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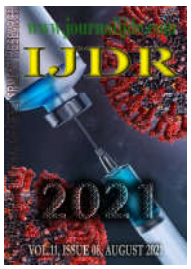

RESEARCH ARTICLE OPEN ACCESS

ANALYSIS OF INFANT HOSPITALIZATIONS FOR PNEUMONIA IN A UNIVERSITY HOSPITAL (2013-2016)

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ABSTRACT

Objective: to understand the clinical-epidemiological profile of admissions for pneumonia at the Júlio Bandeira University Hospital between 2013 and 2016. **Method**: documentary and cross-sectional study, with data collected from medical records of children and adolescents, being approved by the ethics committee with opinion number 2048056. **Results**: 599 hospitalizations occurred in the referred period, with a 38% increase in the. Male cases, of patients up to five years old, coming from the urban area were predominant. Unspecified pneumonia was the most common diagnosis. The patients' biological sex and area of residence did not influence their type of discharge or the use of supplemental oxygen. The hospital stay of female patients was longer ($p = 0.011$), and this subgroup was significantly more submitted to blood count ($p = 0.009$), c-reactive protein (CRP) ($p = 0.001$) and radiography ($p = 0.035$). Consequently, the rate of laboratory tests ($p = 0.003$) and complementary tests in general ($p = 0.009$) was higher in this group. **Conclusion**: the study revealed an increase in hospitalizations for pneumonia, seasonal distribution, in addition to pointing out that gender and area of residence do not influence discharge due to clinical improvement, nor the need to use supplemental oxygen.

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INTRODUCTION

Defined as an infectious process that installs itself in the lower respiratory tract, more precisely in the pulmonary portion, pneumonia is an important cause of morbidity and mortality in all age groups, especially in extreme age groups, patients under five and over sixty. In developing countries, community-acquired pneumonia, when the infectious agent comes from the outside of the hospital environment, represents an important cause of morbidity and mortality among children (Leung *et al*., 2018). Although most cases can be treated on an outpatient basis, considering the potency of oral medications against the main etiological agents, there are cases that require more complex treatment, as they present therapeutic resistance, even after 72 hours of adequate therapy. In these cases, the suspicion index for local complications, such as empyema, or even systemic ones, such as bacteremia, must be high (Benedictis *et al*., 2020). In a 15-year analysis, bacterial pneumonias accounted for more than 16% of avoidable hospitalizations in Brazil, in patients under one year of age (Pinto Júnior *et al*., 2020). Among the general causes of hospitalizations of children up to five years of age, a systematic review pointed out that the respiratory diseases group appears most frequently leading unicentric studies and, in preventable causes, bacterial pneumonia has the leading position (Pedraza e Araújo, 2018). In Paraíba's countryside, pneumonias account for more than 20% of hospitalizations among children and adolescents each year. Of this total, more than 80% of those occurred in patients up to ten years of age (Lima e Farias, 2019). Whereas the health profile is affected by determinants of various natures, and also taking into account that the Northeast of Brazil is still marked by economic, social, environmental and cultural nuances, which characterize its epidemiological structure, it is important to investigate the epidemiological frame of hospitalizations for Pneumonia in children, given that this indicator supports the analysis of access to this sphere of health, as well as the allocation of human and material resources. Based on the epidemiological reality of high regional prevalence of pneumonia among children in the countryside of Paraíba, this study decided to investigate the distribution of this phenomenon in a ward of a reference hospital for the Ninth Regional Health Care Unit in Paraíba. Thus, analysing this phenomenon, it will be possible to contribute to the line of child health care, taking into consideration the knowledge of local characteristics that influence the epidemiological structure in question. Therefore, this study sought to understand the clinical and epidemiological profile of admissions for

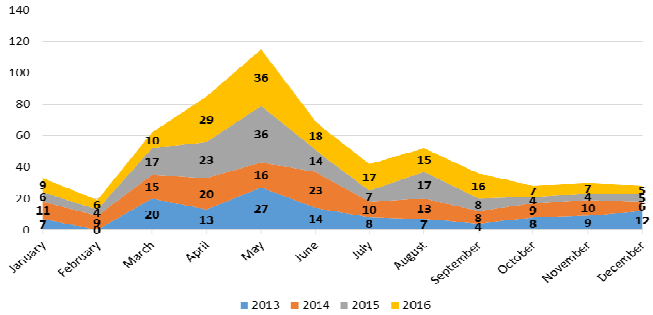
pneumonia at the Júlio Bandeira University Hospital (henceforth, HUJB) from the year 2013 to 2016.

MATERIALS AND METHODS

This is an epidemiological research, of quantitative and cross-sectional nature. As for the design, it consists of a documentary research, focused on the collection and analysis of medical records of children hospitalized in the pediatric ward of the HUJB between 2013 and 2016. When accessing information directly from medical records, the base document for conducting this research, the data for this study are considered primary (Veira e Hossne, 2015). Data were collected from the Medical Archives and Statistics Service (SAME for Portuguese foServiço de ArquivosMédicos e Estatísticas) of the institution in question. That period of investigation was chosen in view of the organization of the service after it was transferred to the Federal University of Campina Grande (UFCG), in 2012, in addition to avoid direct interference from the current COVID-19 pandemic. The target audience consisted of children and adolescents aged between one month and 18 years, who were admitted to the alredy mentioned hospital with pneumonia, comprising ICDs J12 to J18. Medical records of patients from outside the Ninth Regional Health Care Unit were also included. It was used the convenience sampling method, dispensing with a sample calculation in view of the inclusion of all medical records whose patients met the inclusion criteria. The medical records were literally transcribed into a standardized data collection form, previously validated before this stage of the study. The use of medical records as a unit of analysis supressed the risk of recall bias, that may occur in a direct approach with patients or their caregivers, and also the inclusion of 100% of the sample prevents the bias selection of participants. The cross-sectional design of the study also mitigates individuals' loss of follow-up. The sex of the patients, as well as their city, area of origin, color/race, and period (month, semester, year) of hospitalization comprised the sociodemographic epidemiological data. The clinical profile variables included the main diagnosis of hospitalization, length of stay, justification for hospitalization, number of medications used during hospitalization, case outcome, laboratory and imaging tests requested. The primary outcomes of this study were whether the patient had improved and were discharge due to hospital admission and the use of supplemental oxygen. The amount of diagnostic and therapeutic resources used, length of hospital stay and standardized indicators of resources per day of hospitalization constituted secondary outcomes in the analysis. All variables of the patients' sociodemographic data, data related to the diagnosis, reason for hospitalization, treatment and evolution were statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 22.0. To study the correlation between qualitative variables, the chi-square and Fisher's exact test were used; for quantitative ones, Student's t test was used for independent samples, always adopting a significance level of 5% to reject the null hypothesis. There was a comparison of outcomes between patients, dichotomized by biological sex and area of residential origin. This research dispensed with the use of Informed Consent Form, since patients were not directly approached. However, as patients personal information were accessed through medical records, the basic ethical aspects of research involving human beings were observed, as provided for in Brazilian legislation. This investigation is an excerpt from the research, whose translated title is “Description of admissions at the Júlio Bandeira de Mello University Hospital (2013 to 2016)”.Its project had the health institution approval and, observing the ethical principles that guide the development of research involving human beings, was forwarded to the Research Ethics Committee (CEP for Comitê de Ética e Pesquisa in Portuguese), via PlataformaBrasil, and obtained approval opinion on 05/05/2017, under number 2,048,056.

RESULTS

A total of 599 admissions for pneumonia occurred at the institution over the four years investigated. In 2016, at the end of the investigated time-series, 175 hospitalizations were computed for this cause, an increase of 38% compared to the 129 children hospitalized in 2013.



Source: created accoding to the research data (2021).

Figure a. Temporal distribution of pediatric admissions for pneumonia. Cajazeiras, 2013-2016

Table 1. Clinical and sociodemographic characteristics of admissions. Cajazeiras, 2013-2016

Variable	n (%)
Sex	
Male	334 (55,8)
Area of origin	
Urban	395 (65,9)
City	
Cajazeiras	292 (48,7)
São José de Piranhas	66 (11,0)
São João do Rio do Peixe	40 (6,7)
Cachoeira dos Índios	38 (6,3)
Santa Helena	27 (4,5)
Uiraúna	23 (3,8)
Monte Horebe	15 (2,5)
Triunfo	15 (2,5)
Bonito de Santa Fé	15 (2,5)
Bernardino Batista	13 (2,2)
PoçoDantas	13 (2,2)
Poço José de Moura	11 (1,8)
Other cities	46 (7,7)
Year	
2013	129 (21,5)
2014	150 (25,0)
2015	145 (24,2)
2016	175 (29,2)
Monthes	
Januanry	33 (5,5)
February	19 (3,2)
March	62 (10,4)
April	85 (14,2)
May	115 (19,2)
June	69 (11,5)
July	42 (7,0)
August	52 (8,7)
September	36 (6,0)
October	28 (4,7)
November	30 (5,0)
December	28 (4,7)
avoidable admissions	22 (3,7)
Age group (years)	
< 1	160 (26,7)
1 – 4	280 (46,7)
5 – 9	115 (19,2)
> 10	44 (7,3)
Hospitalization outcomes	
Discharge with effectiveness of care	564 (94,2)
Transfer to another health facility	33 (5,5)
Discharge for request	1 (0,2)
Death	1 (0,2)
Diagnose	
Pneumonia UP	501 (83,6)
Bronchopneumonia UP	72 (12,0)
Lobar pneumonia UP	11 (1,8)
Bacterial pneumonia UP	9 (1,5)
Pneumonia due to other gram-negative aerobic bacteria	2 (0,3)
Other bacterial pneumonias	2 (0,3)
Other pneumonias due to UP microorganisms	1 (0,2)
UP viral pneumonia	1 (0,2)

The distribution of cases was not uniform over the years, concentrating mainly in the months of the second quarter of the year, when there is a peak in hospitalizations registered in the four years investigated (Figure a). The majority of the hospitalized patients were male (55.8%), from the urban area (n = 395) and from the city of Cajazeiras (48.7). Hospitalizations in the second semester accounted for more than a third of hospitalizations (36.1%), while only 22.3% belonged to the list of preventable conditions by primary care (Table 1). The annual distribution of admissions showed a positive correlation (r = 0.90), indicating an ascending pattern of hospital stay.The average age of patients was 3.62 years [Confidence Interval 95% (95%CI) = 3.33; 3.91], mainly because children between one and four years old accounted for almost half of the admissions. In the analyzed period, one death was filed, but hospital discharge due to improvement in the condition was the prevalent outcome (94.2%). Pneumonia code most used in hospitalizations was unspecified pneumonia (J18.9). The cases with specified microbiological etiology, together, did not exceed 20% of the hospital prevalence. The rate of hospitalization days in the group was 4.93 days [95%CI 4.68; 5.18].

Table 2. Influence of biological sex on pediatric admissions for pneumonia. Cajazeiras, 2013-2016

Variável	Male	Female	Chi-square	*p*-value
Areaofprovanence				
Urbana	216	179	0,544	0,460
City ofprovenance				
Cajazeiras	168	124	0,727	0,374
Age group (years)				
0,00 – 0,99	97	63	3,460	0,326
1,00 – 4,00	157	123		
4,01 – 10,00	58	57		
10,01 – 17,99	22	22		
Yearofhospitalization				
2013	74	55	0,781	0,854
2014	82	68		
2015	84	61		
2016	94	81		
Semesterofhospitalization				
First	214	169	0,006	0,940
Monthofhospitalization				
January	22	11	12,928	0,298
February	10	9		
March	41	21		
April	42	43		
May	63	52		
June	36	33		
July	25	17		
August	26	26		
September	20	16		
October	11	17		
November	21	9		
December	17	11		
Outcome				
Discharge for effectivinessofcare	315	249	0,032	0,856
Saline solution	130	86	2,682	0,101
Glucose solution	141	118	0,322	0,570
Crystalloids	102	93	1,397	0,237
Hypotonicsolution	1	0	0,795	0,373
Foodrestriction	12	11	0,125	0,724
Respiratoryfisioterapy	187	162	1,607	0,204
Supplementaloxygen	64	46	0,320	0,571
Bloodcomponents	2	2	0,054	0,815
Antibacterial	317	252	0,010	0,918
Laboratoryexam	318	240	4,996	0,025
Imageexam	311	246	0,018	0,892
Complementaryexam	329	258	0,985	0,320

Source: created according to the research data (2021).

Among the therapeutic resources used, respiratory physiotherapy reached a rate of 58.3% in this sample. Paradoxically to the low number of etiologies specified in the ICD, the use of antibacterials was practically unanimous in admissions, being administered to 569 children.

A surveyed severity marker, supplemental oxygen use was recorded in 118 patients. The most requested laboratory test was the complete blood count, on average 1.6 per patient [CI95% 1.51; 1.68]; while the traditional radiography (x-ray) was the most requested among the imaging exams, on average 1.61 [CI95% 1.49; 1.74]. Other tests were dosage of c-reactive protein, with 1.11 tests per patient [CI95% 1.02; 1.20], urinalysis, 0.13 [CI95% 0.13; 0.20], computer tomography, 0.03 [95%CI 0.01; 0.05], and ultrasonography, 0.04 [CI95% 0.02; 0.06]. No complementary, laboratory or imaging test were requested for Twelve children. The number of children who underwent a complementary exam was practically the same, among those who underwent a laboratory (93.2%) or imaging exam (93.0%). When comparing the hospitalizations of patients concerning their sex, it was noted that there was no significant difference considering the main outcomes of this study. The use of supplemental oxygen was slightly higher among males (19.2% versus 17.3%, p = 0.571), while the discharge rate with clinical improvement was approximately equal (94.3% versus 93.9%, p = 0.856). Also, the percentage of male patients who underwent a laboratory test was significantly higher (95.2% versus 92.8%, p = 0.025) (Table 2). The area of provenace, in turn, also did not reveal a significant influence on patient discharge. However, urban patients used supplemental oxygen more frequently (19.0% versus 17.2%, p = 0.583). On the other hand, patients coming from cities outside the regional health care unit in questioln were, more frequently, from rural areas (p < 0.001). Residents in agrarian regions also had a higher rate of use of saline solution (p = 0.04) (Table 3).

Table 3. Influence of area of provenance in pediatric admissions for pneumonia. Cajazeiras, 2013-2016

Variable	Urban Area	Rural area	Chi-square	*p*-value
Sex				
Male	216	118	0,544	0,461
City ofprovenance				
Cajazeiras	220	72	22,412	<0,001
Age group (years)				
0,00 – 0,99	116	44	4,999	0,172
1,00 – 4,00	182	98		
4,01 – 10,00	71	44		
10,01 – 17,99	26	18		
Year of hospitalization				
2013	85	44	1,0833	0,718
2014	99	51		
2015	100	45		
2016	111	64		
Semesterofhospitalization				
First	261	122	2,295	0,130
Month of hospitalization				
January	23	10	15,555	0,158
February	13	6		
March	42	20		
April	58	27		
May	77	38		
June	48	21		
July	25	17		
August	29	23		
September	18	18		
October	19	9		
November	18	12		
December	25	3		
Outcome				
Dischargefor effectivenessofcare	374	190	0,585	0,444
Saline solution	131	85	4,217	0,040
Glucose solution	174	85	0,312	0,577
Crystalloids	137	58	2,395	0,122
Hypotonicsolution	1	0	0,517	0,472
Foodrestriction	14	9	0,274	0,601
Respiratoryfisioterapy	229	120	0,040	0,842
Supplementaloxygen	75	35	0,301	0,583
Bloodcomponents	19	16	2,079	0,149
Antibacterial	373	196	0,768	0,380
Laboratoryexam	365	193	1,024	0,312
Imageexam	367	190	0,011	0,918
Complementaryexam	387	200	0,003	0,957

Source: created according to the research data (2021)

Table 4. Mean differences in resource use between sociodemographic characteristics

Variable	Sexo		*p*-value*	Provenance		*p*-value*
	Male	Female		Urban	Rural	
Age	3,42	3,88	0,121	3,43	4,00	0,062
Hospitalar stay	4,63	5,31	0,011	4,86	5,07	0,480
Medicines	5,63	5,51	0,414	5,56	5,59	0,878
Complete bloodcount	1,49	1,73	0,009	1,60	1,59	0,963
CRP dosage	0,97	1,28	0,001	1,11	1,10	0,910
Urinalysisradiography	0,15	0,18	0,453	0,16	0,18	0,539
Radiography	1,49	1,77	0,035	1,65	1,55	0,497
ComputedTomography	0,04	0,03	0,608	0,03	0,03	0,840
Ultrasound	0,04	0,04	0,697	0,04	0,04	0,843
Laboratorytests (LT)	2,61	3,20	0,003	2,87	2,88	0,964
Imageexams (IE)	1,57	1,84	0,065	1,72	1,63	0,549
Total complementaryexams (TCE)	4,18	5,03	0,009	4,59	4,50	0,801
Medicines / day	1,43	1,25	0,001	1,35	1,36	0,829
LT / day	0,58	0,60	0,388	0,55	0,55	0,825
IE / day	0,34	0,34	0,864	0,34	0,33	0,774
TCE / day	0,92	0,94	0,468	0,93	0,93	0,967

*T test for two independent samples.

The hospital stay of female patients was longer (p = 0.011), and this subgroup was significantly more submitted to blood count (p = 0.009), c-reactive protein (CRP) (p = 0.001) and radiography (p = 0.035). Consequently, laboratory tests rate (p = 0.003) and complementary tests in general (p = 0.009) was also higher for this group. The average number of medications used per hospitalization was higher among male patients (p = 0.001). The area of origin did not generate a significant difference in the average use of therapeutic and diagnostic resources (Table 4).

DISCUSSION

The data from this research showed an age profile with a more accentuated incidence of pneumonia, an increase in prevalence at the end of the time series, seasonal concentration in the second quarter of the year, without any statistically significant differences in the type of hospital discharge or use of supplemental oxygen by sex or area of provenance, primary outcomes. Even though pneumonia is one of the most common diseases, universaly well distributed and known, there is growing new perspective that current knowledge about this morbidity is based on low quality evidence, and there are still gaps to be overcome, such as the concept of acute illness, without long-term repercussions (Jones e Waterer, 2020). At the end of the four years investigated, there was a 38% increase in admissions for pneumonia in the pediatric ward referred to before. Concurrently, the Northeast region showed an increasing tendency to pneumonia mortality rate in the first decades of this century. Projections made from the data are that this region will occupy higher positions in national ranking, with cases gaining greater representation on national scene (Ferraz et al., 2017). In contrast to the empirical reasoning derived from the implementation of pneumococcal vaccine under Brazil's Single Health System (SUS for Sistema Único de Saúde in Portuguese), the increase in admissions opposes the hypothesis of an expected reduction of this data, mainly among patients under five years of age (Vieira e Kupek, 2018), a scenario that was not observed in this study. It is worth mentioning an interesting study carried out with data from the Ceará population, analyzing hospitalizations for bacterial pneumonia, revealing a slight reduction tendency among patients under five years of age, with a percentage variation of -8.9% in thirteen years, at the beginning of this millennium. This time pattern provided a phenomenon that, even in the face of the registered fall, pneumonias came to occupy the second place among preventable hospitalizations in the state and, if the registered tendencies were maintained, they may reach the first place in prevalence, surpassing gastroenteritis (Costa et al., 2017). The study showed a delimited age profile of greater susceptibility, 73.4% of hospitalizations affecting patients aged up to four years. In general, pneumonias had a higher prevalence among populations with immature or compromised immune responses, such as the elderly, immunosuppressed, adults with chronic diseases and children aged up to 5 years (Torres et al., 2021). The primary outcome of improved hospital discharge was not influenced by the factors sex or patient's area of provenance. In the period analyzed, only one death was recorded, out of nearly 600 hospitalizations. In another Brazilian single-center study, also located in a university hospital, the lethality rate showed a tendency to decrease when analyzed in a 15-year series, with severity being the only factor statistically associated with the death of pediatric patients (Ferreira et al., 2014). In this sample, the record of unspecified pneumonia (ICD-10: J18.9) predominated as the main admission diagnosis, opposing the hypothesis that bacterial etiology could predominate in this age group. However, despite the diagnostic difficulty imposed by the limitation of laboratory resources now faced, within the public health network, there is an emergence of new pathogens, as well as atypical occurrences in known etiologies, making it difficult to establish the origin of the infection without isolation of the agent (Perret et al., 2021). Indian statistics for etiology of pneumonia deaths among children indicated approximately 40 deaths from Streptococcus pneumoniae, 20,700 from Respiratory Syncytial Virus, 12,600 from influenza and 7200 from Haemophilus influenzae type b, in an analysis covering the period from 2005 to 2013. There was a seasonal distribution with a higher relative risk of death from this morbidity between the months of December and January in the Asian country (Farrar et al., 2019). In this analysis, the seasonal distribution of cases concentrated a peak in hospital prevalence in the second quarter of the year.

The use of antibacterials in low-risk infections such as bacterial pneumonia needs to be rationalized. In the last ten years, no new drug has been launched with this spectrum of action. On the other hand, there is more robust evidence that courses of treatments shorter than the usual interval between seven and ten days can be equally effective (Korppi, 2021). Secondary outcome in this analysis: the number of patients who received antimicrobial drugs was high and did not differ between sex and areas of provenance. The high percentage of patients who received antibacterials can be linked to the recommendation of global guidelines that, despite specific differences, have the use of antibiotics as a mainstay of treatment, disregarding regional differences that impact the course and presentation of community-acquired pneumonia (BARBERÁN et al., 2020). Another therapeutic novelty that can be validated in the coming years, increasing the therapeutic arsenal, is the use of inhaled corticosteroids. Based on combating the inflammatory response triggered by the infection, the biological plausibility of these compounds is well established in parenteral administration. When used by inhalation, there is the possibility of reducing systemic effects without considerable loss of therapeutic potency (Kukhon e Festic, 2021). In a scenario of high prevalence among children, reducing the effects of exposure to these drugs constitutes a quaternary prevention activity. A limitation of this study was the impossibility of collecting data on the average income of hospitalized patients. Factors in this socioeconomic field influence

the clinical outcome of children. A human development index (HDI) bellow 0.770 was found to be correlated with the development of complications, such as pulmonary empyema, among infants hospitalized for pneumonia (Land et al., 2018). Lower income strata also have a higher prevalence of admissions to intensive care units (ICU). Although a Brazilian cohort has registered a reduction of 33% in this indicator in the poorest strata, in a follow-up that took place over three decades in Southeastern Brazil, the data are superior to the representation of the richest strata (Wehrmeister et al., 2019). As in all cross-sectional studies, this study faces a limitation of pointing out the incidence of pneumonia in the pediatric population in the region studied. As this is a single-center study, the generalization of data to extra-hospital populations or centers of greater complexity has low external validity. However, the documental approach provided a broader list of variables, compared to the traditional ecological delimitation with secondary data, providing the analysis of clinical outcomes, in addition to offering more specific data on the diagnostic and therapeutic resources used in these cases.

CONCLUSION

The study revealed an increase of hospital prevalence or pneumonia among children and adolescents in the population studied at the end of the time series, seasonal distribution of cases, with a concentration in the second quarter of the year and a high percentage of hospitalizations in patients up to five years of age. Patients's sex and area of provenance did not influence their type of discharge or the use of supplemental oxygen. The analysis of these data can support decision-making by managers and health professionals who work on the front lines of the health system, based on knowledge of the characterization of these patients. The generalization of these data to regions with a similar sociodemographic and edaphoclimatic profile can provide an improvement in child and adolescent health care services with an adequate planning of resources to meet this growing demand for hospitalizations.

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