Original Investigation / *Özgün Araştırma*

DOI: 10.5578/ced.20229805 • *J Pediatr Inf 2022;16(2):e95-e105*

Evaluation of Demographic, Clinical, Radiological Features and Treatment Results of Pediatric Patients with Diagnosis of Pneumonia Followed in Hospital

Pnömoni Tanısı ile Hastanede İzlenen Çocuk Hastaların Demografik, Klinik, Radyolojik Özelliklerinin ve Tedavi Sonuçlarının Değerlendirilmesi

Merve Kılıç Çil[1](İD), Özlem Özgür Gündeşlioğlu[1](İD), Ümmühan Çay[1](İD), Gülsüm Sönmez[1](İD), Zahide Orhan Ok[2](İD), Durdane Gaye Kocatepe[3](İD), Süreyya Soyupak[4](İD), Ceren Efe[5](İD), İlker Ünal[5](İD), Derya Alabaz[1](İD), Emine Kocabaş[1](İD)

[1] *Division of Pediatric Infection, Çukurova University Faculty of Medicine, Adana, Türkiye*
[2] *Department of Pediatrics, Çukurova University Faculty of Medicine, Adana, Türkiye*
[3] *Department of Pediatrics, Gaziosmanpaşa University Faculty of Medicine, Tokat, Türkiye*
[4] *Department of Radiology, Çukurova University Faculty of Medicine, Adana, Türkiye*
[5] *Department of Biostatistics, Çukurova University Faculty of Medicine, Adana, Türkiye*

Cite this article as: Kılıç Çil M, Özgür Gündeşlioğlu Ö, Çay Ü, Sönmez G, Orhan Ok Z, Kocatepe DG, et al. Evaluation of demographic, clinical, radiological features and treatment results of pediatric patients with diagnosis of pneumonia followed in hospital. J Pediatr Inf 2022;16(2):e95-e105.

Abstract

Objective: In this study, it was aimed to evaluate the demographic, clinical, laboratory, radiological characteristics and treatment results of pediatric patients hospitalized with the diagnosis of community acquired pneumonia.

Material and Methods: In this study, data of pediatric patients aged between one month and 17 years who were hospitalized with the diagnosis of community acquired pneumonia in the Pediatric Wards of Cukurova University Medical Faculty Hospital between January 1, 2012 and December 31, 2018 were retrospectively analyzed from the patients registry.

Results: In our study, a total of 229 children, 145 male and 84 female, were examined. The ages of the patients ranged from one month to 15 years (median= 24 months). Underlying disease (UD) was present in 58.3% of the patients. The cases with underlying disease, the number of pneumonia in the last one year and the number of pneumonia three or more in the last one year and the history of using antibiotics in the last six months and before admission to the hospital were statistically significantly higher according to the group without underlying disease (p= 0.001, p= 0.001, p= 0.013, respectively, and p= 0.001). In children with higher maternal education; the history of pneumonia in the last one year, hospitalization rates in the last three months and the rate of having two

Öz

Giriş: Bu araştırmada, toplumda gelişen pnömoni tanısı ile hastaneye yatırılarak tedavi edilen çocuk hastaların, demografik, klinik, laboratuvar, radyolojik özelliklerinin ve tedavi sonuçlarının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Bu araştırmada, 1 Ocak 2012-31 Aralık 2018 tarihleri arasında Çukurova Üniversitesi Tıp Fakültesi Hastanesi Çocuk Servislerinde toplumda gelişen pnömoni tanısı ile yatırılan, 1 ay-17 yaş arasındaki çocuk hastalara ait veriler, hasta dosyalarından geriye dönük olarak incelendi.

Bulgular: Araştırmamızda 145'i erkek, 84'ü kız, toplam 229 çocuk hasta incelenmiştir. Hastaların yaşları 1 ay ile 15 yaş (medyan= 24 ay) arasında değişmekteydi. Hastaların %58.3'ünde altta yatan hastalık (AYH) bulunmaktaydı. Altta yatan hastalığı olan olguların, altta yatan hastalığı olmayan gruba göre; son bir yılda pnömoni geçirme ve yine son bir yılda üç ve üzerinde geçirilen pnömoni sayısı ile son altı ayda ve hastaneye başvuru öncesi antibiyotik kullanma öyküleri, istatistiksel olarak anlamlı derecede yüksekti (sırasıyla p= 0.001, p= 0.001, p= 0.013, ve p= 0.001). Anne eğitiminin daha yüksek olduğu çocuklarda; son bir yılda geçirilmiş pnömoni öyküsü, son üç ayda hastaneye yatış oranları ve son bir yılda iki ve daha az sayıda pnömoni geçirme oranı istatistiksel açıdan anlamlı oranda daha düşüktü (sırasıyla p= 0.007, p= 0.005, ve p= 0.014).

Correspondence Address/Yazışma Adresi

Merve Kılıç Çil

Çukurova Üniversitesi Tıp Fakültesi,
Çocuk Sağlığı ve Hastalıkları Anabilim Dalı,
Çocuk Enfeksiyon Bilim Dalı
Adana-Türkiye

E-mail: klcmrwe@gmail.com

Received: 05.06.2021 **Accepted:** 03.10.2021 **Available Online Date:** 30.06.2022

or less pneumonia in the last year were statistically significantly lower (p= 0.007, p= 0.005, and p= 0.014, respectively). In patients whose height and weight percentiles for age are below the 5% percentile value; the history of pneumonia in the last one year and the rate of having three or more pneumonia in the last year were statistically significantly higher (p< 0.001, p= 0.002, respectively). While 96.5% of the patients were discharged with recovery, 8 (3.5%) of a total of 229 patients died. The number of patients followed up in the pediatric intensive care unit was 29 (12.9%). Five (23.2%) of the patients who were followed up in the intensive care unit lost their lives, the mortality rate in the group with UD and being followed up in the intensive care unit was significantly higher than the group not followed in the intensive care (p= 0.003).

Conclusion: In this study, 58.3% of the patients who were hospitalized in the pediatric wards of the university hospital and followed up with a diagnosis of pneumonia were found to have underlying diseases, and 12.9% of these patients were followed in the pediatric intensive care unit due to severe pneumonia and 23.2% of died. Children with underlying disease, lower maternal education and malnutrition are at higher risk of pneumonia. As a result; these findings once again reveal the importance of preventing malnutrition, early diagnosis and treatment in children with underlying diseases, especially in increasing maternal education, in preventing pneumonia and deaths from pneumonia in childhood.

Keywords: Community acquired pneumonia, underlying disease, child

Yaşa göre boy ve ağırlık persantillerinin, persantil değerinin altındaki hastalarda; son bir yılda geçirilmiş pnömoni öyküsü, ve yine son bir yılda üç ve üzerinde pnömoni geçirme oranı istatistiksel açıdan anlamlı oranda daha yüksekti (sırasıyla p< 0.001, p= 0.002). Hastaların %96.5'i şifa ile taburcu olurken, toplam 229 hastanın 8 (%3.5)'i yaşamını kaybetmişti. Çocuk yoğun bakım ünitesinde izlenen hasta sayısı 29 (%12.9) idi. Yoğun bakımda izlenen hastaların 5 (%23.2)'i yaşamını kaybetmişti, AYH olan ve yoğun bakımda izlenen grupta ölüm oranı, yoğun bakımda izlenmeyen gruba göre anlamlı olarak yüksekti (p= 0.003).

Sonuç: Bu araştırmada üçüncü basamak üniversite hastanesi çocuk servislerinde yatırılarak pnömoni tanısıyla izlenen hastaların, %58.3'ünde AYH saptanmış olup, bu hastaların %12.9'u ağır pnömoni nedeniyle çocuk yoğun bakım ünitesinde izlenmiştir ve %23.2'si yaşamını kaybetmiştir. Altta yatan hastalığı olan, anne eğitiminin daha düşük olduğu ve malnütrisyonu olan çocuklarda pnömoni gelişim riski daha yüksekti. Bu bulgular çocukluk çağında pnömoni ve pnömoniden ölümlerin önlenmesinde başta anne eğitiminin yükseltilmesi olmak üzere, özellikle AYH'ı olan çocuklarda malnütrisyonun önlenmesi, erken tanı ve tedavinin önemini bir kez daha gözler önüne sermektedir.

Anahtar Kelimeler: Toplum kaynaklı pnömoni, altta yatan hastalık, çocuk

Introduction

Childhood pneumonia is the most important cause of morbidity and mortality, especially in developing countries, and is the leading cause of death in children under the age of five all over the world. Pneumonia, defined as inflammation of the lung parenchyma, is often caused by bacteria and viruses (1).

The World Health Organization (WHO) reports that 156 million children under the age of five are diagnosed with pneumonia each year, and there are an estimated 20 million cases of severe pneumonia requiring hospitalization. (2). In industrialized countries, the annual incidence of pneumonia is reported to be 33 per 10.000 in children younger than five years of age and 14.5 per 10.000 in children 0-16 years of age. (3) Worldwide, the incidence of lower respiratory tract infections was reported as 31.1 per 100.000 population under 19 years of age in 2015 (4).

Community-acquired pneumonia (CAP) is pneumonia that occurs during daily life in a previously healthy person who does not have a history of hospitalization within 14 days before the onset of his symptoms (5). Approximately half of the children below the age of five with community-acquired pneumonia require hospitalization (4).

In the United States (USA), about two million outpatients are present to outpatient clinics annually due to CAP, and CAP is among the most common causes of hospitalization, with approximately 124.000 hospitalizations per year. The annual incidence of hospitalization in children in the USA has been reported as 15.7-22.5 per 100.000 children. Hospitalizations due to community-acquired pneumonia are most common in children below the age of two, and this rate decreases with increasing age in the pediatric age group (6,7).

The World Health Organization reported that 808.694 children died due to pneumonia in 2017, and pneumonia constituted 15% of all deaths in children under the age of five (8). The mortality rate of pneumonia is lower in industrialized countries (<1 per 1000 per year) (6,9). In developing countries, however, lower respiratory tract infections are not only more common but also more severe and fatal. (10). According to the burden of disease study in Turkey, respiratory tract infections are the second most common cause of death with 13.4% in the 0-4 age group and 6.5% in the 5-14 age group and are responsible for 14% of all deaths in the 0-14 age group (11).

In this study, we aimed to evaluate the demographic, clinical, laboratory, and radiological characteristics and treatment results of pediatric patients hospitalized with the diagnosis of community-acquired pneumonia.

Materials and Methods

In this study, demographic, clinical, laboratory, and radiological characteristics and treatment outcomes of a total of 229 patients (aged one month to 17 years), who were hospitalized with the diagnosis of community-acquired pneumonia in Cukurova University Medical Faculty Hospital were obtained from the patient files following a retrospective search; and the data obtained were recorded in the patient files and digitalized.

Patients with a weight below the 5th percentile by age were classified as malnutrition. Parents with high school and university degrees were considered to be highly educated, and those who graduated from secondary school and primary school were considered to have a low education level.

The diagnosis of pneumonia was made on the basis of "Turkish Thoracic Society, Community-Acquired Pneumonia Diagnosis and Treatment Guidelines in Children Pediatric Population". (12). Complete blood count, C-reactive protein (CRP) and procalcitonin (PCT) values of all patients were studied in the Cukurova University Medical Faculty Hospital Central Laboratory. Complete blood count evaluation was performed with electronic cell counters and Beckman Coulter LH 780. The reference range of the device is 4-10.5 x 1000/μL for white blood cells. C-reactive protein was studied by a nephelometric method using Beckman Coulter device (UniCel DxI 600 Access Immunoassay System). Reference range of the device: 0.0-0.4 mg/dL. Procalcitonin was evaluated using Beckman Coulter device. The reference range of the device was 0.0-0.05 ng/mL. Blood cultures of the patients were studied with automated BACTEC (Becton Dickinson Diagnostic Instruments, Sparks, MD). Antibiograms were performed on those with growth.

Statistical analysis of data was carried out with the IBM SPSS Statistics Version 20.0 package software in the Department of Biostatistics of Cukurova University Medical Faculty Hospital. Due to the retrospective nature of the study, the parameters investigated were evaluated based on the data obtained. Categorical measurements are given as numbers and percentages, and numerical measurements are given as mean and standard deviation (median and minimum-maximum where necessary). The Chi-square test was used to compare categorical measures between groups. The statistical significance level was set at $p< 0.05$ in all tests.

For this study, approval was obtained from the Cukurova University Medical Faculty Hospital Non-Interventional Clinical Research Ethics Committee (Decision No: 5, Date: 21.05.2021).

Results

In this study, a total of 229 pediatric patients, 145 male (63.3%) and 84 female (36.7%), were examined. The ages of the patients ranged from one month to 15 years. The median age was 24 months. 71.6% of the patients were 60 months old or younger, and 32.8% were younger than 12 months. Demographics of the patients followed up with the diagnosis of pneumonia are shown in Table 1. Based on the age of the patients included in the study, 38% were below the 5th percentile in weight, and 28.8% were below the 5th percentile in height. Of the patients examined, 52.8% had a history of pneumonia in the last year, 17.4% of the patients had three or more pneumonia episodes in the last year, and 50% of them had a history of hospitalization in the last three months. 63.9% of the patients had used antibiotics in the last six months and 54.5% of them had used antibiotics before they were admitted to our hospital.

The rates of previous pneumonia and hospitalization according to growth parameters are shown in Table 2. In patients whose height and weight percentiles by age were below the five percentile value history of pneumonia in the last year, hospitalization rates in the last three months and the rate of having three or more pneumonia in the last year were statistically significantly higher ($p< 0.001$, $p= 0.071$, and $p= 0.002$, respectively).

An underlying disease was present in 58.3% of all patients. The most common underlying diseases were neurological diseases with 16.5%, followed by congenital heart diseases (12.2%) and chronic lung diseases (11.7%). Other common underlying diseases were allergic diseases (8.2%), anatomical defects (6.9%), and Down syndrome (5.2%).

Vaccination, history of pneumonia, and hospitalization rates by maternal education level are shown in Table 3. While no statistically significant difference was found in the rates of full immunization based on the mother's level of education ($p= 0.090$), in children with higher maternal education history of pneumonia in the last year, hospitalization rates in the last three months and the rate of having two or fewer pneumonia episodes in the last year were statistically significantly lower. ($p= 0.007$, $p= 0.005$, and $p= 0.014$, respectively)

Table 4 shows the clinical, laboratory and radiological features of the patients followed up with the diagnosis of pneumonia. The most common complaints of the patients at admission were fever (57.3%), cough (37%), and shortness of breath (21%). Fever was the most common complaint with a rate of 57.3% in infants under one year of age. Fever (27.9%) was the most common finding in physical examination. 9.6% of our patients had no respiratory symptoms. Laboratory results showed that 45.1% of the patients had leukocytosis (WBC> 10.000/mm^3) and/or acute phase reactant elevation (CRP> 0.04 mg/dL or PCT> 0.05 ng/L), and 5.3% had positive blood culture. The most common causative agents were *Staphylococcus Hominis* followed by *Staphylococcus Epidermidis*.

All hospitalized patients received antibiotic treatment. 21.5% of the patients received antiviral treatment. 51.2% of the patients received bronchodilators and 36.3% received inhaled steroids. 74% of patients receiving inhaled steroids were 60 months or younger. Twenty nine (12.9%) of all patients were followed up in the pediatric intensive care unit 96.1% of the cases were discharged with recovery.

Consolidation was present in 61% of our patients' PA lung imaging. While pleural effusion was present in 6.5% of the patients, no radiological findings were detected in four patients.

Table 1. Demographic characteristics of patients followed up with pneumonia

Characteristics	Number of patients (n= 229)	%
Gender n (%)		
Boy	145	(63.3)
Girl	84	(36.7)
Age (Month)		
Mean ± SD	43.02 ± 45.267	
Range (min-max)	1-183	
Median	24	
Age Groups (Months)		
0-11 months, n (%)	75	(32.8)
12-24 months, n (%)	42	(18.3)
25-60 months, n (%)	47	(20.5)
61-44 months, n (%)	55	(24)
>144 months, n (%)	10	(4.4)
Premature Birth (+), n (%)	28	(12.2)
Neonatal Mechanical Ventilator History (+), n (%)	44	(19.2)
History of Breastfeeding (+), n (%)	196	(85.6)
Breastfeeding Duration (+), n= 141		
≤3 months	32	22.7
>3 ≤6 months	17	12.1
>6 ≤9 months	16	11.3
>9 ≤12 months	24	17.0
>12 months	52	36.9
Living conditions		
Rural, n (%)	57	(24.9)
Urban, n (%)	171	(74.7)
History of Attending Nursery (+), n (%)	26	(12.4)
Growth Parameters		
<5% p, n (%) (weight)	87	(38)
<5% p, n (%) (height)	66	(28.8)
Vaccines (+), n (%)		
Full	196	(90.3)
Pneumococcal vaccine	174	(82.5)
Influenza vaccine (in season)	65	(30.7)
Number of Siblings, n (%)		
<2	132	(51.4)
2-5	71	(42.0)
>5	12	(5.6)
Presence of Siblings Going to School (+), n (%)	114	(59.8)
History of pneumonia in the last year (+), n (%)	115	(52.8)
# of pneumonia in the last year, n (%)		
2 or fewer	165	(72)
3 or more	40	(17.4)
History of hospitalization in the last 3 months (+), n (%)	111	(50)
Antibiotics use in the last 6 months (+), n (%)	138	(63.9)
Antibiotics use before admission to the hospital (+), n (%)	122	(54.5)
History of Underlying Disease (+), n (%)	133	(58.3)

Table 1. Demographic characteristics of patients followed up with pneumonia (continue)

Characteristics	Number of patients (n= 229)	%
Mother's Level of Education		
Illiterate n (%)	47	(25.1)
Primary school n (%)	67	(35.8)
Secondary school n (%)	28	(15.0)
High school n (%)	24	(12.8)
University n (%)	21	(11.2)
Father's Level of Education		
Illiterate n (%)	27	(14.8)
Primary school n (%)	65	(35.5)
Secondary school n (%)	25	(13.7)
High school n (%)	45	(24.6)
University n (%)	21	(11.5)

Table 2. Previous pneumonia and hospitalization rates by growth parameters

	by Height <5% (n= 66) (28.8%)	by Height ≥5% (n= 163) (71.2%)	p	by Weight <5% (n= 87) (38%)	by Weight ≥5% (n= 142) (62%)	p
History of pneumonia in the last year	47 (78.3)	68 (43.3)	<0.001	56 (70.0)	59 (42.8)	<0.001
Hospitalization rates in the last three months	38 (61.3)	73 (45.9)	0.040	48 (57.8)	63 (45.3)	0.071
Number of pneumonia episodes Two or fewer Three or more	 39 (66.1) 20 (33.9)	 125 (86.2) 20 (13.8)	 0.001	 52 (69.3) 23 (30.7)	 113 (86.9) 17 (13.1)	0.002

Table 3. Vaccination, previous pneumonia, and hospitalization rates by mother's level of education

Mother's Level of Education	Illiterate (n= 47) (25.1%)	Primary education (n= 67) (35.8%)	Secondary education (n= 28) (15.0%)	High school (n= 24) (12.8%)	University (n= 21) (11.2%)	p
Vaccination Full (n) (%)	44 (100)	54 (81.8)	24 (88.9)	22 (95.7)	20 (95.2)	0.900
History of pneumonia in the last year (n) (%)	28 (59.6)	39 (62.9)	11 (40.7)	10 (41.7)	7 (33.3)	0.007
Hospitalization rates in the last three months (n) (%)	30 (65.2)	34 (54)	12 (42.9)	13 (54.2)	5 (23.8)	0.005
Number of pneumonia episodes Two or fewer (n) (%) Three or more (n) (%)	32 (78.0) 9 (22.0)	44 (73.3) 16 (26.7)	25 (89.3) 3 (10.7)	21 (91.3) 2 (8.7)	20 (95.2) 1 (4.8)	0.014

Table 5 shows the demographic and clinical characteristics of the patients based on the presence of underlying disease. The rates of premature birth (88.9%), mechanical ventilator therapy in the neonatal period (30.7%), and breastfeeding history (69.6%) were statistically significantly higher in the group with an underlying disease compared to the group without UD (p< 0.001, p< 0.001, p< 0.001, respectively). When the height and weight percentile values of the patients were examined, the likelihood of weight (57.1%) and height (45.9%) percentiles being below five percentile was found to be significantly higher in the group with UD than in the group without UD (p< 0.001, p< 0.001, respectively).

Maternal education level was statistically significantly higher in the group with UD than in the group without UD (p= 0.016), and the proportion of mothers with a high school or higher education was statistically significantly higher in the group with UD than in the group without UD (p= 0.001).

History of pneumonia in the last year, three or more pneumonia episodes in the last year, antibiotic use in the last six months and before admission to the hospital were statistically significantly more likely in the group with UD than in the group without UD (p= 0.001, p= 0.001, p= 0.013, and p= 0.001, respectively).

The rate of patients whose weight and height percentiles

Table 4. Clinical, laboratory, and radiological characteristics of the patients followed up with the diagnosis of pneumonia

Characteristics	Number of patients (n= 229)	%
Symptoms		
Fever, n (%)	130	(57.3)
Cough, n (%)	86	(37)
Rapid breathing, n (%)	24	(10)
Shortness of breath, n (%)	50	(21)
Cyanosis, n (%)	19	(8)
Runny nose, n (%)	26	(11)
Reduced breastfeeding, n (%)	34	(14)
Findings		
Fever, n (%)	64	(27.9)
No respiratory symptoms, n (%)	22	(9.6)
Chest retractions, n (%)	12	(5.2)
Nasal flaring, n (%)	9	(3.9)
Secretory rales, n (%)	112	(48.9)
Crepitant rales, n (%)	77	(33.6)
Hypoxemia, n (%)	21	(9.1)
Wheezing, n (%)	40	(4.3)
Unilaterally reduced breath sounds, n (%)	2	(0.8)
Leukocytosis/Acute Phase Reactant Elevation, n (%) WBC> 10.000/mm^3 CRP> 0.4 mg/dL PCT> 0.05 ng/mL	51	(45.1)
Growth in Blood Culture (+), n (%)	12	(5.3)
History of ICU Follow up (+), n (%)	29	(12.9)
Bronchodilator Therapy (+), n (%)	109	(51.2)
History of Inhaled Steroids (+), n (%)	77	(36.3)
Antibiotic Use (+), n (%)		
Single	46	(19.7)
Multiple	183	(80.3)
Antiviral Use (+), n (%)	49	(21.5)
Treatment Outcomes, n (%)		
Discharged with recovery	220	(96.1)
Referral	1	(0.4)
Death	8	(3.5)
Chest X-ray Findings		
Normal	4	(0.01)
Consolidation (unilateral)	55	(24)
Consolidation (bilateral)	20	(8.7)
Alveolar consolidation	58	(25.3)
Segmental consolidation	7	(3)
Reticulonodular infiltration	5	(2.1)
Pleural effusion	15	(6.5)
Peribronchial thickening	184	(80.3)
Unilateral atelectasis	46	(20)
Bilateral atelectasis	106	(46.2)
Bronchiectasis	31	(13.5)
Excessive aeration	37	(16.1)
Lymphadenopathy	11	(4.8)

by age were below the 5th percentile was statistically significantly higher in the group with UD than in the group without UD (p= 0.001 and p= 0.001).

While 8 (27%) of the patients with an underlying disease died, none of the patients in the non-UD group died (p= 0.035).

While 23.2% of the patients with an underlying disease died in the intensive care unit, the mortality rate was 2.8% in patients who were not hospitalized in the intensive care unit

Table 5. Characteristics of the patients followed up with the diagnosis of pneumonia according to the presence of the underlying disease

Characteristics	With underlying disease n (%) 133 (58.3)	Without underlying disease* n (%) 95 (41.5)	p
Gender Male, n (%) Female, n (%)	 84 (63.2) 49 (36.8)	 61 (64.2) 34 (35.8)	0.871
Age (Month) Mean ± SD Median (Min-Max)	 44.67 ± 45.12 25 (2-172)	 40.41 ± 45.63 24 (1-183)	0.486
Premature Birth (+), n (%)	24 (88.9)	3 (3.2)	0.001
Asst. Mechanical Ventilator History (+) n (%)	39 (30.7)	5 (5.4)	0.001
History of Breastfeeding (+), n(%)	87 (69.6)	49 (51.6)	0.001
Growth parameters <5% p, n (%) (weight) <5% p, n (%) (height)	 76 (57.1) 61 (45.9)	 11 (11.6) 5 (5.3)	 0.001 0.001
Vaccines (+), n (%) Full Influenza vaccine (in season)	 109 (88.6) 43 (35.5)	 87 (92.6) 22 (24.2)	 0.459 0.104
Presence of Siblings Going to School (+), n (%)	60 (51.7)	54 (60.0)	0.237
History of pneumonia in the last year (+), n (%)	80 (65.0)	35 (36.8)	0.001
Number of Pneumonia Episodes (+), n (%) Two or fewer Three or more	 80 (70.8) 33 (29.2)	 85 (92.4) 7 (7.6)	0.001
Mother's Age (Year) Mean ± SD Median (Min-Max)	 31.34 ± 6.652 31 (18-50)	 31.42 ± 6.899 31.5 (19-58)	0.929
Mother's Level of Education Illiterate n (%) Primary school n (%) Secondary school n (%) High school n (%) University n (%)	 28 (25.7) 47 (43.1) 17 (15.6) 8 (7.3) 9 (8.3)	 19 (24.4) 20 (25.6) 11 (14.1) 16 (20.5) 12(15.4)	0.016
Mother's Level of Education Secondary school or below n (%) High school or above n (%)	 92 (64.8) 17 (37.8)	 50 (35.2) 28 (62.2)	0.001
Father's Level of Education Illiterate n (%) Primary school n (%) Secondary school n (%) High school n (%) University n (%)	 15 (14.2) 40 (37.7) 16 (15.1) 28 (26.4) 7 (6.6)	 12 (15.6) 25 (32.5) 9 (11.7) 17 (22.1) 14 (18.2)	0.175
Father's Level of Education Secondary school or below n (%) High school or above n (%)	 71 (60.7) 35 (53.0)	 46 (39.3) 31 (47.0)	0.315
Antibiotics use in the last 6 months (+), n (%)	86 (71.1)	52 (54.7)	0.013
History of Antibiotic Use Before Admission to the Hospital	57 (44.2)	65 (68.4)	0.001

Table 5. Characteristics of the patients followed up with the diagnosis of pneumonia according to the presence of the underlying disease (continue)

Characteristics	With underlying disease n (%) 133 (58.3)	Without underlying disease* n (%) 95 (41.5)	p
History of Follow-up in Intensive Care (+), n (%)	21 (16.0)	8 (8.7)	0.161
Growth in Blood Culture (+), (%)	8 (9.1)	4 (6.5)	0.762
Antibiotic Use (+), n (%) Single Multiple	 26 (19.5) 107 (80.5)	 18 (19.1) 76 (80.9)	0.940
Antiviral Use (+), n (%)	31 (23.5)	18 (18.9)	0.512
Treatment Outcomes, n (%) Discharged with recovery Referral Death	 124 (93.2) 1 (0.8) 8 (6.0)	 95 (100.0) 0 (0.0) 0 (0.0)	0.035

* 1 Information on the patient's underlying disease was not available.

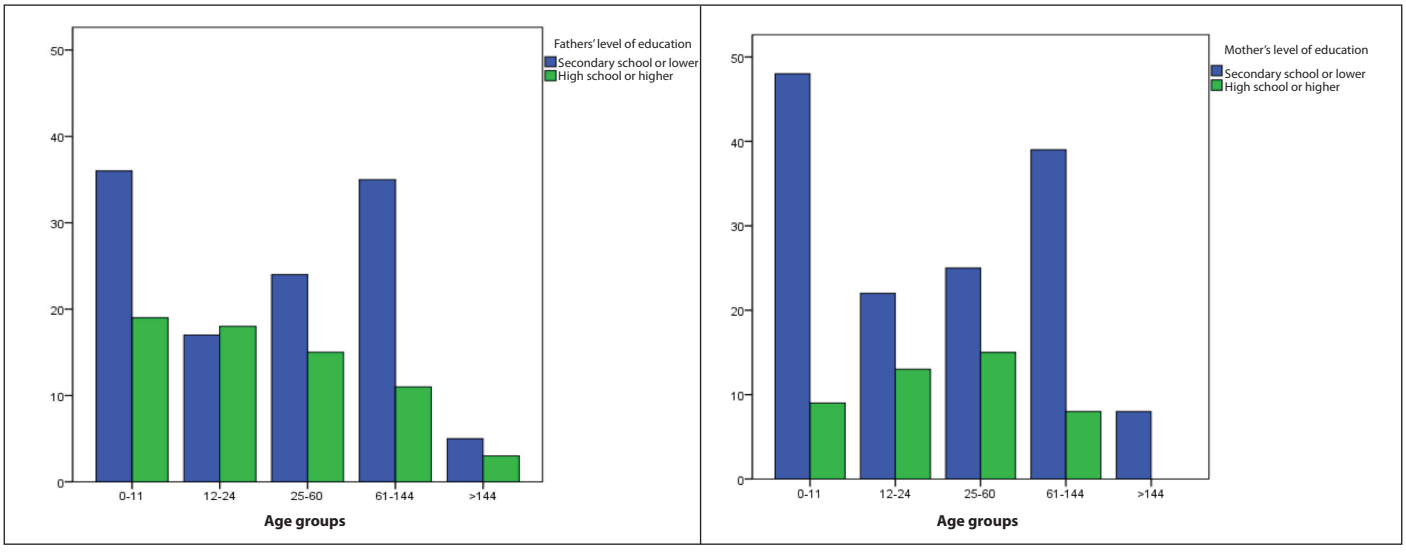

Figure 1. Mothers' and fathers' education levels by age groups.

(p= 0.003). On the other hand, all of the patients who did not have an underlying disease were discharged with recovery, regardless of their history of hospitalization in the intensive care unit.

Discussion

The first five years of life in childhood is the period with the highest incidence of lower respiratory tract infections, and in this period, lower respiratory tract infections are twice as common in boys compared to girls in the first 10 years of life. This rate becomes leveled in adolescence (13). In our study, similar to the literature, among 229 pediatric patients hospitalized with the diagnosis of community-acquired pneumonia, 71.6% were five years old or younger, and 63.3% were male. We found that in the first five years of age, the male ratio was twice as high as the female.

It has been shown that low birth weight and preterm birth play an important role among the risk factors that predispose to lower respiratory tract infections (11). It has been reported that lower socioeconomic level, crowded living conditions, inability to access healthcare, and indoor and outdoor air pollution, especially smoking, are important risk factors that lead to lower respiratory tract infections (7). In our study, 12.4% of our patients had a history of premature birth, and 75% of the patients born prematurely received mechanical ventilator support. Patients with an underlying disease had significantly higher rates of premature birth and mechanical ventilator support compared to patients without UD, and these findings were important risk factors that predisposed the development of pneumonia in patients with UD.

75% of our patients lived in the city center. The effect of risk factors such as air pollution or indoor passive smoking exposure on the development of the disease could not be ex-

amined due to the retrospective nature of our study. Lack of exclusive breastfeeding during the first four months of life has been shown to increase the likelihood of severe pneumonia 2.7 times in low- and middle-income countries and 1.3-fold in high-income countries (14). The rate of exclusive breastfeeding in our patients was 22.7% in the first three months and 34.8% in the first six months. These rates constituted an additional preventable risk factor for the development of pneumonia in our patients.

It has been reported in previous studies that malnutrition and inadequate immunization increase the risk of pneumonia (5). In our study, 38% of our patients were below the 5th percentile for height and 28.8% for weight, based on age. In our malnourished patients, the history of pneumonia in the last year, the rates of hospitalization in the last three months, and the rates of three or more pneumonia episodes in the last year were significantly higher. These findings show that the prevention of malnutrition is also an important factor in the prevention of pneumonia. In our patients with underlying disease, height and weight percentiles for age were significantly lower than in the non-UD group. The fact that our patient group with underlying disease constituted 58.1% of all patients may be a factor in the high rates.

The introduction of pneumococcal and *Haemophilus influenza* Type B vaccines into the national vaccination calendars in the childhood age group has led to a significant decrease in the rates of pneumonia in this age group in the community (15). 90.3% of our patients were fully vaccinated per their months and ages. The pneumococcal vaccination rate was 82.5%, and the influenza vaccination rate was 30.7%. We did not find a significant difference in the vaccination rates of children based on their mother's level of education. In patients with an underlying disease, the rate of vaccination with the influenza vaccine was higher with a rate of 35.5%, which suggests that off-schedule vaccination recommendations are made more frequently for patients at risk of pneumonia development.

In our study, the proportion of patients whose parents were high school or university graduates was lower in all age groups than those with primary and secondary school graduates. Children with parents of higher education had lower rates of pneumonia in the last year and hospitalization in the last three months (p= 0.007 and p= 0.003, respectively). Again, the rate of having three or more pneumonia episodes in the last year was significantly lower in patients with mothers who had higher education levels (p= 0.014). Improving the level of mothers' education is known to be a factor that directly affects children's health in a positive way, especially in reducing the rates of pneumonia development and hospitalization in children (12,16).

It has been reported that the rate of pneumonia increases when the number of people living in the same house and/or the number of siblings going to school increases (7). In our study, 47.6% of our patients had two or more siblings, and 55.3% of them had a sibling at school. These findings were consistent with the literature (12,13).

Studies have shown that the presence of an underlying disease (especially congenital heart diseases, chronic lung diseases, and neuromuscular diseases) is an important factor that predisposes to lower respiratory tract infections (5). In our study, since our hospital was a tertiary university hospital, 58.3% of the patients followed up in our clinics with a diagnosis of pneumonia had an underlying disease. Our patients had underlying diseases such as neurological diseases (16.5%), congenital heart disease (12.2%), and chronic lung disease (11.7%), and these factors played a role in the development of pneumonia. These findings are consistent with the findings of Barson et al. (12,13).

As stated in the literature (12,13), the likelihood of our patients of having had pneumonia in the last year, having used antibiotics in the last six months, and having used antibiotics before admission to the hospital was significantly higher than those without an underlying disease. In this sense, these findings once again showed the necessity for providing widespread education to physicians and society on the correct use of antibiotics.

In studies, it was reported that blood culture positivity was 10-20% in hospitalized patients, while this rate reached 30-40% in patients with parapneumonic effusion or empyema, and the most common agents were streptococci and staphylococci (17). Significant blood culture positivity was detected in 5.3% of our patients. *Staphylococcus hominis* was the most common causative agent and *Staphylococcus epidermidis* was the second most common agent. The fact that the growth rate in blood culture was lower in our study than in the literature points to the high rate of antibiotic use in our patients before hospitalization as the reason.

In our study, it was determined that all our hospitalized patients received antibiotic treatment. Among our patients, the rate of receiving antibiotic treatment before admission to the hospital was 54.5%, and the rate of receiving antiviral treatment was 21.5%. The reasons for this high rate are mainly the lack of education of physicians on the correct antibiotic treatment, the inability to easily access rapid antigen and PCR tests for the early diagnosis of influenza and other respiratory viral infections, therefore, the inability to differentiate between viral and bacterial pneumonia in clinically suspected patients, and ultimately the empirical initiation of antivirals or antibiotics.

It has been reported that the use of nebulized bronchodilators and inhaled steroids in community-acquired pneumonia have no additional impact on the course of the disease, and there is no evidence suggesting any improvement with these

medications (18). In our study, 51.2% of our patients were receiving bronchodilators and 36.3% were receiving inhaled steroids. Of the pediatric patients receiving inhaled steroids, 74% were 60 months and younger, and 35.1% were younger than 12 months. The high rates imply that inhaler therapy is administered to patients with pneumonia without necessity and that acute bronchitis and pneumonia cannot be distinguished, particularly in small infants.

It has been shown that radiological examination is not necessary in cases without severe or very severe pneumonia in childhood. However, PA lung imaging is recommended for patients who are severe enough to be hospitalized (19). Since our study included an inpatient group, PA chest X-rays were obtained for all patients, and there was evidence of consolidation in 61%.

While 96.1% of our patients were discharged with recovery, 3.5% died. 12.9% of our patients were followed up in the pediatric intensive care unit (PICU) because of severe pneumonia. Of the patients followed in the pediatric intensive care unit, 23.2% died. The fact that the deceased patients had an underlying disease supports the fact that infectious diseases such as pneumonia have a more severe course in children with an underlying disease. While the overall mortality rate was reported as 5% in community-acquired pneumonia in children, the mortality rate in our study group was found to be 3.5%. Although 58.5% of the patients in our study group included children with an underlying disease with higher mortality rates, our overall mortality rate was similar to the literature. (20).

In conclusion, these findings once again reveal the importance of early diagnosis and treatment in children with underlying diseases, especially by increasing maternal education and preventing malnutrition, in the prevention of pneumonia and deaths from pneumonia in childhood.

Ethics Committe Approval: This study was approved by Çukurova University Non-invasive Clinical Research Ethics Committee (Decision no: 111, Date: 21.05.2021).

Informed Consent: Patient consent was obtained.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept- EK, ÖÖG; Design- MKÇ; Supervision- EK, DA, ÜÇ; Resource- MKÇ, DGK; Data Collection and/or Processing- GS, ZOO; Analysis and/or Interpretation- İÜ, CE; Literature Search - ÖÖG, Writing- MKÇ, ÜÇ; Critical Review- DA, ÖÖG, SS.

Conflict of Interest: All authors declare that they have no conflicts of interest or funding to disclose.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. *Stein RT, Marostica PJ. Community-acquired pneumonia. Paediatr Respir Rev 2006;7(Suppl 1):S136-7. [CrossRef]*
2. *WHO: Levels and Trends in Child Mortality: Report 2014. United Nations inter agency group for child mortality estimation. UNICEF, WHO, The World Bank, United Nations Population Division New York, 2014.*
3. *Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, et al. British Thoracic Society guidelines for the management of community acquired pneumonia in children: Update 2011 Thorax 2011;66(Suppl 2):ii1-23. [CrossRef]*
4. *McAllister DA, Liu L, Shi T, Chu Y, Reed C, Burrows J, et al. Global, regional, and national estimates of pneumonia morbidity and mortality in children younger than 5 years between 2000 and 2015: A systematic analysis. Lancet Glob Health 2019;7(1):e47-e57. [CrossRef]*
5. *Klein JO. Bacterial Pneumonias. In: Feigin RD, Cherry JD, Demmler GJ, Kaplan SL (Ed). Textbook of Pediatric Infectious Diseases. 4th ed Philadelphia: W.B. Saunders Company; 2004:273-84.*
6. *Jain S, Williams DJ, Arnold SR, Ampofo K, Bramley AM, Reed C, et al. Community-acquired pneumonia requiring hospitalization among U.S. children. N Engl J Med 2015;372(9):835-45. [CrossRef]*
7. *Lee GE, Lorch SA, Sheffler-Collins S, Kronman MP, Shah SS. National hospitalization trends for pediatric pneumonia and associated complications. Pediatrics 2010;126(2):204-13. [CrossRef]*
8. *Recommendations for management of common childhood conditions, Evidence for technical update of pocket book recommendations. Geneva: World Health Organization; 2012 (http://www.who.int/maternal_child_adolescent/documents/management_childhood_conditions/en).*
9. *Global Burden of Disease Child and Adolescent Health Collaboration, Kassebaum N, Kyu HH, Zoeckler L, Olsen HE, Thomas K, et al. Child and adolescent health from 1990 to 2015: Findings from the global burden of diseases, ınjuries, and risk factors 2015 study. JAMA Pediatr 2017;171(6):573-92. [CrossRef]*
10. *Cillóniz C, Polverino E, Ewig S, Aliberti S, Gabarrús A, Menéndez R, et al. Impact of age and comorbidity on cause and outcome in community-acquired pneumonia. Chest 2013;144(3):999-1007. [CrossRef]*
11. *Ünüvar N, Mollahaliloğlu S, Yardım N (editör). Türkiye hastalık Yükü Çalışması 2004. T.C. Sağlık Bakanlığı, Refik Saydam Hıfzısıhha Merkezi Başkanlığı, Hıfzısıhha Mektebi Müdürlüğü. 1. Baskı. Ankara: Adoğdu Ofset Matbaacılık San. ve Tic.Ltd.Şti; 2006:p.1-56.*
12. *Kocabaş E, Ersöz DD, Karakoç F, Tanır G, Cengiz AB, Gür D, et al. Türk Toraks Derneği çocuklarda toplumda gelişen pnömoni tanı ve tedavi uzlaşı raporu. Toraks Derg 2009;0(Ek-3):1-24.*
13. *Barson WJ. Epidemiology, pathogenesis, and etiology of pneumonia in children. Version 16.3 Available from: http:// www.uptodate. com (Accessed date: March, 2021)*
14. *Jackson S, Mathews KH, Pulanic D, Falconer R, Rudan I, Campbell H, et al. Risk factors for severe acute lower respiratory infections in children: A systematic review and meta-analysis. Croat Med J 2013;54(2):110-21. [CrossRef]*
15. *Madhi SA, Klugman KP, Vaccine Trialist Group. A role for Streptococcus pneumoniae in virus-associated pneumonia. Nat Med 2004;10:811. [CrossRef]*

16. *Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü, Türkiye Nüfus ve Sağlık Araştırması, 2003. Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü, Sağlık Bakanlığı Ana Çocuk Sağlığı ve Aile Planlaması Genel Müdürlüğü, Devlet Planlama Teşkilatı ve Avrupa Birliği, Ankara, Türkiye.*
17. *Hickey RW, Bowman MJ, Smith GA. Utility of blood cultures in pediatric patients found to have pneumonia in the emergency department. Ann Emerg Med 1996;27:721-5.* **[CrossRef]**
18. *Kumar P, McKean MC. Evidence based paediatrics: review of BTS guidelines for the managment of community aquired pneumonia in children. J Infection 2004;48:134-8.* **[CrossRef]**
19. *Swingler GH. Observer variation in chest radiography of acute lower respiratory infections in children: A systematic review. BMC Medical Imaging 2001;1:1. Available from: http://www.biomedcentral.com/1471-2342/1/1.* **[CrossRef]**
20. *Fine MJ, Smith MA, Carson CA, Mutha SS, Sankey SS, Weissfeld LA, et al. Prognosis and outcomes of patients with community-acquired pneumonia. A meta-analysis. JAMA 199610;275(2):134-41.* **[CrossRef]**