

# Improvement in school-aged children with asthma during the Covid-19 pandemic

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## Funding information

None

## Abstract

**Introduction:** The coronavirus 2019 disease (Covid-19) pandemic led to a number of measures being introduced in many countries worldwide. Lockdowns were imposed on individuals aged <18 years, education was delivered online, and mask-wearing was made compulsory in public places, resulting in an unprecedented period for children. Real-life data showing how children with asthma are affected by major changes are limited. This study investigated how asthmatic children are affected by pandemic conditions based on real-life data.

**Methods:** Patients with asthma aged 6–18 years followed up from March to May 2019—before the Covid-19 pandemic—were included in the study. Data from March to May 2020 and 2019 were then compared to reveal the effects of pandemic-related lifestyle changes on symptoms, frequency of exacerbations, and drug use in asthmatic children.

**Results:** Eighty-six children with asthma aged 6–18 years were included in this study. Time spent inside the home was significantly higher in 2020 than in 2019. Rescue medication requirements and emergency department visits were significantly lower in 2020 compared to 2019 ( $p < 0.001$ ). The number of well-controlled patients with asthma was higher in 2020 than in 2019 ( $p < 0.0001$ ). The number of patients using prophylactic drugs within the previous 3 months was lower in 2020 compared to 2019 ( $p = 0.007$ ).

**Conclusion:** The present study yielded valuable insights, based on real-life data, into the condition of children over the age of 6 years during the Covid-19 pandemic. Numbers of asthmatic exacerbations, rescue drug use, and asthma control were positively affected in school-aged children with asthma during the pandemic.

## KEYWORDS

asthma, exacerbation, medication, pandemic

## 1 | INTRODUCTION

Asthma is a chronic disease commonly seen during childhood, leading to prolonged drug use and frequent hospitalization due to attacks. Children with asthma should be monitored regularly for symptoms and long-term complications. Numerous factors, but especially

respiratory infections, house dust, and pollen exposure in susceptible individuals, can lead to asthma attacks.

The first cases of coronavirus 2019 disease (Covid-19) were reported in the Wuhan province of China in December 2019. The World Health Organization (WHO) declared this outbreak to be a pandemic on March 11, 2020. The pandemic continues to spread in

Turkey and worldwide.<sup>1</sup> The first case of Covid-19 in Turkey was reported on March 11, 2020. Since severe acute respiratory syndrome coronavirus-2 (SARS-CoV2) is a respiratory virus, it was initially unclear how it would affect patients with asthma. As the Covid-19 pandemic spread, scientists and health professionals around the world began collecting information about the course of the disease. Patients with asthma were reported to exhibit no higher incidence of SARS-CoV2 or disease burden than the normal community.<sup>2,3</sup>

As in many other countries, a number of measures were implemented in Turkey as a result of the Covid-19 pandemic. Face-to-face education in Turkey was suspended on March 16, 2020. A lockdown was implemented for all individuals aged <18, education was carried out online, and mask-wearing became compulsory in public places, all of which created an unprecedented situation for children. Other previously unknown factors associated with this period included a change in the frequency and diversity of infection, a possible increase in domestic allergen exposure as a result of prolonged indoor time, and domestic smoking exposure.

Along with the Covid-19 pandemic, children with asthma faced various risk factors related to air quality, the indoor environment, physical activity, weight control, medication management, and health care delivery. There is currently a paucity of information on the mid- to long-term effects of these factors.<sup>4</sup>

Real-life data showing how children with asthma are affected by major changes in living conditions during the Covid-19 pandemic are limited.<sup>5-7</sup> This study was performed to reveal the effect of the Covid-19 pandemic and of the social isolation rules imposed on children on asthma symptoms, frequency of exacerbations, and prophylactic drug use, to compare clinical follow-up and drug use data with the previous year, and to identify the factors causing a difference.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design

This clinical trial was designed as a cross-sectional descriptive study. The research was conducted at the Pediatric Allergy and Immunology Diseases Clinic at the Dr. Sami Ulus Maternity and Children's Research and Training Hospital between June and September 2020. Face-to-face education in schools was suspended in Turkey from March 16, 2020. Patients with asthma aged 6–18 years who were followed up in our clinic from March to May 2019—before the Covid-19 pandemic—were included in the study. Data from March to May 2020 and March to May 2019 were compared to reveal the effects of the pandemic-related lifestyle changes on symptoms, frequency of exacerbations, and drug use in asthmatic children.

### 2.2 | Study population

Children diagnosed with asthma at the Pediatric Allergy and Immunology Diseases Clinic in the Dr. Sami Ulus Maternity and Children's Research

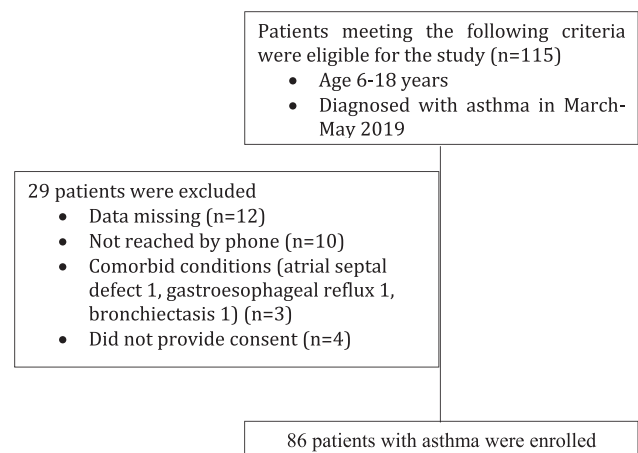
and Training Hospital from March to May 2019 were included in this study. One hundred and twenty children with asthma were initially, determined to be eligible for the study although 29 were subsequently excluded for various reasons. A consort diagram of the study population is shown in Figure 1.

### 2.3 | Data collection

The demographic characteristics, asthma symptom control test results, and allergen sensitivity of patients followed-up due to asthma from March to May 2019 were retrieved from the electronic patient files. Data for the same patients from March to May 2020 data concerning the frequency of respiratory infections, prophylactic drug use, asthma check-ups, frequency of attacks, hospital visits and hospitalizations, living conditions, and social experiences during the pandemic were obtained from their parents/caregivers via a telephone questionnaire.

These patients were then contacted using the phone numbers registered in the electronic patient files. An appointment was scheduled for a suitable time if the parent or legal caregiver of the child agreed to participate in the study. The patients were called by phone by auxiliary researchers at the scheduled appointment times. Telephone interviews were conducted in June and July 2020. Every effort was made to obtain the most accurate information concerning patients' pre- and postpandemic clinical conditions, medication use, numbers of visits to the PED, and hospitalizations. The physicians making the telephone calls (N. B. and S. Ç.) simultaneously checked the patients' electronic files during the interviews and attempted to reduce information that could not be recalled to a minimum.

Children with asthma in our clinic are evaluated using asthma symptom control test charts. Information for the pre-Covid-19 period was retrieved from these. The asthma symptom control test for the Covid-19 period involved a survey during a telephone interview with the parents. The asthma symptom control test was evaluated in accordance with the Global Strategy for Asthma Management and Prevention Report.<sup>8</sup>



**FIGURE 1** Consort diagram of the study population

Information concerning school attendance, time spent outside the home, smoking exposure, presence of pets, and mold in the house was obtained from phone-based recall. Nocturnal cough and exercise-induced cough were determined based on the parents' subjective opinions for 3 months. If the parents themselves regarded this as a problem, it was considered to be present.

Information concerning clinical findings of asthma, medication requirements, visits to the emergency department, respiratory infection, hospitalization, antibiotic use, prophylactic asthma treatment, and living conditions during the pandemic was obtained by means of a questionnaire, and the data onto the created standard study form.

## 2.4 | Statistical analysis

Statistical Package for Social Sciences (SPSS) version 20 software was used to analyze the research data. The Kolmogorov–Smirnov test was used to determine whether the data conformed to normal distribution. The Wilcoxon test, McNemar test, or marginal homogeneity test was used as appropriate in the analysis of dependent variables.

## 3 | RESULTS

Eighty-six children with asthma, 55 (64%) boys and 31 (36%) girls, aged 6–18 years were included in this study. Two (2.6%) patients had a history of contact with a SARS-CoV-2-positive individual, and one had a SARS CoV-2-positive family member living in the household. None of the patients were polymerase chain reaction (PCR) tested for SARS CoV2. The patients' demographic characteristics and laboratory findings are shown in Table 1.

The patients' environmental conditions, school attendance, and time spent outside the home were compared between 2019 and 2020. Time spent outside the home was significantly lower in 2020

than in 2019 ( $p < 0.0001$ ). No significant difference was found between 2019 and 2020 in terms of the presence of pets, mold in the house, or exposure to smoking ( $p > 0.05$ ) (Table 2).

The clinical findings and asthma symptom control test results of asthmatic children were also compared between 2020 and 2019, the findings being shown in Table 3. The number of cases of coughing at night was significantly lower in 2020 compared to 2019 ( $p < 0.0001$ ). The number of cases of exercise-induced cough was also significantly lower in 2020 compared to 2019 ( $p < 0.003$ ). The numbers of days per week and month in which rescue medication was used were also significantly lower in 2020 compared to 2019 ( $p = 0.003$ , and  $p < 0.0001$ , respectively). The number of emergency department visits was similarly significantly lower in 2020 compared to 2019 ( $p = 0.001$ ).

Asthma symptom control was also evaluated. The number of well-controlled patients with asthma was higher in 2020 than in 2019 ( $p < 0.0001$ ). Further information was obtained from asthmatic children and their parents. Compared to 2019, 66 individuals reported a decrease in asthma-related complaints in 2020, while 17 reported that their symptoms remained the same. Only three cases reported an increase in asthma-related complaints in 2020. The medications used by children with asthma in 2019 and 2020 were also compared. The number of patients using prophylactic drugs was lower in 2020 compared to 2019 ( $p = 0.002$ ) (Table 3).

The numbers of patients with allergic rhinitis complaints, respiratory infections, and antibiotic use were compared between March–May 2019 and 2020. The incidences of upper respiratory tract infection (URTI) and lower respiratory tract infection (LRTI) and antibiotic use were significantly lower in 2020 compared to 2019 ( $p < 0.0001$ ) (Table 4).

## 4 | DISCUSSION

The present research is a comprehensive study examining asthma exacerbations, follow-ups, and medication among asthmatic children during the Covid-19 pandemic. The results indicated a significant decrease in the number of days spent at school and outside the home in 2020 compared to 2019.

Asthma exacerbations and respiratory infections during the pandemic (February–June 2020) were compared with the prepandemic period in one recent study. Total asthma exacerbation rates were found to be similar. However, the number of severe asthma attacks decreased and mild asthma attacks increased during the pandemic compared to the prepandemic period. The median number of monthly respiratory infections was lower during the pandemic. To summarize, the strict measures adopted during the Covid-19 pandemic have been shown to result in a decrease in severe asthma exacerbations and respiratory infections.<sup>9</sup> Various recent studies from different countries have reported improvement in the control of children with asthma.<sup>5,6,10</sup> A recently published meta-analysis reported a significant improvement in the level of asthma control compared to the same period before the COVID-19 pandemic. Those

**TABLE 1** Demographic and laboratory findings of the children with asthma ( $n = 86$ )

Age, years, median (min–max)	11 (6–18)
Gender, $n(\%)$	
Male	55 (64)
Female	31 (36)
Contact with a SARS CoV-2 positive, $n$ (%)	2 (2.3)
SARS CoV-2 positive in family, $n$ (%)	1 (1.2)
SARS CoV-2 PCR test sample, $n$ (%)	-
Who participated in the study, $n$ (%)	
Mother	62 (72.1)
Father	24 (27.9)

Abbreviations: max, maximum; min, minimum; PCR, polymerase chain reaction; SARS-CoV2, acute respiratory syndrome coronavirus-2.

**TABLE 2** Comparison of the environmental conditions and school attendance of the patients by years ( $n = 86$ )

	March–April–May 2019	March–April–May 2020	<i>p</i> value
School attendance, <i>n</i> (%)	79 (91.9)	2 (2.3)	<0.0001
No. of days out of the house, days/week, median (min–max)	7 (2–7)	1 (0–7)	<0.0001
No. of days out of the house, days/month, median (min–max)	30 (3–30)	4 (0–0)	<0.0001
Presence of pets, <i>n</i> (%)	12 (14)	10 (11.6)	0.625
Mold in the house, <i>n</i> (%)	9 (10.5)	8 (9.3)	1.0
Smoking exposure, <i>n</i> (%)	40 (46.5)	42 (48.8)	0.5

Abbreviations: max, maximum; min, minimum.

**TABLE 3** Clinical findings and asthma symptom control test of asthmatic children by the years ( $n = 86$ )

	March–April–May 2019	March–April–May 2020	<i>p</i> value
Night cough, <i>n</i> (%)	38 (44.2)	6 (7.0)	<0.0001
Exercise induced cough (%)	38 (44.2)	15 (17.4)	<0.0001
Use of rescue medication, days/week, median (min–max)	0 (0–7)	0 (0–7)	0.003
Use of rescue medication, days/month, median (min–max)	1 (0–30)	0 (0–30)	<0.0001
The number of visits ED, median (min–max)	0 (0–5)	0 (0–1)	<0.0001
No. of patient hospitalization, median (min–max)	0 (0–2)	0	0.18
Received prophylactic medication, <i>n</i> (%)	63 (73.3)	44 (51.2)	0.002
Daily ICS dosage ( $\mu$ g), median (min–max)	250 (100–500)	250 (100–640)	0.824
Asthma control test, <i>n</i> (%)			<0.0001
Well controlled	48 (55.8)	77 (89.5)	
Partly controlled	30 (34.9)	4 (4.7)	
Uncontrolled	8 (9.3)	5 (5.8)	
Parent/caregiver opinion for complaints, <i>n</i> (%)			
Decreased		66 (76.7)	
Same		17 (19.8)	
Increased		3 (3.5)	

Abbreviations: ED, emergency department; ICS, inhaled corticosteroids; max, maximum; min, minimum.

authors also emphasized that the exact factors leading to these improvements needed to be identified.<sup>7</sup>

In addition to other previous studies, respiratory infections were also compared before and during the pandemic in this study. Our study indicates that the decrease in numbers of URIs and LRTIs played a role in the improvement in asthmatic children over a 3-month period in the pandemic. We, therefore, think that this study will contribute to the literature in terms of “determining the factors affecting the

improvement in children with asthma” referred to in the above meta-analysis. Parents' own opinions were obtained for a better understanding of the difference in asthmatic children before and during the pandemic. Sixty-six percent of parents reported an improvement in their children's asthma symptoms. Nocturnal cough and exercise-induced cough were also investigated in terms of parents' subjective opinions. We think that this resulted in a more accurate determination of the state of asthmatic children. The present study was completed in

	March–April–May 2019	March–April–May 2020	p value
No. of URTI, median (min–max)	0 (0–5)	0 (0–4)	<0.0001
No. of LRTI, median (min–max)	0 (0–5)	0 (0–4)	<0.0001
No. of use antibiotic, median (min–max)	0 (0–5)	0 (0–2)	<0.0001
No. of patients vaccinated against flu, n (%)	27 (31.4)	20 (23.3)	0.189
No. of had AR complaints, n (%)	51 (59.3)	39 (45.3)	0.002

Abbreviations: AR, allergic rhinitis; LRTI, lower respiratory tract infection; max, maximum; min, minimum; URTI, upper respiratory tract infection.

September 2020. Pandemic restrictions were also reduced in Turkey in 2021, resulting in an increase in social mobility. Our observations indicated an increase in medication requirements, numbers of emergency visits, and the frequency of respiratory tract infections in our asthmatic patients in 2021.

Night cough and exercise-induced cough were significantly less frequent during the pandemic. Similarly, weekly and monthly rescue medication requirements were lower. The numbers of visits to the emergency department were also lower, and no asthmatic patients were hospitalized during the pandemic. To summarize, asthmatic children's complaints, rescue medication requirements, and numbers of visits to the emergency department were all significantly lower in 2020. Other studies have also reported a decrease in visits to pediatric emergency departments during the pandemic.<sup>11,12</sup> Similarly, a significant decrease was reported in emergency department presentations in asthmatic children after the Covid-19 pandemic.<sup>4</sup>

Degrees of asthma control were also evaluated in the present study. The asthma control test data showed that 93.4% of patients were well-controlled in 2020, a significantly higher figure compared to 2019. In terms of the personal opinions of parents or caregivers, a decrease in complaints was observed in 76.7% of asthmatic children, while only 3.5% of parents or caregivers reported an increase. These results indicate that asthma control was better during the pandemic compared to the prepandemic period.

This study also compared prophylactic asthma medications received by children. The number of patients receiving prophylactic treatment during the pandemic was lower than in the prepandemic period, although no difference was determined in the type of prophylactic drugs used. Inhaled corticosteroid (ICS) dosages were also similar among asthmatic children who used ICS. This finding indicated no increase in ICS requirements among asthmatic children using medications.

No increase was also determined in the number of asthmatic children vaccinated against influenza during the pandemic. However, the numbers of URTIs and LRTIs, and antibiotics used by asthmatic children were significantly lower during the pandemic. This clearly revealed that online education instead of face-to-face teaching in crowded classrooms led to a decrease in seasonal respiratory infections during the pandemic. Allergic rhinitis complaints in asthmatic children were also compared, and a significant decrease was observed in 2020. We believe that this is attributable to the

lockdown being more severe, with the amount of time spent at home being significantly longer in the previous 3 months during the pandemic.

There are a number of limitations to this study. The most significant involves the possibility of recall bias as most outcomes were yielded by a questionnaire involving events that occurred more than 1 year previously. Nonetheless, every effort was made to obtain the most accurate information concerning patients' pre- and postpandemic clinical conditions, medication use, numbers of visits to the PED, and hospitalizations. However, it was only possible to conduct a study of this nature during the pandemic by telephone or using digital methods. Another important limitation is the lack of follow-up regarding the clinical conditions, medication needs, and respiratory tract infections of children with asthma in 2021 when the pandemic measures in Turkey were being stepped down. Further studies investigating the status of children with asthma after the pandemic are now needed.

In conclusion, this study investigated how asthmatic children are affected by pandemic conditions based on real-life data. During the pandemic, time spent at home increased and children avoided crowded social environments such as schools. Factors such as restricted social life, use of online education instead of face-to-face teaching, and a decreased incidence of viral diseases positively affected the numbers of exacerbations, drug use, and degree of asthma control in asthmatic children during this period. We think that the present study is important as it provides valuable insights into the condition of children over 6 years during the Covid-19 pandemic based on real-life data.

#### AUTHOR CONTRIBUTIONS

All the authors were involved in the study design, collection of cases, and writing of the manuscript.

#### ACKNOWLEDGMENTS

We would like to thank Dr. Seda Sirin Köse for her contributions. The authors have no financial relationship with the organization that sponsored the research.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

**TABLE 4** Comparison of allergic rhinitis complaints, respiratory infections, and antibiotic use by the years ( $n = 86$ )

## DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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**How to cite this article:** Akelma Z, Başkaya N, Çetin S, Bostancı İ, Özmen S. Improvement in school-aged children with asthma during the Covid-19 pandemic. *Pediatric Pulmonology*. 2022;57:2518-2523. doi:10.1002/ppul.26068