory tract infections are more severe in CF. The first case of coronavirus disease 2019 (COVID-19) was seen in Turkey on March 11, 2020, and nationwide school closure and lockdown were implemented. School closure and home confinement might have adverse effects on children's physical and mental health. In this study, we aimed to compare the effect of the COVID-19 pandemic on psychological reactions of CF patients and healthy controls.

Methods: This is a controlled cross-sectional study including 7–18-year-old children with CF. The survey included questions regarding family environment and peer relations, self-care, and psychological reactions to the COVID-19 pandemic. The questionnaire was administered to children via telephone calls under parental supervision.

Results: We evaluated 132 CF patients and 135 of their healthy peers. Mean age was 11.5 ± 2.9 years in the CF group and 11.8 ± 3.2 years in the control group ($P = 0.98$). There were 55 girls (41.7%) in the CF group and 81 girls (60%) in the control group ($P = 0.027$). The socioeconomic status of their families was similar. The CF patients were found to be less anxious for family members at risk of COVID-19, less upset about school closure, and less anxious about the COVID-19 pandemic ($P < 0.001, 0.02, 0.01$, respectively).

Conclusions: Cystic fibrosis patients seem to show more resilience in coping with the pandemic. Appropriate psychological support should be provided to them and resilience strategies in coping with the pandemic should be nurtured.

Key words anxiety, coping, COVID-19, cystic fibrosis.

Introduction

Cystic fibrosis (CF) is a chronic, life-shortening disease causing recurrent respiratory tract infections and loss of lung function.¹ Previous meta-analyses and systematic reviews have shown that adults and children with chronic diseases have higher risk of depression and anxiety than the rest of the community.^{2,3} A number of studies reported increased anxiety and depression in CF patients compared with healthy controls.^{4–6} Facing a chronic disease such as CF on a daily basis causes a significant emotional burden, which can be attributed to a large number of treatments, hospitalizations, multiple diagnostic procedures, chronic respiratory symptoms, and a lower body mass index.⁶

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Viral respiratory tract infections are more severe in patients with CF than in the general population. The influenza pandemic (H1N1 infection) in 2009 caused significant morbidity in patients with CF, and in a subgroup of patients with severe lung disease, H1N1 infection was associated with respiratory deterioration, intensive care admission and even death.^{7,8} Coronavirus disease-19 (COVID-19) has emerged in China and has been spreading all over the world since December 2019. The first case of COVID-19 infection was confirmed in Turkey on March 11, 2020. In most of the pediatric cases (>90%) the disease is asymptomatic or presented with signs of upper respiratory tract infection symptoms. However, in a small number of children (0.6%), the infection may progress into critical disease causing respiratory insufficiency and death.⁹

During the COVID-19 pandemic people are likely to experience fear of falling sick, or dying, or feelings of helplessness, and a number of studies revealed a wide range of psychosocial impacts on people.⁴ In a study by Wang *et al.*, which included 1,210 respondents, the psychological impact of

the outbreak was rated as moderate or severe in 53.8%. Moderate to severe depression, anxiety symptoms, and stress were present in 16.5%, 28.8%, and 8.1% of the participants, respectively.¹⁰ Another cross-sectional study in 7,143 college students demonstrated that 21.3% had mild and 3.6% had moderate-to-severe anxiety symptoms, and economic effects on daily life and delays in academic activities were positively associated with anxiety symptoms.¹¹

Although children seem to be less vulnerable than adults to COVID-19, initial reports from China indicate that children and adolescents also have been impacted psychologically, manifesting behavioral problem. Previous studies suggested that when children are out of school (e.g., at weekends and during summer holidays), they are physically less active, have longer screen time, irregular sleep patterns, and less favorable feeding habits, resulting in weight gain and a loss of cardiorespiratory fitness.^{12,13}

Shuang-Jiang Zhou *et al.* conducted a cross-sectional study including 8,079 students aged 12–18 years during the COVID-19 pandemic period. The prevalence of depressive symptoms, anxiety symptoms, and a combination of depressive and anxiety symptoms was found to be 43.7%, 37.4%, and 31.3%, respectively.¹⁴ Home confinement during the pandemic appears to be another factor in increasing stress levels in children. In 2013, Sprang *et al.* found that the post-traumatic stress scores of quarantined children were four times higher than for those who were not quarantined.¹⁵

Although the mortality of COVID-19 infection was found to be higher in patients with underlying diseases, until now, there has been no evidence to suggest that the course of COVID-19 is more severe in CF patients than in the general population.¹⁶ Clinical features of COVID-19, including dry cough, myalgia, and fever, are quite distinct from the symptoms of CF and are recognizable. However it is possible that mild disease might be labeled as within the normal spectrum of symptoms for that individual. Nevertheless COVID-19 infection still might cause more stress and anxiety in CF patients. There is a study from Turkey evaluating anxiety of CF patients during COVID-19 pandemic. Senkalfa *et al.* compared the anxiety of 45 CF patients with 90 healthy control group and revealed that healthy children aged 13–18 years had higher state anxiety scores than age-matched children with CF.¹⁷

In this study, our aim was to evaluate the effect of the COVID-19 pandemic on family environment and relations, self-care practices, peer relations, psychological reactions including anxiety and coping of CF patients, and to compare them with healthy controls.

Methods

Study design and population

This is a case-controlled, cross-sectional, single-center study including 7–18 year-old CF children who have been followed

up in the Cystic Fibrosis Center of our hospital and their healthy peers. All 7–18 year-old CF patients undergoing regular follow-up at our CF center were considered for participation. Children undergoing psychiatric treatment for clinical anxiety and/or depression, children with mental problems, and children who had caught COVID-19 or had a family member with COVID-19 were excluded from the study. As a result 27 of 159 CF patients were excluded from the study and 83% participated. We recruited a control group consisting of 135 participants who were contacted from close associations of patients' group like neighbors, children's classmates and friends.

In CF patients, data regarding the presence of pancreatic insufficiency, colonization by *Pseudomonas aeruginosa*, and level of forced expiratory volume in 1 s (FEV₁) were collected from patients' medical records. Lung disease was categorized as mild, moderate, or severe according to baseline FEV₁ measurements (FEV₁ 70–89% mild lung disease, FEV₁ 40 to 69% moderate lung disease, FEV₁ <40% severe lung disease).¹⁸

The data were collected between April 30, 2020 and May 15, at which time COVID-19 started to peak in Turkey, schools were closed, and education was online. We conducted phone surveys by asking questions directly to the children under parental supervision. Informed consent was obtained from all parents following their agreement to participate in the phone survey and the study was approved by the medical ethics committee of our Marmara university.

Questionnaire

Separate behavioral questionnaires for two different age groups (7–12 years for children and 13–18 years for adolescents), based on the child psychiatry mental health examination references,¹⁹ were developed by the authors in Child and Adolescent Psychiatry Department and were not standardized. There were 27 questions in children's questionnaire and 30 questions in adolescents' questionnaire. Twenty-six of questions were identical. The only different question in children's questionnaire was about separation anxiety regarding family and siblings during lockdown. The different questions in adolescents' questionnaire included that if they followed the COVID-19 news (if the answer is yes, how many hours per day they spent for it), they had an admission examination for high school or university this year, and had performance anxiety for the exam.

The questionnaire consists of three subscales: (i) family environment and relations; (ii) self-care practices and peer relations during lockdown, and (iii) psychological reactions regarding the COVID-19 pandemic. Data regarding the presence of a health worker in the family, or a family member diagnosed with COVID-19, current anxiety level, sleep disturbances, change in appetite, activities to mitigate anxiety (any attempt to have a new hobby etc.) and seek psychological help were also collected.

Statistical analyses

Data were analyzed by using the SPSS Statistical Package for Windows version 23.0. Numerical variables were expressed as mean \pm standard deviation or median. Categorical variables were compared using the χ^2 test and expressed as numbers and percentages. A P value of <0.05 was considered statistically significant.

Results

This study included 132 CF patients and 135 healthy peers. The mean ages were 11.53 ± 2.86 and 11.76 ± 3.15 years respectively, in CF group and control group ($P = 0.98$).

There were 55 girls (41.7%) in the CF group and 81 girls (60%) in the control group ($P = 0.027$).

Of the 132 CF patients, 95 (72%) had pancreatic insufficiency, 41 (31.1%) were colonized with *Pseudomonas aeruginosa*, 59 (44.7%) had normal FEV₁ value, 40 (30.3%) had mild lung disease, 23 (17.4%) had moderate lung disease, and 5 (3.8%) of them had severe lung disease. There was no statistically significant difference in terms of severity of the disease and anxiety levels of CF patients ($P > 0.05$). A comparison of psychosocial and psychological findings between CF patients and the control group is presented in Table 1. Cystic fibrosis patients were found to be less anxious about family members at risk of COVID-19, less upset about school closure, and less anxious about the COVID-19 pandemic ($P < 0.001, 0.02, 0.01$ respectively). The control group was more overthinking about the pandemic, and felt more sad, lonely, or reluctant to have a playful time ($P = 0.03$ and 0.02 , respectively). The control

group also tried to have new hobbies more in comparison with the CF group ($P = 0.01$).

In the CF group, 71 (53.8%) of patients were children and 61 (46.2%) were adolescents. Children were feeling more upset about school closure ($P = 0.01$) and more anxiety about the COVID-19 pandemic ($P = 0.008$), had more appetite changes ($P = 0.03$), expressed more reluctance to do homework for online education ($P = 0.03$), engaged more in activities to decrease their anxiety ($P = 0.01$), and tried to find new hobbies during lockdown ($P = 0.005$) more than adolescents. Although it was not statistically significant, children stated that they needed psychological help more than adolescents ($P = 0.059$). Adolescents communicated with their friends via social media more than children ($P = 0.005$). Comparison of psychological and psychosocial findings in CF group as children and adolescent was presented in Table 2.

In the control group, 79 (58.5%) of them were children and 56 (41.5%) of them were adolescents. Although adolescents communicated with their friends from social media more than children ($P = 0.003$), children felt happier communicating online with their friends ($P = 0.02$). Children also engaged in new activities more than adolescents ($P = 0.008$). A comparison of psychosocial and psychological findings in the control group for children and adolescents is presented in Table 3.

In Turkey, examinations for high school and university admission are big stressors for adolescents. Twenty-four (39.4%) of CF and 17 (30.4%) of control group had admission examinations for high school or university. We also asked these adolescents if the pandemic, school closure, and online education increased their anxiety. Although it was not

Table 1 Comparison of psychosocial and psychological findings between CF patients and control group

	CF patients ($n = 132$)	Controls ($n = 135$)	P
Family environment and relations			
Existence of health professionals in the family ($n, \%$)	13 (9.8)	15 (11.1)	0.73
Obligated to separate from mother or father during pandemic ($n, \%$)	10 (7.6)	11 (8.1)	0.86
Feeling of parents spending enough time together ($n, \%$)	125 (94.6)	120 (88.9)	0.12
Self-care and peer relations during lockdown			
Communication with friends from social media ($n, \%$)	97 (73.4)	106 (78.5)	0.33
Feeling happy communicating online with friends ($n, \%$)	78 (59.1)	97 (71.9)	1.0
Engaging in activities to decrease anxiety ($n, \%$)	111 (84.1)	120 (88.9)	0.25
New hobbies during lockdown ($n, \%$)	32 (24.2)	51 (37.8)	0.01
Psychological reactions regarding COVID-19 pandemic			
Feeling anxious for family members at risk of COVID-19 ($n, \%$)	31 (23.5)	59 (43.7)	<0.001
Feeling upset by school closure ($n, \%$)	54 (40.9)	82 (60.7)	0.02
Attentional problems regarding online education ($n, \%$)	26 (19.7)	24 (17.8)	0.7
Reluctance to do homework for online education ($n, \%$)	6 (4.5)	5 (3.7)	0.67
Feeling anxious about the COVID-19 pandemic ($n, \%$)	44 (33.3)	67 (49.6)	0.01
Having sleep problems ($n, \%$)	13 (9.8)	21 (15.6)	0.09
Having appetite changes ($n, \%$)	65 (49.2)	66 (48.9)	0.95
Overthinking about the pandemic ($n, \%$)	4 (3)	11 (8.1)	0.03
Having somatic complaints of pain, weakness, and fatigue ($n, \%$)	3 (2.3)	4 (3)	0.70
Feeling sad, lonely, or reluctant to have playful time ($n, \%$)	1 (0.8)	7 (5.2)	0.02
Need for psychological help ($n, \%$)	24 (18.1)	36 (26.7)	0.11

Statistically significant values ($p < 0.05$) are presented as bold values.

Table 2 Comparison of psychological and psychosocial findings in the CF group for children and adolescents

	Children (7–12 years) (<i>n</i> = 71)	Adolescent (13–18 years) (<i>n</i> = 61)	<i>P</i>
Family environment and relations			
Health professionals in family (<i>n</i> , %)	9 (12.7)	4 (6.6)	0.24
Obligated to separate from mother or father during pandemic (<i>n</i> , %)	5 (7)	5 (8.2)	1.0
Feeling of parents spending enough time together (<i>n</i> , %)	68 (95.8)	57 (93.4)	0.70
Self-care and peer relations during lockdown			
Communication with friends via social media (<i>n</i> , %)	45 (63.4)	52 (85.2)	0.005
Engaging in activities to decrease anxiety (<i>n</i> , %)	65 (91.5)	46 (75.4)	0.01
New hobbies during lockdown (<i>n</i> , %)	24 (33.8)	8 (13.1)	0.005
Psychological reactions regarding COVID-19 pandemic			
Feeling anxious for family members at risk of COVID-19 (<i>n</i> , %)	20 (28.2)	11 (18)	0.76
Feeling upset by school closure (<i>n</i> , %)	34 (47.9)	20 (32.8)	0.01
Attentional problems regarding online education (<i>n</i> , %)	16 (22.5)	10 (16.4)	0.41
Reluctance to do homework for online education (<i>n</i> , %)	6 (8.5)	0	0.03
Feeling happy communicating online with friends (<i>n</i> , %)	37 (52.1)	41 (67.2)	0.11
Feeling anxious about the COVID-19 pandemic (<i>n</i> , %)	31 (43.7)	13 (21.3)	0.008
Having sleep problems (<i>n</i> , %)	6 (8.5)	7 (11.5)	0.64
Having appetite changes (<i>n</i> , %)	41 (57.7)	24 (39.3)	0.03
Overthinking about outbreak (<i>n</i> , %)	2 (2.8)	2 (3.3)	0.63
Having somatic complaints of pain, weakness, and fatigue (<i>n</i> , %)	0	3 (4.9)	0.09
Feeling sad, lonely, or reluctant to have playful time (<i>n</i> , %)	0	1 (1.6)	0.44
Need for psychological help (<i>n</i> , %)	17 (23.9)	7 (11.5)	0.06

Statistically significant values ($p < 0.05$) are presented as bold values.

Table 3 Comparison of psychosocial and psychological findings in control group for children and adolescents

	Children (7–12 years) (<i>n</i> = 79)	Adolescent (13–18 years) (<i>n</i> = 56)	<i>P</i>
Family environment and relations			
Health professionals in family (<i>n</i> , %)	11 (13.9)	4 (7.1)	0.21
Obligated to separate from mother or father during pandemic (<i>n</i> , %)	6 (7.6)	5 (8.9)	0.76
Feeling of parents spending enough time together (<i>n</i> , %)	73 (92.4)	48 (85.7)	0.20
Self-care and peer relations during lockdown			
Communication with friends via social media (<i>n</i> , %)	55 (69.6)	51 (91.1)	0.003
Engaging in activities to decrease anxiety (<i>n</i> , %)	75 (94.9)	45 (80.4)	0.008
New hobbies during lockdown (<i>n</i> , %)	35 (44.9)	16 (28.6)	0.06
Psychological reactions regarding Covid-19 pandemic			
Feeling anxious for family members at risk of COVID-19 (<i>n</i> , %)	35 (44.3)	24 (42.9)	0.10
Feeling upset by school closure (<i>n</i> , %)	49 (62)	33 (58.9)	0.79
Attentional problems regarding online education (<i>n</i> , %)	15 (19)	9 (16.1)	0.87
Reluctance to do homework for online education (<i>n</i> , %)	2 (2.5)	3 (5.4)	0.33
Feeling happy communicating online with friends (<i>n</i> , %)	59 (74.7)	38 (67.9)	0.02
Feeling anxious about the COVID-19 pandemic (<i>n</i> , %)	39 (49.4)	28 (50)	0.04
Having sleep problems (<i>n</i> , %)	11 (13.9)	10 (17.9)	0.50
Having appetite changes (<i>n</i> , %)	40 (50.6)	26 (46.4)	0.63
Overthinking about outbreak (<i>n</i> , %)	6 (7.6)	5 (8.9)	1.0
Having somatic complaints of pain, weakness, and fatigue (<i>n</i> , %)	2 (2.5)	2 (3.6)	1.0
Feeling sad, lonely, or reluctant to have playful time (<i>n</i> , %)	3 (3.8)	4 (7.1)	0.41
Need for psychological help	25 (31.6)	11 (19.6)	0.11

Statistically significant values ($p < 0.05$) are presented as bold values.

statistically significant ($P = 0.21$), exam anxiety was higher in control group than in CF patients (46.4% versus 24.6%).

Discussion

The COVID-19 has spread all over the world since the first quarter of 2020 and uncertainty about the personal and global effects of COVID-19, in addition to the psychological effects of quarantine, have caused fear and anxiety. Previous studies have suggested that the outbreaks can have many psychological effects like anxiety and depression.^{20,21} Although a number of studies have evaluated the psychological impact of the COVID-19 pandemic in children and adults, data regarding the effect of the pandemic in patients with chronic disease are scarce.¹⁷

In this study we evaluated the psychological reactions, family and peer relations, self-care practices and coping methods of CF patients during pandemic and compared with healthy controls. Symptoms of anxiety were unexpectedly higher in controls than CF patients. Almost 50% of the children in the control group and 33% of the CF patients were feeling anxious about the COVID-19 pandemic. Feeling upset for school closure, worries about a family member having the risk of COVID-19 infection, feeling sad, lonely or reluctant to have playful time, overthinking about pandemic are all more common psychological reactions regarding pandemic in the control group than in the CF patients.

Consistent with the results of current study, Senkalfa *et al.* also reported lower anxiety scores regarding the COVID-19 pandemic in CF patients than in age-matched healthy control group.¹⁷ In a 1,030-patient study, in which more than 90% of the patients had a nonpulmonary chronic disease, considerable levels of fear and anxiety were observed in a significant number of patients.²² Surprisingly lower anxiety scores in CF patients in both of Senkalfa's and our study may be related to a number of factors.

As the viral respiratory tract infections tend to be more severe in CF patients with an increased risk of complications and a negative impact on lung function, in the first days of pandemic, our patients and their families were more concerned about the possible effect of COVID-19 infection. However, until now, only few cases of COVID-19 infection in people with CF were reported, which probably related to the efforts of families and patients to minimize social contacts.²³ Reported cases are mainly adult CF patients and COVID-19 infection does not have an apparent effect on CF disease severity. It is not possible to identify protective factors and we need more data to determine the impact of COVID-19 on patients with CF. In cooperation with national registries, the European Cystic Fibrosis Society (ECFS) Patient Registry has established an international dataset to identify factors that predict severity of COVID-19. However, we assume that low numbers and mild course of COVID-19 infection caused a relieve in CF patients, which may partly explain lower anxiety levels in our patients.

During the pandemic, consistent with international guidelines, we recommended self-isolation for our CF patients. Recommendations for preventive measures, such as using face masks and practicing adequate hand hygiene, were reinforced. The CF team cancelled routine clinic appointments to prevent unnecessary hospital visits and viral spread. Phone calls and email contacts were used to monitor the clinical condition of patients immediately after the lockdown. In a study from China, the presence of psychological problems was negatively associated with the level of awareness of COVID-19.¹⁴ Wang *et al.* revealed that wearing a mask and practicing hand hygiene decreases the level of anxiety in children older than 12 years.¹⁰ Cystic fibrosis patients are used to following instructions for infection control, including wearing masks and avoiding close in-person contact with other CF patients. Awareness regarding respiratory tract infections and familiarity with infection-control measurements might be factors that decrease the level of anxiety in CF patients.

Psychosocial maladjustment might be another reason for lower anxiety levels in CF patients. Children with chronic physical disorders have twice the risk of psychosocial maladjustment compared with healthy children.²⁴ This maladjustment phenomenon might be an explanation for CF patients to give fewer psychological reactions in our study group in the case of pandemic, as they are already spending a longer time at home, mostly detached from school or peer relations.

Cystic fibrosis patients are always facing with a serious health problem and have associated anxiety symptoms; however, healthy peers have encountered fear of disease for the first time in their life during the pandemic, which can also partly explain relatively lower levels of anxiety in CF patients compared with healthy controls.

Although no significant difference was found between CF and control groups regarding family environment and relations or self-care and peer relations, almost half of the children had appetite changes in both groups, and the incidence of sleeping problem was 10% in CF patients and 15% in the control group. In Turkey, during the disease outbreak, right after the school closure and home confinement, a home schooling plan was implemented. In addition to academic learning, age appropriate and attractive videos may motivate children to have a healthy lifestyle at home by increasing physical activity, and having a balanced diet, a regular sleep pattern, and good personal hygiene.

Whereas CF patients had a lower tendency to need psychological help compared to control group, children in CF group had more anxiety symptoms than adolescents and required more psychological help than adolescents in both groups. During the pandemic children are constantly exposed to pandemic-related news, so having direct conversations with children about these issues could alleviate their anxiety. Home confinement, with the right parenting approach, could be a good opportunity to enhance family interactions and improve the self-sufficiency of the children.²⁵

Resilience is the ability to adapt properly and react positively to adversity, trauma, individual, or society tragedies,

including serious health threats.^{26,27} Coping responses mean the behaviors, thoughts and feelings that individuals adopt to avoid being harmed by life stressors.²⁸ In this study, we found that CF patients seem more resilient and developed adaptive coping strategies related to the pandemic. The mental health of children and adolescents constitute the basis for future adult mental health and are related to quality of life, productivity, and wellbeing, as well as compliance with treatment in the presence of a chronic health condition. It is therefore a vital effort to understand the psychological reactions of CF patients during the unusual period of the pandemic, in addition to the chronic illness status.

The current study has several limitations. The first and the most important one was the lack of a validated questionnaire. Second, the study design was cross-sectional so causality cannot be interpreted. Third although the CF and control groups are aged matched, they are not gender matched. It has been shown that girls experience more anxiety than boys in previous studies.^{29,30} However, as the anxiety levels of girls in our study were similar in CF and control groups, we assumed that the gender difference has not had an important impact on our results. Fourth, this was a phone survey and participants were recruited under parental supervision. As it was a self-report assessment, the indicated levels of anxiety may not always be consistent with the assessment of mental health by a professional. Despite these limitations, the study had some strengths. Significant number of subjects were participated in the survey just at the time of the pandemic's first peak. The psychological reactions associated with the pandemic were attempted to be analyzed with questions specific to COVID-19. This study can be a resource for future studies.

Several studies reported increased anxiety and depression in CF patients compared with healthy controls and routine screening is strongly recommended.⁴⁻⁶ In a recent unpublished study, before the pandemic, we revealed that moderate to severe depression and moderate anxiety were present in 25.5% and 17.6% of 50 adolescent CF patients, respectively, in our center.

The current study revealed that CF patients had lower anxiety symptoms and they were more resilient in coping during pandemic than their healthy peers.

In conclusion, although acute events such as pandemics may not seem to increase baseline anxiety and were not associated with an important psychological impact in CF patients compared with the healthy population, lack of psychological support in routine care may lead to higher levels of anxiety and depression in the long term.

Disclosure

The authors declare no conflict of interests.

Author contributions

Mürüvvet Yanaz administered the questionnaires, collected the data, conducted the statistical analysis, and wrote the

manuscript. Cansu Yilmaz Yegit administered the questionnaires, collected the data, and conducted the statistical analysis. Almala Pinar Ergenekon performed the statistical analysis and wrote the manuscript. Ayse Toksoy Aksoy contributed to the conception of the study and tables in the manuscript, and collected the data. Gulcin Bilicen administered the questionnaires and collected the data. Yasemin Gökdemir was involved in study design, conceptualization and statistical analysis, wrote the manuscript, and supervised the whole study process. Ela Erdem Eralp was involved in study design, conceptualization and statistical analysis, wrote the manuscript and supervised the whole study process. Ayşe Rodopman Arman was involved in study design and conceptualization and supervised the statistical analysis and the manuscript. Fazilet Karakoc wrote the manuscript and supervised the whole study process. Bulent Karadag was involved in study design, conceptualization and statistical analysis, wrote the manuscript, and supervised the whole study process. All of the authors read and approved the final manuscript.

References

- 1 Flume PA, Mogayzel PJ Jr, Robinson KA *et al.* Cystic fibrosis pulmonary guidelines: treatment of pulmonary exacerbations. *Am. J. Respir. Crit. Care Med.* 2009; **180**: 802–8.
- 2 Pinquart M, Shen Y. Depressive symptoms in children and adolescents with chronic physical illness: an updated meta-analysis. *J. Pediatr. Psychol.* 2011; **36**: 375–84.
- 3 Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the world health surveys. *Lancet* 2007; **370**: 851–8.
- 4 Şenses-Dinç G, Özçelik U, Çak T *et al.* Psychiatric morbidity and quality of life in children and adolescents with cystic fibrosis. *Turk. J. Pediatr.* 2018; **60**: 32–40.
- 5 Besier T, Goldbeck L. Anxiety and depression in adolescents with CF and their caregivers. *J. Cyst. Fibros.* 2011; **10**: 435–42.
- 6 Catastini P, Di Marco S, Furriolo M *et al.* The prevalence of anxiety and depression in Italian patients with cystic fibrosis and their caregivers. *Pediatr. Pulmonol.* 2016; **51**: 1311–9.
- 7 Colombo C, Battezzati PM, Lucidi V *et al.* Influenza A/H1N1 in patients with cystic fibrosis in Italy: a multicentre cohort study. *Thorax* 2011; **66**: 260–1.
- 8 Bucher J, Boelle PY, Hubert D *et al.* Lessons from a French collaborative case-control study in cystic fibrosis patients during the 2009 A/H1N1 influenza pandemic. *BMC Infect. Dis.* 2016; **16**: 55.
- 9 Dong Y, Mo X, Hu Y *et al.* Epidemiology of COVID-19 among children in China. *Pediatrics* 2020; **145**: e20200702.
- 10 Wang C, Pan R, Wan X *et al.* Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 2020; **17**: 1729.
- 11 Cao W, Fang Z, Hou G *et al.* The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatr. Res.* 2020; **287**: 112934.
- 12 Brazendale K, Beets MW, Weaver RG *et al.* Understanding differences between summer vs. school obesogenic behaviors of children: the structured days hypothesis. *Int. J. Behav. Nutr. Phys. Act.* 2017; **14**: 100.

- 13 Wang G, Zhang J, Lam SP *et al.* Ten-year secular trends in sleep/wake patterns in Shanghai and Hong Kong school-aged children: a tale of two cities. *J. Clin. Sleep Med.* 2019; **15**: 1495–502.
- 14 Zhou SJ, Zhang LG, Wang LL *et al.* Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *Eur. Child Adolesc. Psychiatry* 2020; **29**: 749–58.
- 15 Sprang G, Silman M. Posttraumatic stress disorder in parents and youth after health related disasters. *Disaster Med. Public Health Prep.* 2013; **7**: 105–10.
- 16 Colombo C, Burchell PR, Gartner S *et al.* Impact of COVID-19 on people with cystic fibrosis. *Lancet Respir. Med.* 2020; **8**: e35–6.
- 17 Senkalfa BP, Eyuboglu TB, Aslan AT *et al.* Effect of the COVID-19 pandemic on anxiety among children with cystic fibrosis and their mothers. *Pediatr. Pulmonol.* 2020; **55**: 2128–34.
- 18 Cystic Fibrosis Foundation Patient Registry. 2018 Annual Data Report, 2018.
- 19 Lempp T, de Lange D, Radeloff D, Bachmann C. The clinical examination of children, adolescents and their families. In: Rey JM (Ed). *IACAPAP e-Textbook of child and adolescent mental health*. International Association for Child and Adolescent Psychiatry and Allied Professions, Geneva, 2012.
- 20 Rubin GJ, Amlôt R, Page L, Wessely S. Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. *BMJ* 2009; **339**: b2651.
- 21 Wheaton MG, Abramowitz JS, Berman NC, Fabricant LE, Olatunji BO. Psychological predictors of anxiety in response to the H1N1 (Swine Flu) pandemic. *Cogn. Ther. Res.* 2011; **36**: 210–8.
- 22 Al-Rahimi JS, Nass NM, Hassoubah SA, Wazqar DY, Alamoudi SA. Levels and predictors of fear and health anxiety during the current outbreak of COVID-19 in immunocompromised and chronic disease patients in Saudi Arabia: a cross-sectional correlational study. *PLoS One* 2021; **16**: e0250554.
- 23 European Cystic Fibrosis Society COVID-CF Project in Europe. Available from <https://www.ecfs.eu/covid-cf-project-europe> Accessed date is 30.08.2020
- 24 Pless IB, Nolan T. Revision, replication and neglect—research on maladjustment in chronic illness. *J. Child Psychol. Psychiatry* 1991; **32**: 347–65.
- 25 Wang G, Zhang Y, Zhao J, Zhang J, Jiang F. Mitigate the effects of home confinement on children during the COVID-19 outbreak. *Lancet* 2020; **395**: 945–7.
- 26 Stewart M, Reid G, Mangham C. Fostering children’s resilience. *J. Pediatr. Nurs.* 1997; **12**: 21–31.
- 27 Traub F, Boynton-Jarrett R. Modifiable resilience factors to childhood adversity for clinical pediatric practice. *Pediatrics* 2017; **139**: e20162569.
- 28 Abbott J, Dodd M, Gee L, Webb K. Ways of coping with cystic fibrosis: implications for treatment adherence. *Disabil. Rehabil.* 2001; **23**: 315–24.
- 29 Bender PK, Reinholdt-Dunne EBH, Pons F. Emotion dysregulation and anxiety in children and adolescents: gender differences. *Personality Individ. Differ.* 2012; **53**: 284–8.
- 30 Zahn-Waxler C, Shirtcliff EA, Marceau K. Disorders of childhood and adolescence: gender and psychopathology. *Annu. Rev. Clin. Psychol.* 2008; **4**: 275–303.