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EPIDEMIOLOGICAL PROFILE OF PEDIATRIC ADMISSIONS DURING THE TWO YEARS OF THE COVID-19 PANDEMIC

PERFIL EPIDEMIOLÓGICO DAS INTERNAÇÕES PEDIÁTRICAS DURANTE OS DOIS ANOS DA PANDEMIA DE COVID-19

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ABSTRACT: To describe the profile of pediatric hospitalizations during the first two years of the COVID-19 pandemic (2020–2021) in a pediatric unit in Ceará. This retrospective and analytical study was based on medical record analysis and employed a quantitative approach, using a sample of 100 pediatric medical records from the second half of 2020 and 2021. The study aimed to analyze the sociodemographic and clinical profiles, as well as hospitalization data. Data were analyzed using R software. Most hospitalizations involved male children (52%), with the majority aged 2 to 3 years (42%). 45% of the patients were from Fortaleza, while 55% were from other municipalities. Main complaints were fever (51%), cough (42%), and dyspnea (30%). Most common diagnosis was pneumonia caused by unspecified microorganisms (25%), and the majority of patients (73.74%) were discharged. The study highlights the prevalence of respiratory complaints and diagnoses among children hospitalized during the pandemic.
KEYWORDS: Covid-19. Hospitalization. Pediatrics.

RESUMO: Descrever o perfil das internações pediátricas durante os dois primeiros anos de pandemia da COVID-19 (2020-2021) em uma unidade pediátrica no Ceará. Trata-se de uma pesquisa retrospectiva e analítica, desenvolvida a partir da análise de prontuário, com abordagem quantitativa, utilizando a amostra de 100 prontuários de crianças, nos semestres de 2020.2 e 2021.2. Buscou-se analisar o perfil sociodemográfico, clínico e dados de internação. Os dados foram analisados através do *software* R. A maioria das internações ocorreram entre crianças do sexo masculino (52%), maioria com 2 e 3 anos de idade (42%). 45% eram de Fortaleza e 55% de outros municípios. As principais queixas foram febre (51%), tosse (42%) e dispneia (30%). O diagnóstico mais comum foi pneumonias devido a microorganismos não especificados (25%) e a maioria (73,74%) dos pacientes tiveram alta. O estudo destaca a prevalência de queixas e diagnósticos respiratórios entre crianças internadas durante a pandemia.
PALAVRAS-CHAVE: Covid-19. Hospitalização. Pediatria.

INTRODUCTION

COVID-19, first identified in late 2019 in Wuhan, China, is caused by the SARS-CoV-2 virus, which exhibits high transmissibility and rapidly spread worldwide, being declared a pandemic by the World Health Organization[1]. Since then, societies have had to adapt to guidelines established by national and international health organizations. Among various population groups, children and adolescents have experienced the pandemic's impacts in unique ways, particularly regarding hospital admissions[2].

During the first two years of the pandemic, pediatric hospitalizations continued to occur for a variety of reasons not solely related to COVID-19[2]. Respiratory conditions remained one of the primary causes of hospitalization in children, with pneumonia being the most frequent diagnosis[3]. In Brazil, a study investigating the main causes of hospitalizations in children under five years of age revealed that respiratory diseases were the leading causes, followed by gastroenteritis and parasitic diseases[4]. However, it is important to note that the distribution of these causes varies significantly across regions.

In the state of Ceará, there was a significant increase in demand for emergency care at pediatric reference hospitals during the pandemic, reflecting a potential greater severity of pediatric cases. Data indicate a 25% and 35% increase in emergency visits in 2021 and 2022, respectively, compared to 2020, which recorded 68,683 annual visits and a mortality rate of 3.63% per year[5].

These findings highlight the complexity and diversity of clinical manifestations observed in pediatric patients during the pandemic, including severe inflammatory conditions and respiratory diseases such as pneumonias, which remained prevalent. Even before the pandemic, studies had already emphasized the importance of respiratory diseases as one of the main causes of pediatric hospitalizations, a trend confirmed during the pandemic[6].

Given this scenario, it is essential to investigate the profile of pediatric hospitalizations in reference hospitals during the first two years of the COVID-19 pandemic in Ceará. Such an investigation will enable the development of more effective strategies for managing and treating these cases while providing valuable data for the scientific community[7]. Studies conducted during this period have indicated that preventive measures such as mask usage, hand hygiene, and avoiding crowds contributed to a significant reduction in respiratory diseases[8].

Updating the clinical and epidemiological data of children and adolescents hospitalized during the first two years of the pandemic provides fundamental information for planning health actions to address emerging demands. These studies not only help understand the general patterns and behaviors of diseases but also identify risk factors and lay the foundation for implementing more effective public policies[9].

Additionally, understanding the profile of pediatric hospitalizations during the pandemic enhances resource management and the quality of clinical care while emphasizing the importance of health promotion as a fundamental tool to reduce morbidity and mortality in this population. Investing in strategies that promote health not only assists in disease prevention but also strengthens overall well-being, directly benefiting the quality of life of the pediatric population[10].

Therefore, this study aims to describe the profile of pediatric hospitalizations during the first two years of the COVID-19 pandemic (2020–2021) in a pediatric unit in Ceará.

METHODOLOGY

This retrospective and analytical study was based on medical record analysis, employing a quantitative approach. The research was conducted at a Pediatric Emergency Admission Center within a public hospital in Fortaleza, Ceará.

We defined the sample using simple random sampling, comprising 100 medical records. Data collection occurred between March and April 2022. The sample included 50 medical records from each of two previously defined periods: the second half of 2020 (July to December) and the second half of 2021 (July to December). These periods were selected due to their comparable seasonal variations in disease occurrence, enabling the examination and comparison of epidemiological patterns across these two identical intervals. Access restrictions influenced the total number of analyzed records during the pandemic.

Inclusion criteria were: children aged 0 to 3 years admitted between July and December 2020 and July and December 2021, who presented to the emergency department and had a hospitalization period exceeding 24 hours. The hospital serves children aged 0 to under 18 years; however, this specific age group was chosen due to the higher prevalence of respiratory diseases among them. Exclusion criteria included hospitalizations lasting less than 24 hours and incomplete or inconclusive medical records.

This study is part of a larger project entitled Epidemiological profile of hospitalizations in a pediatric unit in Ceará during the COVID-19 pandemic. Data collection was conducted through the following procedures: 1. Securing prior authorization for data collection from the healthcare institution; 2. Random selection of medical records to ensure data representativeness; 3. Information collection using a data collection instrument developed by Oliveira et al.[11], which included variables such as age, sex, place of origin, reason for admission, outcome, length of hospital stay, affected bodily system, and medical procedures performed.

We tabulated and organized the data in a spreadsheet using the Google Docs® platform and analyzed it with the R open-source statistical language. Data were accessed remotely and entered into the statistical package, creating an identified database in compliance with the General Data Protection Law (Law No. 13,709/2018)[12]. Subsequently, data underwent consistency evaluations to identify missing or logically problematic entries. No data were excluded due to logical consistency issues.

We conducted a descriptive analysis, presenting qualitative variables as absolute and relative frequencies and quantitative variables using central tendency and dispersion measures. Descriptive analyses included the complete dataset as well as stratifications by the second half of 2020 and the second half of 2021.

The study adhered to the recommendations of Resolution No. 466/12 of the National Health Council[13] and received ethical approval from the Research Ethics Committee of the Albert Sabin Children's Hospital, under protocol No. 5.586.849/2022, and Certificate of Ethical Appraisal Presentation (CAAE) No. 56481222.2.0000.5042.

RESULTS

The study sample consisted of 100 medical records, 50 of which were from hospitalizations conducted during the second half of 2020 and 50 during the second half of 2021. The sociodemographic characteristics of the children are presented below, highlighting a predominance of male patients (52%).

Regarding age, 31 children were between 0 and 1 year old (31%), 27 were between 1 and 2 years old (27%), and 42 were between 2 and 3 years old (42%). Concerning place of origin, 45 children (45%) were from the state capital, Fortaleza, while 55 (55%) were from non-metropolitan areas within the state (55%).

Variable	2nd half 2020		2nd half 2021	
Sex	**N**	**%**	**N**	**%**
Male	27	54	25	50
Female	23	46	25	50
Age	**N**	**%**	**N**	**%**
0-1	17	34	14	28
1-2	15	30	12	24
2-3	18	36	24	48
Place of origin	**N**	**%**	**N**	**%**
Fortaleza	25	50	20	40
Others	25	50	30	60
Total	50	100	50	100

Table 1. Sociodemographic characteristics of children hospitalized in a pediatric unit in Ceará during the COVID-19 pandemic in the second half of 2020 and the second half of 2021. Fortaleza, Brazil, 2024 (n = 100).
Source: Research data, 2024.

According to Table 2, the most frequent main complaints (MCs) were fever (51%), cough (42%), dyspnea (30%), vomiting (20%), respiratory discomfort (19%), abdominal pain (13%), nasal discharge (12%), diarrhea (8%), skin spots (6%), and seizures (3%). Certain main complaints occurred only in one year and not the other, including skin spots, seizures, headache, jaundice, and rectal prolapse.

Variable	2nd half 2020		2nd half 2021	
Main complaint (MC)	**N**	**%**	**N**	**%**
Fever	24	48	27	54
Cough	24	48	18	36
Dyspnea	19	38	11	22
Vomiting	9	18	11	22
Respiratory discomfort	8	16	11	22
Abdominal pain	4	8	9	18
Nasal discharge	6	12	6	12
Diarrhea	5	10	3	6
Skin spots	6	12	0	0
Seizures	3	6	0	0
Headache, jaundice, lymphadenopathy (each)	2	4	0	0
Rectal prolapse	0	0	2	4
Other MCs (combined)	6	12	13	26

Table 2. Main complaints of children hospitalized in a pediatric unit in Ceará during the COVID-19 pandemic in the second half of 2020 and the second half of 2021. Fortaleza, Brazil, 2024 (n = 100).
Source: Research data, 2024.

The most frequent diagnoses were “Other types of pneumonia due to unspecified microorganisms” (25%), “Acute lymphoblastic leukemia” (7%), “Coronavirus infection of unspecified location” (6%), “Unspecified bacterial intestinal infection” (6%), “Unspecified acute bronchitis” (5%), “Unspecified bacterial infection” (3%), and “Acute appendicitis” (3%) (Table 3).

Variable	2nd half 2020		2nd half 2021	
Diagnosis	**N**	**%**	**N**	**%**
Other types of pneumonia due to unspecified microorganisms	17	34	8	16
Acute lymphoblastic leukemia	3	6	4	8
Coronavirus infection of unspecified location	6	12	0	0
Unspecified bacterial intestinal infection	1	2	5	10
Unspecified acute bronchitis	2	4	3	6
Unspecified bacterial infection	0	0	3	6
Unspecified asthma	2	4	0	0
Chronic myeloid leukemia	2	4	0	0
Malignant neoplasm of connective tissue	2	4	0	0
Other diagnoses (combined)	11	22	16	32
Outcomes	**N**	**%**	**N**	**%**
Discharged	37	74	36	72
Transferred	9	18	7	14
Death	0	0	1	2
Referred to ICU	4	8	5	10
Other	0	0	1	2
Total	50	100	50	100

Table 3. Medical diagnosis and outcomes of children hospitalized in a pediatric unit in Ceará during the COVID-19 pandemic in the second half of 2020 and the second half of 2021. Fortaleza, Brazil, 2024 (n = 100).
Source: Research data, 2024.

Regarding outcomes, of the 100 medical records, only 99 contained data on patient outcomes. Among these, 73 patients (73.74%) were discharged, 16 (16.16%) were transferred, 9 (9.09%) were admitted to the ICU, and one patient died (Table 3). The average length of stay (LOS) was 10.95 days (standard deviation ± 9.61 days). The median LOS was 7 days, with a minimum of 1 day and a maximum of 60 days.

When assessing the devices most frequently used by patients, the following were observed: peripheral venous catheter (80%), oxygen therapy (18%), nasal cannula (13%), Venturi mask (5%), and central venous catheter (4%), as shown in Table 4.

Variable	2nd half 2020		2nd half 2021	
Device	**N**	**%**	**N**	**%**
Peripheral venous catheter	41	84	38	76
Oxygen therapy	12	24	6	12
Nasal cannula	8	16	5	10
Venturi mask	4	8	1	2
Peripheral venous catheter	3	6	1	2
TT	0	0	1	2
NG/NE tube	1	2	0	0
OG tube	0	0	1	2
GT/JT	0	0	1	2
Total	50	100	50	100

Table 4. Main devices used in children hospitalized in a pediatric unit in Ceará during the COVID-19 pandemic in the second half of 2020 and the second half of 2021. Fortaleza, Brazil, 2024 (n=100).
Source: Research data, 2024.

DISCUSSION

Understanding the importance of addressing pediatric health, we aimed to investigate the epidemiological patterns, clinical characteristics, and outcomes of children hospitalized during two distinct six-month periods. Among our primary observations, we noted a predominance of male patients, comprising 52% of the total sample, along with an even age distribution ranging from 0 to 3 years.

A similar study that evaluated the profile of pediatric hospitalizations during pandemic and non-pandemic periods also reported a predominance of male patients (54.1%) and a higher prevalence of admissions among children aged 29 days to 2 years (45.9%) during the pandemic period in 202014. These findings align with international studies that have similarly highlighted the prevalence of male pediatric admissions[15,16].

Although the literature remains inconclusive on how a child's sex influences hospitalization rates, some authors suggest this may be associated with societal perceptions. In this context, girls are often perceived as more fragile, leading families to exercise greater caution, whereas boys are viewed as resilient and are encouraged to engage in activities that may expose them to pathogens at an earlier age[17].

Additionally, a study conducted in the state of Minas Gerais analyzed 2,606 pediatric hospitalizations and identified 164 confirmed cases of SARS-CoV-2 infection (6.3%). Among the affected children, 70% were under the age of 5, and 54.9% were male[18].

An analysis of the most frequent complaints reported by patients in 2020 showed that fever and cough were the most common, each with an incidence of 48%, followed by other complaints in the same order. In 2021, fever (56%) and cough (36%) remained the leading complaints, followed by dyspnea, vomiting, and respiratory discomfort (22% each).

These results demonstrate consistency in complaints reported across both periods, with fever, cough, and dyspnea being the most common manifestations. This finding is consistent with another study[19], which identified cough as the most prevalent symptom, reported in approximately 80% of analyzed cases, followed by fever (50%), dyspnea (45%), and respiratory discomfort (25%).

Regarding patients' most frequently used devices, a cohort study noted that supplemental oxygen was required in 28 (43.1%) pediatric COVID-19 patients. Oxygen was delivered using various devices, including nasal cannulas in 15 (53.6%) patients, reservoir masks in 6 (21.5%), simple masks in 2 (7.1%), and non-invasive positive pressure ventilation in 2 (7.1%)[20].

It is important to highlight that in both semesters, the peripheral venous catheter was the most frequent among the devices utilized. This result is consistent with its status as a widely used invasive procedure in pediatrics for administering medications or fluids. Additionally, the literature reports that PVC placement is performed approximately 60 times more frequently than central venous catheter placement in hospital settings, due to its lower associated risks[21,22]. These findings align with the results of this study.

As for the diagnoses leading to hospitalizations during the second halves of 2020 and 2021, respiratory diseases stood out as a major cause of admissions. These findings corroborate previous studies. A study analyzing hospitalizations during the pandemic confirmed that pneumonia remained one of the leading diagnoses. Among hospitalized patients, 60% presented respiratory symptoms, with the majority being diagnosed with pneumonia or bronchiolitis (70%)[6].

Additionally, 13% of patients exhibited multisystem inflammatory syndrome (MIS), while 60% showed symptoms resembling Kawasaki disease. The remaining 28% of patients displayed

gastrointestinal and neurological symptoms[6]. These findings underscore the complexity and diversity of clinical manifestations observed during the pandemic, with a significant proportion of cases related to respiratory diseases such as pneumonia.

However, even before the pandemic, studies had already highlighted the prevalence of respiratory diseases as a leading cause of pediatric hospitalizations—a trend that persisted during the COVID-19 pandemic. A 2019 investigation found similar results, reaffirming the significance of these health conditions[23]. The analysis of hospitalization characteristics in children during their first six years of life revealed that respiratory diseases were among the primary causes of admission[24].

Regarding the length of hospital stay, the average duration was 10.95 days, with a median of 7 days, and a range from 1 to 60 days. Another study reported similar findings, with an average length of stay of 10 days for hospitalized children[25].

A study conducted by Megiani et al.[26] from 2013 to 2022 involving hospitalized children and adolescents found that 52.5% of resources allocated for the treatment of respiratory diseases were exclusively used for pneumonia management. During this period, 4,713,847 hospitalizations were associated with these conditions, generating a total cost of R$3,368,528,322.13 (US$551,498,825.43) in hospital services. Of this amount, 52.5% (R$1,768,513,172.37, that is, US$289,542,745.09) was allocated to pneumonia, which accounted for 2,287,581 hospitalizations, representing 48.5% of respiratory disease cases.

A study in the Federal District analyzed hospitalizations for primary care-sensitive conditions (PCSCs) among children aged 0 to 9 years between 2008 and 2017. The study recorded 7,037 PCSCs within this age group, with hospitalization rates increasing by 35.43% among children aged 0 to 4 years and by 69.56% among those aged 5 to 9 years. The primary causes identified were asthma, bacterial pneumonia, and infectious gastroenteritis, which together accounted for 52.51% of the hospitalizations. The total cost of these hospitalizations was estimated at R$2,805,551.53 (US$459,327.70), with a 10.23% increase in expenditures from the study's first to the final year. Asthma emerged as the most expensive condition, accounting for 27.93% of the total costs[27].

Regarding outcomes, 73.74% of patients were discharged, 16.16% were transferred, 9.09% were admitted to the intensive care unit (ICU), and one patient died. Similar results have been reported in other studies, where the majority of pediatric patients experienced improvement or recovery during both the pre-pandemic[17,28] and post-pandemic periods[14].

This study provides a valuable foundation for practical actions in both hospital and community settings, contributing to health promotion and disease prevention in the pediatric population. The findings can guide improvements in care delivery processes within pediatric units, enabling the efficient allocation of resources and better clinical management of children with respiratory diseases. Moreover, the study emphasizes the importance of regional strategies aimed at prevention, early diagnosis, and effective treatment of pediatric complications, including the expansion of educational campaigns and childhood vaccination programs. These findings underscore the central role of data-driven interventions in strengthening preventive and care practices, with a direct impact on reducing pediatric morbidity and mortality.

CONCLUSION

We identified that among the 100 medical records analyzed of children hospitalized in a pediatric unit in Ceará, the majority during the two periods analyzed were male, with a predominance of children

aged two to three years. The most frequent complaints in both periods were fever and cough, reflecting the high incidence of respiratory diseases, corroborated by the predominant diagnoses of pneumonia and other respiratory infections. The hospital discharge rate was high, although a significant proportion of severe cases required transfer or intensive care. The average hospital stay was 10.95 days. These findings underscore the importance of strengthening healthcare services focused on pediatric respiratory diseases, immunization protocols, and public health policies targeting this area.

Certain limitations of this research should be noted, including the small sample size, which limits external inferences. Additionally, the quality of information from medical records, often subject to incomplete data and missing entries, warrants attention. Furthermore, the study was conducted in only one hospital unit, emphasizing the need to expand the sample to other pediatric hospitalization sectors.

Given these considerations, the findings of this study are better suited to support adjustments in the hospital's internal processes and enhance understanding of institutional and regional epidemiology. We recommend that future epidemiological studies encompass a broader timeframe and involve multiple hospital units to allow for a more robust and comprehensive analysis. Such studies could provide new evidence on the true profile of pediatric hospitalizations during the COVID-19 pandemic, contributing to more targeted planning of child health initiatives and addressing diseases and complications in similar contexts.

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