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The impact of COVID-19 pandemic on patients followed up on the pediatric infectious diseases ward

COVID-19 pandemisinin pediatrik enfeksiyon hastalıkları servisinde izlenen hastalar üzerindeki etkisi

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ABSTRACT

Aim: This study aims to evaluate the impact of the COVID-19 pandemic on hospitalization rates, patient characteristics, and treatment practices in a pediatric infectious diseases outpatient clinic by comparing the pre-pandemic, pandemic, and post-pandemic periods.

Materials and Methods: The hospitalization rates of patients who presented to the Pediatric Infectious Diseases outpatient clinic at Aydın Adnan Menderes University Hospital between July 1, 2018, and October 1, 2023, as well as the data of those who were hospitalized, were retrospectively compared and analyzed across the pre-pandemic (Pr-P), pandemic (PP), and post-pandemic (Po-P) periods.

Results: The numbers of patients admitted to the PID outpatient clinic in Pr-P, PP, and Po-P were 10,906, 6,396 and 15835, respectively. The proportion of hospitalized patients was higher in PP, at 7.8%, compared to the other periods (p<0.001). The median patient age was higher in Pr-P compared to the other periods (Pr-P: 56 (22-109) months, PP: 31 (11-71) months, and Po-P: 40 (15-75) months, p<0.001). The presence of any underlying disease was more common in PP patients (p=0.003), and neurological conditions were the most frequently encountered diseases in across all periods. The most common diagnoses for hospitalization during PP were prolonged fever, bacteremia, or sepsis. Antibiotic use was most frequent in Po-P (p<0.001). The rate of use of wider-spectrum antibiotics, such as piperacillin-tazobactam (p=0.006) and meropenem (p=0.018) increased during and after PP. Transfer to the pediatric intensive care unit (PICU) requirements were more frequent during PP.

Conclusion: A higher hospitalization rate in the PID outpatient clinic, younger children being hospitalized and monitored, an increased use of broad-spectrum antibiotics, and greater transfer from the PID ward to the intensive care unit requirements were observed during the pandemic.

Keywords: Pandemic, hospitalization, COVID-19, antibiotics

Note: This study was presented as an oral presentation at the 3rd Aydın Pediatric Autumn School Congress held in Didim, Aydın, on October 27–29, 2023.

ÖZ

Amaç: *Bu çalışma, COVID-19 pandemisinin pediatrik enfeksiyon hastalıkları polikliniğinden hastaneye*

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yatış oranları, hasta özellikleri ve tedavi uygulamaları üzerindeki etkisini; pandemi öncesi, pandemi ve pandemi sonrası dönemlerini karşılaştırarak değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntem: *Aydın Adnan Menderes Üniversitesi Hastanesi Çocuk enfeksiyon hastalıkları polikliniğine 1 Temmuz 2018- 1 Ekim 2023 tarihleri arasında ayaktan başvuran hastaların yatış oranları ve hastaneye yatırılan hastaların verileri pandemi önesi dönem (Pr-P), pandemi dönemi (PP) ve pandemi sonrası dönem (Po-P) olarak retrospektif karşılaştırılmış ve analiz edilmiştir.*

Bulgular: *Pediatrik enfeksiyon hastalıkları polikliniğine başvuran toplam hasta sayıları Pr-P, PP ve Po-P dönemlerinde sırasıyla 10.906, 6.396 ve 15.835 olarak kaydedilmiştir. Hastaneye yatırılan hasta oranı, %7,8 ile pandemi döneminde diğer dönemlere göre anlamlı olarak daha yüksekti (p<0,001). Ortanca hasta yaşı Pr-P döneminde diğer dönemlere göre daha yüksekti (Pr-P: 56 (22–109) ay, PP: 31 (11–71) ay, Po-P: 40 (15–75) ay; p<0,001). Altta yatan hastalık varlığı PP dönemindeki hastalarda daha yaygındı (p=0,003) ve tüm dönemlerde en sık karşılaşılan altta yatan hastalıklar nörolojik rahatsızlıklar oldu. PP döneminde en sık hastaneye yatış nedenleri uzun süreli ateş, bakteriyemi ve sepsis olarak belirlendi. Antibiyotik kullanımı Po-P döneminde en yüksekti (p<0,001). Piperasilin-tazobaktam (p=0,006) ve meropenem (p=0,018) gibi geniş spektrumlu antibiyotiklerin kullanım oranı PP ve Po-P dönemlerinde artış gösterdi. Pediatrik yoğun bakım ünitesine transfer gereksinimi PP döneminde daha sıktı.*

Sonuç: *COVID-19 pandemisi sürecinde, Pediatrik enfeksiyon hastalıkları polikliniğine başvuran hastalarda hastaneye yatış oranlarının arttığı, daha küçük yaştaki çocukların yatırılarak izlendiği, geniş spektrumlu antibiyotik kullanımında artış olduğu ve pediatrik enfeksiyon hastalıkları servisinden yoğun bakıma transfer oranlarının yükseldiği gözlemlenmiştir.*

Anahtar Sözcükler: *Pandemi, hastaneye yatış, COVİD-19, antibiyotik*

Not: *Bu çalışma 27-29 Ekim 2023 tarihlerinde Aydın, Didim'de düzenlenen 3. Aydın Pediatri Sonbahar Okulu Kongresi'nde sözlü bildiri olarak sunulmuştur.*

INTRODUCTION

A novel *coronavirus* was identified at the end of 2019 as the cause of pneumonia cases in Wuhan, China. The World Health Organization (WHO) designated the disease as COVID-19 in February 2020 (1). The virus spread rapidly, with more than 772 million global cases and seven million deaths reported to date, including 17 million cases and 101,419 deaths in Türkiye (1). To mitigate transmission, governments implemented public health measures such as social distancing, school closures, and travel restrictions, beginning in March 2020 in Türkiye. These interventions were gradually lifted by March 1, 2022, when face mask mandates ended and the pandemic was declared under control (2).

Initially, children were considered less affected by COVID-19, with many being asymptomatic and most symptomatic cases presenting with mild features such as fever, cough, and upper respiratory symptoms (3-7). However, as the pandemic progressed, pediatric complications, including MIS-C, pneumonia, myocarditis, thromboembolic events, and long COVID manifestations such as diabetes and cardiac dysrhythmias were reported (8). Additionally, compared to the pandemic period, the observed rise in RSV, influenza, and secondary bacterial infections during the post-pandemic period (9,10) may be explained by the reduced circulation of respiratory viruses during the pandemic, which was likely a consequence of widespread isolation measures and limited exposure.

These shifts have influenced pediatric infectious diseases (PID) practice. Changes in pathogen prevalence, disease severity, and healthcare-seeking behaviors impacted hospitalization rates, timing, and patient management strategies (11-13). The aim of this study was to evaluate how the COVID-19 pandemic altered hospitalization patterns and clinical practices in PID units

MATERIALS AND METHODS

Patients aged between one month and 18 years who were hospitalized in the Pediatric Infectious Diseases Department of Aydın Adnan Menderes University Hospital, Türkiye, between July 1, 2018, and September 1, 2023, were retrospectively included in the study. Outpatient admissions during this period were recorded, and hospitalization rates were evaluated. The clinical and demographic characteristics of hospitalized patients were compared. Patients were assigned to three different groups representing the pre-pandemic, pandemic, and post-pandemic periods. The ‘pandemic period (PP)’ was defined as the period between the starting of the pandemic in Türkiye on March 15, 2020, when restrictions were imposed, and the end point on March 1, 2022, when the face mask requirement in indoor and outdoor areas was lifted. Similar lengths of time were selected before March 15, 2020, as the ‘pre-pandemic period’ (Pr-P) and after March 1, 2022, as the ‘post-pandemic period’ (Po-P).

Data including the patients’ age, gender, date of admission, admission diagnosis, presence of fever, presence of underlying disease, antibiotics used during hospitalization, duration of hospitalization, and transfer to the intensive care unit requirements were recorded retrospectively. Patients with multiple underlying conditions were evaluated based on a single major disease. Antibiotic regimens used for specific diseases such as tuberculosis, brucellosis, and congenital CMV infection were not included in the evaluation, as they fall outside the scope of standard empirical antibiotic therapy. The three groups were then compared in terms of these parameters. Ethical approval was obtained from the Aydın Adnan Menderes University Rectorate Non-Interventional Clinical Research Ethics Committee (Protocol Number: 2024/69 29/4/2024).

Statistical Package for Social Science (SPSS) version 27 software was used for statistical analyses (IBM Corp., released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY, USA). Descriptive statistics were presented as number and percentage for categorical data, as mean plus standard deviation for continuous variables exhibiting normal distribution, and as median, minimum, and maximum values for non-normally distributed data. Normality of distribution of continuous variables was evaluated by means of descriptive statistics, steepness and skewness coefficients, histograms, and the Kolmogorov-Smirnov test. The chi-square test was used for the analysis of categorical data, the t test in the comparison of two independent groups in case of normal distribution, and the Mann Whitney U test if distribution was not normal. One-way analysis of variance (ANOVA) was applied for the analysis of variance if the data were normally distributed (Tukey’s test for post hoc evaluation if the variances were homogeneous, and the Tamhane test if the variances were not homogeneous), and the Kruskal Wallis H test in case of non-normal distribution (Dunn’s test at post hoc evaluation). The type I error level was set at 5%.

RESULTS

The numbers of patients admitted to the PID outpatient clinic in Pr-P, PP, and Po-P were 10,906, 6,396 and 15,835, respectively. The numbers of hospitalized patients in these periods were 433, 496, and 836, respectively. The proportion of hospitalized patients was higher in PP, at 7.8%, than in the other two periods ($p<0.001$). Hospitalization rates among patients who were presented on an outpatient basis were as follows: 4.0% in the Pre-P period (433/10,906), 7.8% in the PP period (496/6,396), and 5.3% in the Po-P period (836/15,835). The hospitalization rate was significantly higher during the PP period compared to the other periods ($p<0.001$), and significantly lower during the Pre-P period ($p<0.001$). The median age (months) of the patients was higher in Pr-P compared to the other periods (Pr-P: 56 (22-109), PP: 31 (11-71), and Po-P: 40 (15-75), $p<0.001$). A higher proportion of cases were male in PP (Pr-P: 52.2%, PP: 58.5%, and Po-P: 50.5%, $p=0.017$). The presence of any underlying disease was more common in pandemic-era patients ($p=0.003$) (Table-2). Neurological diseases were the most frequently encountered diseases in all three periods.

The most frequent diagnosis for hospitalization during PP was prolonged fever, bacteremia, or sepsis (Table-3). Bacterial pneumonia was least common during PP, while non-COVID viral pneumonia was more common during PP compared to the other periods (Table-3). The use of antibiotherapy was least frequent during PP and most frequent in Po-P (Pr-P: 78.8%, PP: 70.2%, Po-P: 84.8%, $p<0.001$) (Table-3). Ampicillin-sulbactam and clarithromycin were used more frequently in Pr-P, while the rate of ceftriaxone use rose in Po-P. The rate of use of wider spectrum antibiotics, such as piperacillin-tazobactam and meropenem, increased both during and after the pandemic. Transfer to the pediatric intensive care unit (PICU) requirements were more frequent during PP (Pr-P: 3.7%, PP: 26.0%, Po-P: 3.9%, $p<0.001$). The median length of hospital stay was shorter in Po-P (Pr-P: 6(5-9), PP: 6(4-9) and Po-P: 4(3-6) days, $p<0.001$). Only one patient died due to sepsis during PP.

Table-1. Demographic data of the hospitalized patients, n (%)

	Pr-P (n=433)	**PP (n=496)**	**Po-P (n=836)**	**p**
Age (months)				
1 – 12 months	57(13.2)	143(28.8)	169(20.2)	
13 – 60 months	177(40.9)	209(42.1)	377(45.1)	**<0.001**[1]
61– 120 months	106(24.5)	74(14.9)	188(22.5)	
121 – 216 months	93(21.5)	70(14.1)	102(12.2)	
Gender (boy)	226(52.2)	290(58.5)	422(50.5)	**0.017**[2]

[1] Pr-P is higher than the other periods (p<0.001)
[2] PP is higher than Po-P (p=0.020)

Table-2. Underlying diseases of hospitalized patients, n (%)

	Pr-P (n=433)	**PP (n=496)**	**Po-P (n=836)**	**p**
Underlying disease	117(27.0)	174(35.1)	224(26.8)	**0.003**[1]
Neurologic	48(41)	98(56.3)	77(34.4)	
Nephrological	9(7.7)	22(12.6)	26(11.6)	
Cardiological	17(14.5)	12(6.9)	22(9.8)	
Allergic	25(21.4)	11(6.3)	10(4.5)	
Hematological	8(6.8)	17(9.8)	14(6.3)	
Metabolic	5(4.3)	10(5.7)	12(5.4)	
Genetic	0(0)	0(0)	24(10.7)	
Immunological	4(3.4)	4(2.3)	9(4)	
Endocrinologic	0(0)	0(0)	9(4)	
Psychiatric	1(0.9)	0(0)	4(1.8)	
Neurometabolic	0(0)	0(0)	4(1.8)	
Congenital	0(0)	0(0)	4(1.8)	
Rheumatological	0(0)	0(0)	4(1.8)	
Gastroenterological	0(0)	0(0)	3(1.3)	
Pulmonary diseases	0(0)	0(0)	2(0.9)	

[1] PP is higher than the other periods (p=0.003)
Patients with multiple underlying conditions were evaluated based on a single major disease.

Table-3. Diagnosis and antibiotic treatments of hospitalized patients, n (%)

	Pr-P (n=433)	**PP (n=496)**	**Po-P(n=836)**	**p**
Diagnosis				
Prolonged fever[a]	93(21.5)	165(33.3)	180(21.5)	**<0.001**[1]
Bacterial pneumonia	99(22.9)	41(8.3)	195(23.3)	
non-COVID viral pneumonia	53(12.2)	85(17.1)	63(7.5)	
Soft tissue infection	45(10.4)	33(6.7)	82(9.8)	
Gastroenteritis	36(8.3)	41(8.3)	65(7.8)	
CNS infections	22(5.1)	29(5.8)	44(5.3)	
Lymphadenitis	34(7.9)	25(5)	34(4.1)	
Urinary tract infections	10(2.3)	28(5.6)	46(5.5)	
Septic arthritis	14(3.2)	10(2)	13(1.6)	
COVID-19 infection	0(0)	20(4)	17(2)	
Kawasaki disease	7(1.6)	0(0)	24(2.9)	
Complicated URTI	4(0.9)	1(0.2)	22(2.6)	
Tuberculosis	10(2.3)	4(0.8)	9(1.1)	
MIS-C	0(0)	12(2.4)	5(0.6)	
Viral diseases with rash	0(0)	0(0)	13(1.6)	
Brucellosis	2(0.5)	0(0)	1(0.1)	
Others[b]	4(0.9)	2(0.4)	23(2.8)	
Use of antibiotics*	341(78.8)	348(70.2)	709(84.8)	**<0.001**[2]
Ampicillin-sulbactam		66(13.3)	79(9.4)	**<0.001**[3]
Ceftriaxone Clarithromycin			514(61.5)	**<0.001**[4]

Piperacillin-Tazobactam	84(19.4)	210(42.3)	42(5.0)	**<0.001**[5]
Meropenem	213(49.2)	20(4.0)	31(3.7)	**0.006**[6]
	48(11.1)	12(2.4)	27(3.2)	**0.018**[7]
	3(0.7)	15(3.0)		
	3(0.7)			

[a] Prolonged fever, bacteremia, or sepsis; [b] Others, (tick bites, hydatid cysts, immunodeficiency, congenital CMV infections, conjunctivitis, viral hepatitis, herpetic candidiasis, herpetic paronychia, myositis, mucositis, scabies infection, cholelithiasis, pericarditis, and preoperative patient; CNS: central nervous system; URTI: upper respiratory tract infection; MIS-C: multisystemic inflammatory syndrome in children; *Use of antibiotics, number of patients treated with (antibiotic).

[1] Prolonged fever is higher at PP than the other periods (p<0.001); bacterial pneumonia is lower at PP than the other periods (p<0.001); non-COVID viral pneumonia is lower at Po-P than the other periods (p<0.001); lymphadenitis is higher at Pr-P than Po-P (p<0.001); urinary tract infections is lower at Pr-P than the other periods (p<0.001); Covid-19 infection is similar between PP and Po-P; MIS-C is higher at PP than Po-PP (p<0.001); Kawasaki is lower at PP than the other periods (p<0.001); complicated URTI is higher at Po-P than PP (p<0.001); viral diseases with rahs is higher at Po-P than the other periods (p<0.001)

[2] Po-P is higher than Pr-P and PP is lower than Pr-P (p<0.001)

[3] Pr-P is higher than the other periods (p<0.001)

[4] Po-P is higher than the other periods (p<0.001)

[5] Pr-P is higher than the other periods (p<0.001)

[6] Po-P is higher than Pr-P (p=0.015)

[7] Pr-P is lower than the other periods (p=0.020)

DISCUSSION

This study evaluated and compared the hospitalization characteristics of patients in the PID department, one of the busiest units during the pandemic. One of the most striking findings was that admission to the PID outpatient clinic was least frequent during PP. Several measures, including curfews, restricted outpatient services other than those provided by emergency clinics, school closures, and the use of masks and personal protective equipment may account for this lower level compared to the periods before and after the pandemic. A systematic review by Chien-Wei Cheng et al. (14) reported that emergency department visits also decreased in Italy during the COVID-19 pandemic. Admissions to emergency departments due to infectious diseases decreased 56% of 25 studies, while admissions due to trauma decreased by 52%. A study by Brisca et al. (15) from a tertiary pediatric hospital in Italy reported a statistically significant decrease in the total number of pediatric consultations in the emergency department and bronchiolitis cases in 2020 compared to 2019.

In the present study, while the numbers of hospitalizations were similar in Pre-P and Po-P, hospitalization rates were significantly higher in PP. Nascimento et al. (16). evaluated the impact of SARS-CoV-2 pandemic measures on childhood respiratory diseases and determined that such measures significantly affected the seasonality of these diseases, leading to a statistically significant reduction in numbers of hospitalizations and lengths of hospital stay. The rate of bronchiolitis among patients hospitalized when restrictions were in place also decreased significantly in that study. We speculated that the higher hospitalization rates during PP in the present study may be related to patients presenting to the hospital with more severe findings due to a fear of leaving home on the part of their parents and late admission to hospital during this period, the emergence of important new clinical diagnoses, such as MIS-C, associated with the SARS-CoV-2, and potential concerns or anxieties on the part of physicians in terms of changing their approach to the usual infectious diseases.

Median hospitalization durations in this study were similar between Pre-P and PP but were shorter in Po-P (Pr-P: 6 (5–9), PP: 6 (4–9), and Po-P: 4 (3–6) days, p<0.001). We attributed this to the cessation of COVID-19 measures in Po-P and to the resulting growing burden and turn-over of other infectious diseases. Additionally, the shorter length of hospital stay during the post-pandemic period may also be related to the increased hospitalization rate, which could have placed pressure on inpatient capacity, necessitating earlier discharges.

The majority of patients in PP were hospitalized with diagnoses of prolonged fever, bacteremia, or sepsis. Hospital admission times were extended due to the restrictions imposed during the pandemic, and some diagnoses were delayed. It has been suggested that the increased hospitalizations due to prolonged fever/bacteremia during PP were secondary to these delays and inappropriately treated infections (17). Another noteworthy phenomenon during PP was that non-COVID viral pneumonia cases were higher while those of bacterial pneumonia were lower compared to the other periods. Many early COVID-19 pandemic studies showed a reduction in the incidence of community-acquired pneumonia, which causes a significant clinical burden with both viral and bacterial etiologies, as a result of the restrictions imposed. *Influenza virus, respiratory syncytial virus, seasonal human coronavirus, human parainfluenza virus, human parainfluenza virus, human metapneumovirus, rhinovirus*, and respiratory enterovirus infections all decreased significantly at the onset of the pandemic. In the subsequent period, the frequency of *rhinovirus* and respiratory enterovirus infections returned to pre-pandemic levels, while the decrease in the frequency of infections due to other non-COVID respiratory viruses persisted (18). Shumeli et al. (19) examined the impact of the COVID-19 epidemic on pediatric infectious diseases. Those authors determined that the pandemic significantly altered the seasonal characteristics of a number of pediatric infectious diseases, such as *influenza* and RSV, and caused a decrease in their incidences. They also showed that other respiratory viruses, such as *rhinovirus/enterovirus* and *adenovirus*, were less affected by the epidemic. The effects of the epidemic were not limited only to viral infections, but also a decrease in the incidence of other bacterial pneumonias. A study comparing annual hospitalization rates due to bronchiolitis in children under one year of age in Brazil from March 2016 to March 2020 observed that these decreased significantly in March 2020 with the implementation of pandemic-era restrictions, compared to other periods (20). In contrast to previous studies, the results of the present research revealed a lower prevalence of non-covid viral pneumonia during the Po-P compared to the PP. We attributed this to our hospital being a tertiary referral center, located relatively far from the city center, where more complicated bacterial pneumonia cases are frequently managed due to referrals from surrounding healthcare facilities.

While the frequency of bacterial pneumonia in patients hospitalized on the pediatric infection ward was similar in the pre- and post-pandemic periods, a significant decrease was observed in PP. A study from England investigated the impact of the pandemic on the frequency of invasive pneumococcal disease. The incidence of invasive pneumococcal infections incidence in children under 15 was higher in July-December 2021, after the lifting of COVID-19 restrictions (1.96/100,000 children) than in the equivalent period in 2020 (0.7/100,000 children) and the pre-pandemic period in 2017–2019 (1.43/100,000 children) (9). Vasquez et al. (10) evaluated invasive *group A streptococcal* infections in Spain and reported a significant increase in the severity and number of cases in 2022, especially in the later months of that year, compared to Pr-P. These findings were similar to those elsewhere in literature.

The mean age of the patients hospitalized during PP in this study was lower than in the other periods. Guo et al. (21) compared the age and gender differences of patients with urgent and life-threatening conditions before and during the pandemic in the resuscitation area of an emergency department. From January 2019 to January 2021, those authors observed no significant difference in age or gender between the two groups. Our own results suggested that restrictions imposed during the pandemic had less impact on hospital admissions in the 1-12 months group, since fever in such children can be a more serious symptom and a sign of a life-threatening condition. The prevalence of serious bacterial infections such as meningitis, urinary tract infections, and pneumonia is known to be higher in this age group.

The results of this study also revealed that the presence of any underlying disease was more frequent in patients hospitalized during PP. In addition, hospitalization was most frequent among patients with neurological diseases. It has already been confirmed that neurological diseases facilitate infectious diseases. Children with neurological impairment are more susceptible to community-acquired and aspiration pneumonia. Pneumonia is the leading cause of death, especially in cerebral palsy (22). Ren et al. (23) compared RSV-infected patients and showed that a smaller proportion of those in the 2020–2021 season had any underlying conditions than those in 2018–2019. Prematurity and congenital heart disease were the most frequently encountered conditions in that study. A similarity in terms of underlying diseases was also observed in influenza-infected patients. Kapoor et al. (24) evaluated the comorbidities of hospitalized pediatric COVID-19 patients. Those authors reported tuberculosis as the most common comorbidity, followed by other infections and hematological conditions. However, no association was observed between the presence of any comorbidity and the severity of COVID-19 infection, length of hospital stays, or adverse outcomes.

The use of antibiotics rate in this study was lowest during PP and highest in Po-P. The diversity of antibiotic use also changed over time. While antibiotics with a narrower spectrum were most frequently used in Pr-P, the use of antibiotics with a wider spectrum began to increase with the pandemic. This increase in the use of broad-spectrum antibiotics was interpreted as resulting from difficulty in differentiating COVID-19 pneumonia from bacterial pneumonia and the increased frequency of prolonged fever/bacteremia during the pandemic. Katz et al. (25) observed that face-to-face communication decreased due to restrictions imposed in the early stage of the COVID-19 pandemic, thus resulting in a decrease in infectious disease diagnoses and general antibiotic prescriptions, and an increase in non-infectious disease visits. In fact, a decrease in antibiotic prescription was detected in patients with suspected infection. However, no comparable decrease was observed in that study in antibiotic prescription rates for diseases such as urinary tract infections and skin/soft tissue infections, which are not related to the respiratory tract and in which the restrictions imposed were less effective. Alde et al (26). investigated the effects of COVID-19 on antibiotic use in respiratory and ear infections in children in primary care. A significant decrease, which persisted until the end of partial restrictions, was determined in the rate of antibiotic prescription for these indications. Shumeli et al.'s (19) review study observed that the unnecessary use of several drugs, including antibiotics, increased during the pandemic, even though there was no evidence of their effectiveness against SARS-CoV-2. The authors suggested that this increase might be related to the fear of multidrug-resistant bacterial and fungal infections potentially accompanying SARS-CoV-2 in adults. That research also revealed that antibiotic prescription rates during COVID-related visits were significantly lower for children and adolescents than for adults (19). However, other authors observed no effect of the pandemic on antibiotic prescription practices (27).

Patients required more frequent admission to the PICU during PP. This may be related to the more common clinical manifestation of bacteremia/sepsis or more severe pneumonia. A previous study from Türkiye determined a decrease in the number of PICU admissions in 2020 compared to 2019 (28). Research has also reported a lower number of PICU admissions, decreased lower respiratory tract infections, and a higher rate of cardiopulmonary resuscitation before PICU admission during the restriction period compared to the post-restriction period. Another study from Italy reported a decrease in emergency admissions in March 2020 compared with the equivalent period in 2018 and 2019 (29). Those authors also reported an association between PICU admission and mortality and delayed hospital admission.

Relevant data are scarce, and the findings of this study are therefore important and valuable in terms of revealing the effects of the COVID-19 pandemic on PID practice. However, some limitations should also be kept in mind when interpreting the results. First, the research was conducted as a single-center and retrospective study and cannot therefore be generalized to the whole country. The study data were analyzed in three periods: Pr-P, PP, and Po-P. However, due to the timing of the restrictions imposed, the durations of the three periods were unequal, which also applies to the types of seasons within each period. This may particularly be regarded as a limitation in terms of evaluating the frequency of respiratory tract infections. Additionally, because of the viral factor, the research was not conducted with patients hospitalized for non-COVID viral pneumonia, and we were therefore unable to accurately evaluate the increase in the frequency of pneumonia due to viral factors.

CONCLUSION

In conclusion, the COVID-19 pandemic led to numerous changes in patient management practices among PID specialists. The epidemiology of many infectious diseases is also well known to have changed. This study shows that PID outpatient admissions decreased, while the proportion of hospitalized patients was higher, in PP compared to the other two periods. The patients were also the youngest and had the highest rates of any underlying disease during PP. Children were principally hospitalized due to prolonged fever, bacteremia, or sepsis during PP. Although the use of antibiotic treatment was the least frequent during the pandemic, the spectrum of the antibiotics used increased during and after it. Patient transfers to the PICU were more frequent during PP. The duration of hospital stay was shorter in Po-P. Pandemics may alter the epidemiology and clinical course of infectious diseases in children. Further studies are now needed to determine the management of patients from that perspective.

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Authorship Contributions:

Data Collection: N.B.B., M.A., E.S., S.Ö., D.İ.

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References

1. World Health Organization. Coronavirus (COVID-19) data. [Internet]. Available from: www.covid19.who.int [Accessed 9 May 2024].
2. T.C. Sağlık Bakanlığı [homepage on the Internet]. Artık açık havada maske kullanmak zorunda değiliz. Available from: https://www.saglik.gov.tr/TR,87522/artik-acik-havada-maske-kullanmak-zorunda-degiliz.html [Accessed 5 Jul 2025]
3. Viner RM, Ward JL, Hudson LD, Ashe M, Patel SV, Hargreaves D, et al. Systematic review of reviews of symptoms and signs of COVID-19 in children and adolescents. Arch Dis Child. 2020 Dec 17: archdischild-2020-320972.
4. Cao Q, Chen YC, Chen CL, Chiu CH. SARS-CoV-2 infection in children: Transmission dynamics and clinical characteristics. J Formos Med Assoc. 2020;119(3):670-3.
5. Zhu F, Ang JY. COVID-19 Infection in Children: Diagnosis and Management. Current Infectious Disease Reports. 2022;24(4):51-62.
6. Chow EJ, Englund JA. Severe Acute Respiratory Syndrome Coronavirus 2 Infections in Children. Infectious Disease Clinics of North America 2022;36(2):435-79.
7. Siebach MK, Piedimonte G, Ley SH. COVID-19 in childhood: Transmission, clinical presentation, complications and risk factors. Pediatric Pulmonology. 2021;56(6):1342-56.
8. Kompaniyets L, Bull-Otterson L, Boehmer TK, Baca S, Alvarez P, Hong K, et al. Post-COVID-19 Symptoms and Conditions Among Children and Adolescents - United States, March 1, 2020-January 31, 2022. MMWR Morb Mortal Wkly Rep. 2022;71(31):993-9.
9. Bertran M, Amin-Chowdhury Z, Sheppard CL, Eletu S, Zamarreño DV, Ramsay ME, Litt D, Fry NK, Ladhani SN. Increased Incidence of Invasive Pneumococcal Disease among Children after COVID-19 Pandemic, England. Emerg Infect Dis. 2022 Aug;28(8):1669-1672. doi: 10.3201/eid2808.220304. PMID: 35876698; PMCID: PMC9328924.
10. Cobo-Vázquez E, Aguilera-Alonso D, Carrasco-Colom J, Calvo C, Saavedra-Lozano J; PedGAS-net Working Group. Increasing incidence and severity of invasive Group A streptococcal disease in Spanish children in 2019-2022. Lancet Reg Health Eur. 2023;27: 100597.
11. Rubens JH, Akindele NP, Tschudy MM, Sick-Samuels AC. Acute covid-19 and multisystem inflammatory syndrome in children. *BMJ*. 2021;n385.
12. Cowling BJ, Ali ST, Ng TWY, Tsang TK, Li JCM, Fong MW, et al. Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study. Lancet Public Health. 2020;5(5):e279-e88.
13. Kuitunen I, Artama M, Mäkelä L, Backman K, Heiskanen-Kosma T, Renko M. Effect of Social Distancing Due to the COVID-19 Pandemic on the Incidence of Viral Respiratory Tract Infections in Children in Finland During Early 2020. The Pediatric infectious disease journal, 39(12), e423-e427.

14. Cheng CW, Huang YB, Chao HY, Ng CJ, Chen SY. Impact of the COVID-19 pandemic on pediatric emergency medicine: A systematic review. Medicina (Kaunas). 2022;58(8):1112
15. Brisca G, Vagelli G, Tagliarini G, Rotulo A, Pirlo D, Romanengo M, et al. The impact of COVID-19 lockdown on children with medical complexity in pediatric emergency department. Am J Emerg Med. 2021;42:225–7.
16. Nascimento MS, Baggio DM, Fascina LP, Prado C. Impact of social isolation due to COVID-19 on the seasonality of pediatric respiratory diseases. PLoS One. 2020;15(12): e0243694
17. Lazzerini M, Barbi E, Apicella A, Marchetti F, Cardinale F, Trobia G. Delayed access or provision of care in Italy resulting from fear of COVID-19. Lancet Child Adolesc Health. 2020; 4(5):e10-e11
18. Chow EJ, Uyeki TM, Chu HY. The effects of the COVID-19 pandemic on community respiratory virus activity. Nat Rev Microbiol. 2023 Mar;21(3):195-210.
19. Shmueli M, Lendner I, Ben Shimol S. Effect of the COVID-19 pandemic on the pediatric infectious disease landscape: Review. European Journal of Pediatrics. 2024,183.3:1001-1009.
20. Friedrich F, Ongaratto R, Scotta MC, Veras TN, Stein R, Lumertz MS, et al. Early Impact of social distancing in response to COVID-19 on hospitalizations for acute bronchiolitis in infants in Brazil. Clin Infect Dis. 2021;72(12):2071-75
21. Guo F, Qin Y, Fu H, Xu F. The impact of COVID-19 on Emergency Department length of stay for urgent and life-threatening patients. BMC Health Serv Res. 2022;22(1):696.
22. Thorburn K, Jardine M, Taylor N, Reilly N, Sarginson RE, van Saene HK. Antibiotic-resistant bacteria and infection in children with cerebral palsy requiring mechanical ventilation. Pediatr Crit Care Med. 2009;10(2):222-6.
23. Young NL, McCormick AM, Gilbert T, Ayling-Campos A, Burke T, Fehlings D, et al. Reasons for hospital admissions among youth and young adults with cerebral palsy. Arch Phys Med Rehabil. 2011;92(1):46-50.
24. Ren L, Lin L, Zhang H, Wang Q, Cheng Y, Liu Q, et al. Epidemiological and clinical characteristics of respiratory syncytial virus and influenza infections in hospitalized children before and during the COVID-19 pandemic in Central China. Influenza Other Respir Viruses. 2023;17(2):e13103.
25. Kapoor D, Kumar V, Pemde H, Singh P. Impact of Comorbidities on Outcome in Children With COVID-19 at a Tertiary Care Pediatric Hospital. Indian Pediatr. 2021;58(6):572-5.
26. Katz SE, Spencer H, Zhang M, Banerjee R. Impact of the COVID-19 pandemic on infectious diagnoses and antibiotic use in pediatric ambulatory practices. J Pediatric Infect Dis Soc. 2021;10(1):62-4.
27. Aldè M, DI Berardino C, Marchisio P, Braga L, Franchi M, DI Berardino F. Impact of COVID-19 containment measures on antibiotic prescribing for respiratory and ear diseases in pediatric primary care. Minerva Pediatr (Torino). 2022 Sep 30.
28. Vestesson E, Booth J, Hatcher J, McGarrity O, Sebire NJ, Steventon A, et al. The impact of the COVID-19 pandemic on antimicrobial prescribing at a specialist paediatric hospital: An observational study. J Antimicrob Chemother. 2022;77(4):1185-8.
29. Yazıcı Özkaya P, Arı HF, Baş İ, Turanlı EE, Karapınar B. Impact of the COVID-19 pandemic on pediatric intensive care unit admissions: A single centre experience. J Pediatr Res. 2022;9(2):164-8.