

Quality of life and the psychological status of the adolescents with asthma and their parents during the COVID-19 pandemic

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ABSTRACT

Background. The new coronavirus pandemic affected many people's both physical and mental health around the world, psychiatric problems and anxiety was common during the pandemic. We aim to evaluate the anxiety and quality of life (QoL) of children and their parents who were followed up with the diagnosis of asthma during the COVID-19 pandemic comparing with an age-matched control group.

Methods. This study was conducted after the first lockdown of the coronavirus pandemic, namely the new normalization period. Demographic features were noted, all adolescents completed the State-Trait Anxiety Inventories for Children (STAI-C) state and trait scales, and Pediatric QoL inventories (PedsQL). Parents also filled PedsQL parent version, STAI state and trait scales. Asthma control test (ACT) was completed only by the asthma group.

Results. Totally 121 adolescents [61 asthma group (59% female); 60 control group (73.8% female)] were included in the study. The mean age of the patients was 15.4 ± 1.69 years and their parents was 41.52 ± 6.04 years. In the asthma group 65.6% of the patients used asthma medications regularly and 73.8% of them continued asthma follow-up during the pandemic. There was no significant difference in terms of PedsQL from both the child's and parent's perspective, STAI-C and STAI scores between study groups. The QoL was associated with asthma severity, all of the PedsQL scores were significantly lower in the uncontrolled asthma group. Asthma severity was also correlated with anxiety, as the uncontrolled asthma group reached the highest STAI-C trait scores. Girls with asthma had significantly lower physical PedsQL and ACT scores than boys.

Conclusions. Although the quality of life and anxiety scores of children with asthma did not differ from the control group, good asthma control in adolescents with asthma may improve QoL. Adolescence is a sensitive age group, and requires meticulous consideration by caregivers. The parents' awareness of anxiety and other psychological symptoms may help them to cope with the challenges during the pandemic.

Key words: adolescent, anxiety, asthma, coronavirus pandemic, COVID-19, psychological, quality of life.

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The new coronavirus disease namely COVID-19 caused a wide spectrum of clinical findings ranging from asymptomatic infection or with mild clinical symptoms to pneumonia or severe respiratory distress and even death.¹ Initially COVID-19 infection was thought to be asymptomatic or with mild clinical presentation

in children², but later a new phenomenon multisystem inflammatory syndrome in children (MIS-C) was reported in relatively older children mimicking Kawasaki Syndrome.³

Asthma is one of the most common chronic lower airway diseases among children⁴ and has a potential risk of severe COVID-19 infection similar to other underlying chronic diseases.⁵ Previous studies about severe SARS-CoV-2 infection in patients with asthma had controversial results, Guan et al.⁶ reported the presence of comorbidities in a considerable number of patients with COVID-19 and there were no patients diagnosed with asthma. Contrastingly, in a recent study from United Kingdom (UK), asthma was reported as a risk factor of death from COVID-19.⁷

Adolescence is a special period in which significant physical, psychological and social developments are seen during the transition from childhood to adulthood. During adolescence, an individual acquires the physical, cognitive, emotional, social, and economic resources that are the foundation for later life, health and wellbeing.⁸

Asthma treatment compliance is essential for optimal asthma control, and better asthma control is associated with good quality of life.^{9,10} Studies have shown that poor asthma control is associated with puberty and health related quality of life (HRQoL) of adolescents are negatively affected by inadequate asthma control.^{10,11} Moreover, adolescents with asthma reported poorer HRQoL scores than their peers without asthma.¹²

Anxiety is one of most prevalent psychiatric disorder among Turkish children.^{13,14} Stressful life events, health concerns and excessive use of internet can affect the mental health of adolescents.¹⁵ Since the pandemic has begun, the lives of many people around the world have been affected socially and economically as well as their mental health. Social interactions have also been interrupted due to the pandemic, for instance social distancing, school closures

and lockdowns have also had psychosocial effects on mental health causing anxiety and depression symptoms.¹⁶

In addition, the current epidemic situation causes fear of viral contamination during hospital admissions in patients, especially those with chronic diseases. Patients and families worry about their health conditions and COVID-19, which may cause negative psychological effects and anxiety.¹⁷ In the present study, we aimed to evaluate the quality of life of adolescents with asthma and the anxiety that may occur due to COVID-19 pandemic compared with an age-matched control group during their hospital visits. A further aim was to assess the asthma control status and its effect on quality of life of adolescents with asthma during the COVID-19 pandemic.

Material and Methods

Study participants

This was a population-based, observational and cross-sectional study. This study was conducted after the first lockdown of the coronavirus pandemic, namely the new normalization period. Sixty-one adolescents aged between 12 and 18 years, who were followed by a diagnosis of asthma based on Global Initiative for Asthma (GINA) report¹⁸ at least six months in our outpatient pediatric allergy and immunology clinic and their parents were prospectively recruited to the study throughout 15 May-15 November 2020. Sixty children without a previous history of atopic or any other chronic disease and without any sign or complaints of COVID-19 infection in the same age group who were admitted to the adolescent outpatient clinic and their parents were also included as a control group for the study. Demographic features (age, gender, parental gender, age and education, family income etc.) of the participants were recorded. And, also a follow-up form was filled in the asthma group, including asthma medications, symptoms, atopy and control asthma status.

The study was approved by the institutional ethics committee of Ankara City Hospital (approval no. E1-20-689) and the study protocol was approved by the Turkish Ministry of Health. Written informed consent was obtained from the study participants.

Measurements

The State-Trait Anxiety Inventories for Children (STAI-C)

This is a self-report scale composed of two subscales each with 20 items, and it rates state and trait anxiety levels of children.^{19,20} State anxiety refers to anxiety symptoms under certain circumstances and trait anxiety to permanent individual features creating a tendency for anxiety perception. Higher scores indicate a high anxiety level.

Pediatric Quality of Life Inventory (PedsQL)

These were developed to rate health-related quality of lives of children and adolescents aged 2-18 years. It questions the domains of physical health, emotional and social functionality, which are the properties of the state of healthiness as defined by the World Health Organization. This scale is used in children with a variety of chronic medical conditions. It contains two subscale scores, namely psychosocial health (PSH) and physical health (PH), and a total health (TH) score. The scale contains both parent and child versions for physical and psychosocial functioning, and a higher PedsQL total score indicates a better QoL. In this study, the parent version PedsQL scale was administered to the caregiver. Memik et al. established the validity and reliability study in Turkish.^{21,22}

State-Trait Anxiety Inventory (STAI)

The STAI-A is a 40-item scale. The scale can be used to measure both trait anxiety (STAI-T: how dispositionally anxious a person is across time and situations) and state anxiety (STAI-S: how anxious a person is feeling at a particular moment) as it consists of two separate sub-

scales and each has 20 items.^{23,24} Higher scores indicate a high anxiety level.

Asthma Control Test

The questionnaire consists of 5 items which evaluates self-reported asthma symptoms, the impact of asthma on daily life, and the need of rescue medications in the past 4 weeks. The items response range from 1 to 5, and lower scores are compatible with poor asthma control.^{25,26}

Data analysis

Data analysis was performed by SPSS® version 22.0 for Windows (IBM SPSS, Chicago, IL, USA). The definitions were fulfilled as numbers and proportions for distinct variables; means and standard deviations or as medians with 25th or 75th percentile values in case skewed distribution. for continuous variables. Categorical variables were analyzed by using chi square test. Independent t-test was used for parametric tests and Mann-Whitney U test was used for nonparametric tests to comparison of independent groups. One-way ANOVA with post hoc Tukey HSD test or Kruskal-Wallis test were used to compare more than two independent groups according to the skewed distribution. Pearson and Spearman correlation analysis were used for correlation analysis according to the data distribution. ANCOVA test was used to remove gender effect on scores. A *p* value of less than 0.05 was considered statistically significant.

Results

Characteristics of the whole population

Totally 121 adolescents [61 asthma group (59% female); 60 control group (73.8% female)] were included into the study. The mean age of the patients was 15.4 (± 1.69) years, and the mean age of the parents were 41.52 (± 6.04) years. The comparative demographic and general characteristics of the patients are shown in Table I.

Table I. Demographic characteristics of patients with asthma and the control group.

	Study population (n=121)		P value
	Asthma group (n=61)	Control group (n=60)	
Age(year) †	15.26 ± 1.90	15.55 ± 1.45	0.35
Gender, (%)			0.022
Male	25 (41)	13 (21.7)	
Female	36 (59)	47 (78.3)	
Parent's age †	41.36 ± 6.49	41.68 ± 5.6	0.77
Parent's gender, (%)			0.2
Male	16 (26.2)	14 (23.3)	
Female	45 (73.8)	46 (76.7)	
Parental chronic disease, n (%)	16 (26.2)	18 (30)	0.64
Parental psychiatric disorder, n (%)	5 (8.2)	4 (6.7)	0.74
Mother's education, n (%)			0.32
Primary school	26 (42.6)	22 (36.7)	
Secondary school	14 (23)	10 (16.7)	
High school	16 (26.2)	16 (26.7)	
Undergraduate	5 (8.2)	10 (16.7)	
Postgraduate	0	2 (3.3)	
Father's education, n (%)			0.13
Primary school	15 (24.6)	11 (18.3)	
Secondary school	12 (19.7)	9 (15)	
High school	24 (39.3)	19 (31.7)	
Undergraduate	10 (16.4)	21 (35)	
Monthly income, n (%)			0.38
<1500 TL	6 (9.8)	4 (6.7)	
1501-3000 TL	28 (45.9)	22 (36.6)	
>3001 TL	27 (44.3)	34 (56.7)	
Owens a pet, n (%)	11 (18)	14 (23.3)	0.55

† mean ± standard deviation; TL: Turkish Lira

There was no significant difference between the asthma and control group in terms of child's and parent's proxy PedsQL PH, PSH and TH scores (Table II). And, also no significant difference was found in the comparison of children's STAI-C (state and trait), and parents' STAI (state and trait) scores (Table II). The gender effect on the scores was removed with ANCOVA test and re-analyzed, there was no difference in the clinical scores of the asthma and control group ($p > 0.05$).

Characteristics of the asthma group

The mean age of the adolescents with asthma was 15.26 ± 1.9 years (male/female=25/36) and

the median time for asthma follow-up time was 48 (IQR: 12-96) months. In the asthma group 65.6% of the patients used asthma medications regularly and 73.8% of them continued asthma follow-up during the COVID-19 pandemic. None of the patients with asthma had a history of SARS-CoV-2 infection neither in themselves nor in their families. 54.1% asthmatic adolescents had no history of emergency admission and none of the patients required intensive care admission due to asthma in the last year.

Asthma group was subdivided into 3 groups according to asthma symptom control based on GINA asthma report¹⁸, and 52.5% of them were classified as well-controlled asthma. Children's

Table II. The comparison of the clinical scores of the children and parents.

	Study population (n=121)		P value
	Asthma group (n=61)	Control group (n=60)	
PedsQL Physical Health Score			
Child self-report	71.26 ± 20.04	70.46 ± 19.79	0.83
Parent proxy-report	68.53 ± 2 0.03	68.85 ± 19.58	0.93
PedsQL Psychosocial Health Score			
Child self-report	75.77 ± 14.13	72.39 ± 15.72	0.21
Parent proxy-report	76.89 ± 16.05	72.55 ± 15.31	0.13
PedsQL Total Score			
Child self-report	74.2 ± 14.62	71.72 ± 15.35	0.36
Parent proxy-report	74 ± 15.85	71.52 ± 14.86	0.37
Children STAI-C			
State anxiety score	35.11 ± 5.89	35.07 ± 6.6	0.96
Trait anxiety score	36.89 ± 6.46	37.45 ± 6.99	0.64
Parent STAI			
State anxiety score	38.31 ± 8.13	39.25 ± 9.48	0.56
Trait anxiety score	42.16 ± 9.27	41.63 ± 10.67	0.77

All data expressed as mean ± standard deviation; PedsQL: Pediatric Quality of Life Inventory; STAI: State-Trait Anxiety Inventory

STAI-C trait scores were significantly different according to asthma symptom control groups ($p=0.006$), the uncontrolled asthma group had the highest anxiety scores (Fig. 1A). A statistically significant deterioration in terms of asthma control status was observed with increasing age in adolescents ($p<0.001$). PedsQL PH, PSH and TH scores were also significantly different according to the asthma control status, p value is <0.001 , 0.023 and 0.008 , respectively. The uncontrolled asthma group had the lowest PedsQL scores (Fig. 1B-D).

There were 36 (59%) girls and 25 boys (41%) in the asthma group. The age of the girls was significantly older than boys ($p <0.001$), and when we compare the ACT, STAI, STAI-C and PedsQL PH, PSH and TH scores by gender, the PedsQL PH and ACT scores were significantly lower in girls than boys, p value was 0.011 and 0.021 , respectively.

Correlation analysis

The PedsQL scores of the adolescents with asthma had a significant correlation with parents' proxy PedsQL scores, and there was

a significant, but weak, reverse correlation between the PedsQL scores and parent's STAI (state and trait) scores (Table III).

The PedsQL scores of the adolescents with asthma had a significant correlation with each other and ACT scores. Moreover, there was a significant, but reverse correlation between the PedsQL scores and children's STAI-C (state and trait) scores (Table IV).

Discussion

Asthma is one of the most common chronic lung disease that requires regular treatment and follow-up.¹⁸ Asthma has considerable physical and psychological effects not only on children but also on their parents.²⁷ In our study we evaluate the impact of the COVID-19 pandemic on quality of life and anxiety in adolescents with asthma and their parents compared with a control group. In the comparison of PedsQL both child's and parent's perspective, and anxiety levels we couldn't find any significant difference between study groups. In the asthma group the quality of life was associated with

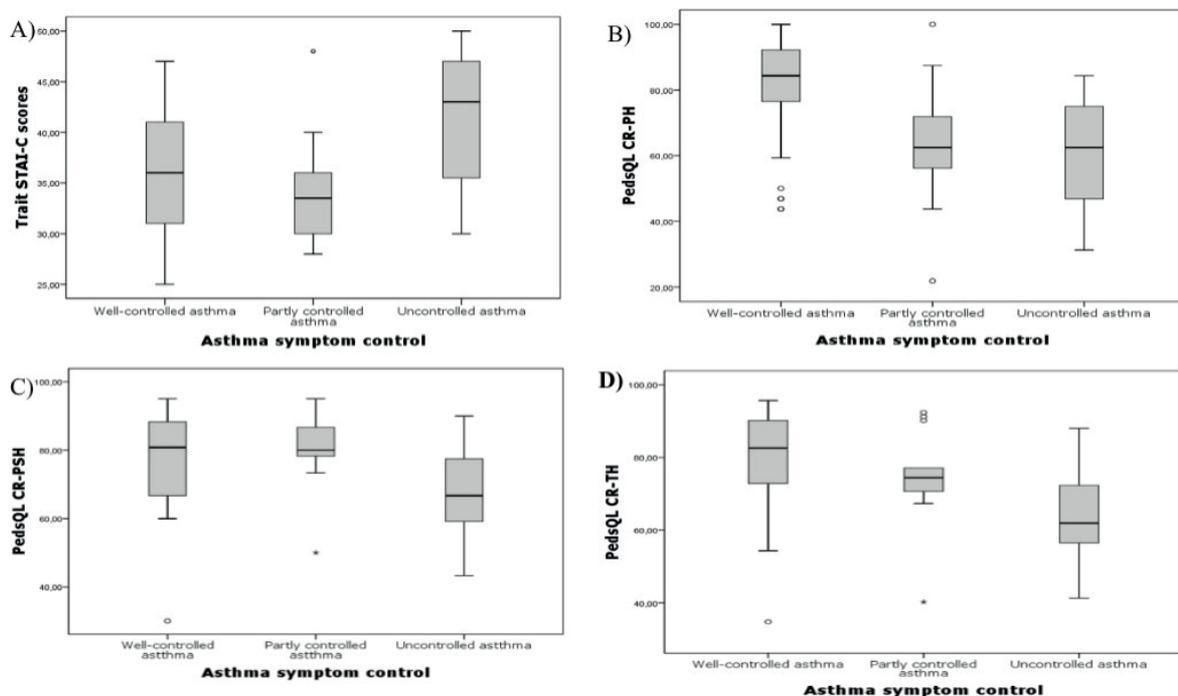


Fig. 1. Clinical scores of the adolescents with asthma according to their asthma control status: **A)** State-Trait Anxiety Inventory for Children (STAI-C) trait scores, **B)** Pediatric Quality of Life Inventory (PedsQL) child self-report physical health scores (CR-PH), **C)** PedsQL child self-report psychosocial health scores (CR-PSH); and **D)** PedsQL child self-report total health scores (CR-TH).

Table III. Bivariate correlation analysis between child self-report PedsQL scores and parent proxy-report PedsQL and parent STAI scores.

	PedsQL PR-PH	PedsQL PR-PSH	PedsQL PR-TH	STAI-State	STAI-Trait
PedsQL CR-PH	r=0.630** p<0.001	r=0.452** p<0.001	r=0.591** p<0.001	r=-0.235 p=0.068	r=-0.249 p=0.053
PedsQL CR-PSH	r=0.455** p<0.001	r=0.736** p<0.001	r=0.686** p<0.001	r=-0.390** p=0.002	r=-0.300* p=0.019
PedsQL CR-TH	r=0.587** p<0.001	r=0.679** p<0.001	r=0.714** p<0.001	r=-0.358** p=0.005	r=-0.308* p=0.016

PedsQL: Pediatric Quality of Life Inventory; CR-PH: Child self-report physical health score; CR-PSH: Child self-report psychosocial health score; CR-TH: Child self-report total health score; PR-PH: Parent proxy-report physical health score; PR-PSH: Parent proxy-report psychosocial health score; PR-TH: Parent proxy-report total health score; STAI: State-Trait Anxiety Inventory

asthma severity, all of the PedsQL scores were significantly lower in the uncontrolled asthma group. Asthma severity was also correlated with anxiety, as the uncontrolled asthma group reached the highest STAI-C trait scores. Moreover, in the asthma group when we compared the clinical scores by gender, girls with asthma had significantly lower physical PedsQL and ACT scores than boys.

The SARS-CoV-2 infection is a highly contagious virus which has led to a dramatic increase of cases in a short while throughout the world.²⁸ The spread of the COVID-19 pandemic has not only impacted the physical but also mental health by causing negative emotions. Mandatory stay-at-home, economic burden, school and business closures contributed to negative emotions and cognition.²⁹ The obscurities at the beginning

Table IV. Bivariate correlation analysis between child self-report PedsQL scores, STAI-C scores, and ACT score.

	PedsQL CR-PH	PedsQL CR-PSH	PedsQL CR-TH	STAI-C State	STAI-C Trait	ACT score
PedsQL CR-PH	-	r=0.624** p<0.001	r=0.870** p<0.001	r=-0.498** p<0.001	r=-0.555** p<0.001	r=0.499** p<0.001
PedsQL CR-PSH	r=0.624** p<0.001	-	r=0.928** p<0.001	r=-0.488** p<0.001	r=-0.714** p<0.001	r=0.299* p=0.021
PedsQL CR-TH	r=0.870** p<0.001	r=0.928** p<0.001	-	r=-0.545** p<0.001	r=-0.715** p<0.001	r=0.441** p<0.001

PedsQL: Pediatric Quality of Life Inventory; CR-PH: Child self-report physical health score; CR-PSH: Child self-report psychosocial health score; CR-TH: Child self-report total health score; ACT: Asthma control test; STAI: State-Trait Anxiety Inventory

of the pandemic caused health concerns, fear and anxiety in people especially those with underlying chronic diseases. Many patients with chronic diseases postponed hospital admissions and routine health controls due to risk of contamination. A new healthcare system telemedicine consultation came into our lives during the pandemic which prevents the risk of disease transmission to patients.³⁰

Lung involvement is common during the SARS-CoV-2 infection due to the relatively large number of angiotensin converting enzyme (ACE2) receptors in the respiratory epithelium.³¹ Therefore, chronic lung diseases have a potential predisposition to the SARS-CoV-2 infection. But the psychological impact of COVID-19 pandemic on children with chronic lung diseases had disputable results. Senkalfa et al.³² reported that COVID-19 had no effect on the anxiety of children with cystic fibrosis (CF). In contrast, in another study which evaluated psychiatric and general health effects of COVID-19 in children with chronic lung diseases in which majority of them were diagnosed with CF, both children and their parents had more anxiety due to the COVID-19 pandemic comparing with healthy peers.³³ In our study, we couldn't find any significant difference in health quality and anxiety scores between adolescents with asthma and the control group. This may be attributed to none of the adolescents with asthma having a history of COVID-19 infection in our cohort.

The COVID-19 pandemic is challenging for the asthmatic patients, as asthma is the most widespread chronic lung disease.¹⁸ The clinical course of SARS-CoV-2 infections still remains unclear in asthmatic patients. There are some studies including pediatric COVID-19 patients that have reported no association with asthma and COVID-19.^{2,34,35} Long-lasting school closures, reduced air pollution and wearing masks may prevent the transmission of viral infections which may trigger asthma exacerbations.³⁶ Furthermore, a recent study including adults and children with asthma, depicted the lower expression of ACE2 receptors in those with allergic sensitization. These findings may suggest the reduced risk of severe COVID-19 infection in patients with respiratory allergies.³⁷ These preventive effects may be related to similar QoL and anxiety asthmatic adolescents with the control group.

Conversely, Choi et al.³⁸ reported 2.9% prevalence of asthma among 7590 COVID-19 patients, and they also indicated high mortality rate among the patients with asthma. Williamson et. al.⁷ also emphasized the link between asthma and higher risk of hospital death from COVID-19. This difference may be related to the diversity in the control status of asthmatic patients. In our study, the control status of asthma was negatively associated with QoL of asthmatic adolescents. Careful management of asthma may be especially important during the pandemic and uncontrolled patients may need

special care both for physical and psychosocial wellbeing. Further studies are required to determine the relationship between COVID-19 and asthma.

Separation from classmates due to school closures, prolonged exposure to internet, online distance learning, health and future concerns led anxiety during the pandemic.¹⁵ In previous studies, well-controlled childhood asthma was associated with no increased risk of anxiety and depression comparing with healthy controls.³⁹ In our study, most of the patients in the asthma group were classified as well-controlled and partly controlled asthma, this may have had an effect on the absence of difference in anxiety scores between the asthma and control group.

The QoL of adolescents with asthma is a substantial health outcome which is affected by various factors. COVID-19 pandemic has had an impact on mental health and may cause psychological distress.¹⁶ To our knowledge there is no study evaluating QoL of adolescents with asthma during the COVID-19 pandemic. Several studies have been conducted on assessing the quality of life in children with asthma before the COVID-19 pandemic.^{11,40} Similar to our findings Stridsman et al.¹¹ reported the female gender and poor asthma control to be associated with low QoL scores.

Although, sometimes there may be differences in perception of QoL between parents and adolescents, in our study group, QoL results of adolescents and parents were correlated with each other.

STAI-C trait and STAI-C state scores of our patients showed an inverse correlation with PedsQL scores. This shows us that asthmatic adolescents with lower QoL may experience higher anxiety and thus physicians must be aware of this possibility to evaluate the presence and help management of anxiety among this patient group.

Asthma control test results of our patients were positively correlated with PedsQL scores,

showing that asthma control was correlated with QoL. The effect of disease control has been previously reported in the literature, for increasing the QoL of asthmatic adolescents and the first step is to take measures for providing asthma control.⁴¹

Asthma control and QoL are important disease outcomes for asthmatic patients. Illness perceptions (cognitive and emotional representations of the illness) and medication beliefs are essential determinants of medication adherence, and subsequently disease control and QoL in adolescents. Kosse et al.⁴¹ have found a strong positive correlation between disease control and QoL in 243 adolescents with asthma. They also mentioned that all illness perceptions items were correlated with disease control and QoL, and medication adherence was correlated to medication beliefs, disease control, and QoL.

In our study population, the PedsQL PH and ACT scores were significantly lower in girls than boys. This gender difference in QoL is in accordance with the literature. Asthmatic girls are reported to have a worse perception of the disease in spite of similar or even better pulmonary function tests and similar medications. This effect of gender is not fully understood, however there have been some probable explanations. Female sex hormones are hypothesized to affect asthma outcomes. Furthermore, females are shown to have lower threshold for healthcare contact and they seem to need more encouragement and education for correct use of inhalers. Caregivers are reported to help their male children better than girls and this may also have an impact.^{11,42,43}

Moreover, studies have shown the high rate of mental problems in adolescents during the pandemic, and female gender was related with high risk for anxiety and depression symptoms.⁴⁴ Whatever the underlying reason, adolescent girls have more severely affected quality of life and this indicates to the need for more attention for this patient group during the management of asthma.

In our study, asthma control was declining with increasing age. This may be the effect of adolescent behavior getting more obvious with increasing age and getting more freedom from parent control for older adolescents.

The most important limitation of our study is that although we excluded atopic, chronic diseases and the patients with COVID-19 infection related symptoms in the control group, there may be other contributing factors which may affect the clinical scores that we could not predict. However, there was no significant difference in terms of parents' chronic or psychiatric diseases between groups which may have an impact on clinical scores. Another limitation of our study is that we could not take all independent variables that can affect the quality of life of our patients, however we believe we evaluated the most important factors that were directly related to the subject.

The most important strength of our study is that we evaluated the anxiety and QoL of adolescents with asthma and age-matched controls during their hospital visits with face-to-face questionnaire which helps to determine real scores.

In conclusion, the impact of COVID-19 pandemic on adolescents, in terms of QoL and anxiety did not differ between the asthma and control groups. The QoL scores and trait anxiety scores were related with asthma control status in adolescents with asthma. Girls had poor asthma control with lower ACT and physical QoL scores than boys.

Adolescence is a sensitive age group, and requires meticulous consideration by caregivers. Adolescents need the feeling of support and unconditional love from their parents. Optimizing asthma treatment adherence, being aware of the difficulties that adolescents experience during the pandemic and improving coping styles may help to promote both physical and mental health of adolescents during the COVID-19 pandemic.

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Ethical approval

The study was approved by the institutional ethics committee of Ankara City Hospital (approval no. E1-20-689) and the study protocol was approved by the Turkish Ministry of Health.

Author contribution

The authors confirm contribution to the paper as follows: study conception and design: BK, EDM, OSU; data collection: BK, AS, ZSE, AOA, GSD; analysis and interpretation of results: BK, EC, EC, MT, EDM; draft manuscript preparation: BK, MT, EDM. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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