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ORIGINAL ARTICLE

Predictors to hospitalization in early childhood in a Tertiary Hospoital at Fortaleza, Ceará

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Abstract

Introduction: the morbidity profile in early childhood is considered an indicator of the quality of basic health care. it is believed that patients with failed pediatric follow-up are more vulnerable, at greater risk for repeat hospitalizations and for preventable conditions. **Objective:** to study the risk factors associated with hospitalization in early childhood at the Hospital Infantil Albert Sabin - Fortaleza, Ceará, Brazil. **Methods:** observational cross-sectional study with data collected using a form applied to children aged 1 month to 5 years. **Results:** The sample consisted of 100 children, of which 38% reported some chronic illness. 10% were classified as intermediate hospitalization and 59% as prolonged hospitalization. There was a statistically significant correlation between length of stay and the following variables: male gender, first child, contact with animals, passive smoking, difficulty with breastfeeding, previous comorbidities, surgical procedure and supplementation. The main organ system affected was the respiratory system (54%), with pneumonia being the most prevalent diagnosis. Discussion: The majority of patients were on their first hospitalization. Performing a surgical procedure during hospitalization may correspond to greater severity of the condition. The vaccination rate found was low when compared to expected. More than half of patients did not have a routine consultation with a trained health professional. **Conclusion:** In this study we managed to raise the suspicion that patients who undergo a surgical procedure in a pediatric clinical ward tend to have prolonged hospitalization. Furthermore, use of vitamin D and contact with domestic animals were related to protective factors for intermediate hospitalizations.

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INTRODUCTION

Early childhood is the phase that encompasses the first five years of a child's life, a period of major physical and behavioral changes. The morbidity profile in this age group is considered an indicator of the quality of basic health care provided by public policies[1].

Through childcare, a field area of healthcare that monitors child growth and development, families could have longitudinal follow-up with a trained healthcare professional, seeking to prevent morbidity, early detection of treatable and non-treatable diseases, in addition to family support to deal with a child who is constantly growing and learning. The bond created and strengthened by an integrated team, with systematic and continuous monitoring, can guarantee the physical, mental and social integrity of children and their families, identifying early situations of vulnerability that put children's lives at risk[2,3].

Routine pediatric monitoring has been well established for years, focusing on growth, neuropsychomotor development, the vaccination schedule, routine laboratory tests, prevention of domestic accidents, hygiene and eating habits, in addition to important family guidance, including information on breastfeeding. All of these topics discussed during a regular child visit can provide a better quality of life for the children and their family. However, despite being nationally recognized as essential in the life of a child, there is still a need to reinforce the importance of this specialized monitoring, especially in early childhood, given the persistent high rates of hospitalizations in this age group. The main diseases that affect children in early childhood involve the respiratory and gastrointestinal systems and are often the result of poor basic care in municipal childcare services, whether due to difficulty in accessing healthcare units, lack of trained professionals or social vulnerability involved. The main risk factors reported in the literature are: low family income, passive smoking, early weaning, family overcrowding, maternal absence in comprehensive care, malnutrition and poor environmental conditions[1,4,5].

The impact caused by the hospitalization of a child encompasses social and economic factors, and can lead to higher costs with intensive hospital therapies, in addition to a direct impact on the quality of life of the child and their family, such as the interruption of work activities of legal guardians to care for their dependents; the patient's absence from school activities, often resulting in related learning difficulties; in addition to psychological trauma that can be acquired within the hospital environment, whether due to lights, noises or invasive procedures. Thus, indicators of length of stay in healthcare units are tools that help detect risk factors for prolonged hospitalization[6].

In this context, knowledge about the conditions that lead to morbidity and increased length of hospitalization in these children is essential to determine the quality of public healthcare. Monitoring cases of hospitalized early childhood patients can guide healthcare agents to intervene where there is a greater need to avoid an increase in the rate of hospitalization of children, improving the quality of life of the local population.

METHODOLOGY

Type of study

This was an observational cross-sectional study with primary data collected using a form applied to a sample of the population admitted to the Albert Sabin Children's Hospital (HIAS) in children aged 1 month to 5 years, in the city of Fortaleza, Ceará.

Data collection took place from May to October 2023.

Study location

The study was developed in the General Pediatrics services of the HIAS, located in the Vila União distric, in the city of Fortaleza, State of Ceará, Brazil. It is a tertiary support hospital for the entire state of Ceará and other states in the Northeast, a reference in early diagnosis, monitoring of rare diseases and complex surgical procedures in childhood, in addition to specialized services in several areas of Pediatrics. It is also characterized by being a teaching hospital, welcoming undergraduate students and medical residents in specialization.

Study population and sample

The study included individuals aged 1 month to 5 years and 11 months admitted to the General Pediatrics Service of the Albert Sabin Children's Hospital in 2023 (from May to July). Patients whose guardians did not consent to participate in the study and children of other age groups were excluded from the sample.

Data collection instrument and procedures

A semi-structured questionnaire was applied, completed using data recorded by the medical team from each patient's medical record, in addition to questions directed to the guardian of the hospitalized patient; with the agreement of the head of the service and the signature of the free and informed consent form signed by the guardian. The variables analyzed included socioeconomic and epidemiological data, in addition to the evaluation of personal data related to childcare monitoring in early childhood and anthropometric measurements. The papers used as bibliographic references were selected through Pubmed, being filtered using keywords related to the studied topic.

The length of hospital stay was divided by classification according to the Kan Ban system determined by the complexity profile of HIAS patients. Standard hospital stays, within expected limits, were those lasting less than 14 days. Intermediate hospital stays, with an alarm signal for intervention, were characterized by 15 to 21 days. Hospital stays lasting more than 22 days were considered prolonged, requiring intervention.

Data processing

The data were plotted and organized in a Google Docs® spreadsheet and analyzed using the public domain statistical language R. The information was accessed electronically and remotely and fed into the statistical package, creating a de-identified database, following the guidelines of the General Data Protection Law (Law No. 13,709/2018). The data were then processed to assess their consistency, and missing records or records with logical problems were identified. A descriptive analysis was performed describing the qualitative variables using absolute and relative frequencies, and the quantitative variables using measures of central tendency and dispersion. The inferential analysis was performed using a multinomial logistic model. Variables with an excess of missing records or little contrast (very small values in the categories) were not used to adjust the model, which was adjusted with all the chosen variables. The method of sequential removal of non-significant variables was used until only variables with a p-value < 0.05 remained. The results of the logistic model were expressed as odds ratio, standard error of the odds ratio and 95% confidence interval, in addition to the p-values.

Ethical aspects

This study was proposed in accordance with the regulatory standards and guidelines for research involving human beings, Ordinance of the National Health Council (CNS), Resolution No. 466/2012.

The guardians of the children admitted to the study were clearly informed about the objectives and importance of the study, as well as the risks and benefits inherent to the project. They were also informed about the Informed Consent Form, which they signed and agreed to participate in the study.

The study protocol was submitted to the Ethics Committee for Analysis of Research Projects – Ethics and Research Committee - CEP HIAS, under CAAE number 64644622.0.0000.5042, and was approved by the committee through opinion number 6.000.069. It is duly registered in the National Information System on Ethics in Research Involving Human Beings (SISNEP).

RESULTS

The study sample consisted of 100 children, with no patients meeting the exclusion criteria. The socioepidemiological data are shown in Table 1.

Table 1. Socioepidemiological aspects of the sample.

Gender	
Female	54 (54%)
Male	46 (46%)
Ethnics	
Brown	57 (57%)
Other	43 (43%)
Schooling	
Yes	27 (27%)
No	73 (73%)
Maternal schooling	
ES or HS incomplete	48 (48%)
Complete HS or higher education	52 (52%)
Basic sanitation	
Yes	72 (72%)
No	28 (28%)
Pets	
Yes	36 (36%)
No	64 (64%)
Passive smoking	
Yes	24 (24%)
No	76 (76%)

Source: the author.

The average number of siblings was 1.6 (ranging from 0-8). Considering the birth order, 33% of the patients were the couple's second child, while 28% were the couple's first child. The average number of people living in the household was 4.2 (ranging from 2-10), with the mother being the main caregiver in 87% of cases, followed by the grandmother in 5%. The average maternal age was 28.5 years.

Regarding feeding in the first year of life of the patients, 35% had difficulty breastfeeding, either due to maternal or infant problems, and 9% reported confirmed allergy to cow's milk protein.

Also, regarding infant feeding, the average of exclusive breastfeeding was 96 days, with a median of 76 days. The total duration of breastfeeding had an average of 238 days, corresponding to approximately 8 months of life, and a median of 122, approximately 4 months of age.

The presence of comorbidities prior to the current diagnosis was also investigated, and it was shown that 38% of patients reported some chronic disease. Further data on the current hospitalization are shown in Table 2.

Table 2. Data on the patient's current hospitalization.

First hospitalization	
Yes	**56 (56%)**
No	**44 (44%)**
Submitted to surgery in current hospitalization	
Yes	20 (20%)
No	80 (80%)

Source: the author.

Regarding the length of hospital stay, 10% of patients were classified as having intermediate hospitalization and 59% as having prolonged hospitalization. The factors related to these data can be assessed in greater detail in Table 3, in which the total number of records included in the multinomial logistic model was 89. The number of variables included in the final model was 20 (table). The number of degrees of freedom was 42, the accuracy was 0.75, and the sensitivity and specificity were 0.7 and 0.82. The area under the ROC curve was 0.87, and the chi-square test for goodness of fit was significant at $p < 0.001$.

There was no statistically significant relationship between "prolonged hospitalization" and the following variables: consultation with a doctor, consultation with a nurse, current weight, and up-to-date vaccinations.

Among the organic systems affected, the main one was the respiratory system, with 54% of patients, followed by neurological (12%) and infectious (7%). Detailing the most prevalent diagnoses, it is possible to mention pneumonia 35.56%, acute viral bronchiolitis 14.44%, and epilepsy 5.56%.

In addition, some data were used as quality indicators of a childcare service appropriate for patients, including an up-to-date vaccination schedule, vitamin D and iron supplementation, assessment of neuropsychomotor development (NSMD), access to a basic healthcare unit (BHU), and routine consultations with a doctor and/or nurse (table 4).

Table 4. Childcare quality indicators.

Updated vaccination	**63 (63%)**
Vitamin D use	49 (49%)
Iron supplementation	34 (34%)
Adequate NSMD	71 (71%)
Access to a BHU	82 (82%)
Consult with a pediatrician	42 (42%)
Consult with a nurse	38 (38%)

Source: the author.

The main reasons reported for difficulty in accessing basic healthcare were long distance to the basic healthcare unit, lack of transportation, lack of professionals in the units, and delays in obtaining appointments or exams.

DISCUSSION

In the present study, the population was evenly divided between males and females, with a predominance of younger children. Socioeconomic conditions were adequate in most cases, with the presence of basic sanitation and a low rate

Table 3. Factors related to intermediate and prolonged hospitalization.

Variable	OR	SE	CI 95% of the OR	*p value*
Intermediate hospitalization (15-21 days)				
Male	0,008	0,057	0,008-0,009	<0,01
First child	453,8	0,078	389,3-529	<0,01
Contact with animals	0,052	0,065	0,046-0,059	<0,01
Passive smoking	13,3	0,071	11,6-15,33	<0,01
EMA difficulty	1,54	0,076	1,328-1,786	<0,01
Prior comorbidities	0,074	0,122	0,058-0,093	<0,01
Surgery during hospitalization	16,98	0,033	15,91-18,11	<0,01
Use vitamin D	0,122	0,051	0,110-0,135	<0,01
Use iron	1,036	0,051	0,110-0,135	<0,01
Prolonged hospitalization (> 22 days)				
First child	0,416	0,145	0,314-0,553	<0,01
Passive smoking	0,263	0,346	0,134-0,519	<0,01
Prior comorbidities	2,305	0,350	1,161-4,575	0,0169483
Surgery during the hospitalization	3,363	0,198	2,282-4,957	<0,01
Use iron	0,721	0,319	0,386-1,346	0,3045072
Use vitamin D	1,327	0,292	0,744-2,332	0,3453665

OR: *odds ratio*; SE: Standard Error; CI: confidence Interval. Source: the author.

of passive smoking. The main caregiver most often reported was the mother, with an average age and level of education favorable to caring for children.

In the sample, the largest number of patients were in the younger age group. This was observed in the literature, showing that the highest hospitalization rate occurred in the first year of life, remaining stable until four years of age and decreasing shortly after that age[7].

In Brazil, respiratory diseases are the leading cause of hospitalization in children under five years of age, followed by intestinal infectious diseases and surgical causes[7-9]. In the current study, in fact, the main cause of hospitalization was respiratory system involvement, with lower airway infections, such as pneumonia and bronchiolitis, being the most prevalent.

Most patients had no prior comorbidities and were in their first hospitalization. The adequate vaccination rate found in this population was low, when compared to the expected vaccination coverage of at least 90%. However, this data is in line with the literature, which has been showing a drop in this coverage since 2012, with a percentage of 60.7% in 2022, according to DATASUS from the Ministry of Health[10]. It is worth remembering that part of the prevention of respiratory and infectious diseases could be avoided by updating the vaccination schedule, a fact that makes this data extremely important in this study.

Among the factors associated with prolonged hospitalization in this study, it is possible to mention the presence of prior comorbidities, which would be expected according to medical knowledge in the literature, and the performance of a surgical procedure during the hospitalization period. Given that the study was carried out in a pediatric ward, with patients who were initially admitted without surgical indication, this factor may be related to complications that arise during the treatment of frequent comorbidities in childhood, such as patients with pneumonia who require chest drainage.

Regarding intermediate hospitalization, the following protective factors were observed: use of vitamin D, male gender, and contact with animals. Passive smoking and difficulty in carrying out exclusive breastfeeding were associated with a higher risk of intermediate hospitalization. The high rate of early weaning was evidenced by the average exclusive breastfeeding duration, which was around 3 months, in addition to the short duration of maintenance of this milk supply, which was around 8 months of age. Early weaning may also be a factor related to the increased rate of hospitalizations, as well as the increased length of hospitalization, given the fragility of children's immune systems in the first months of life[11]. However, the relationship between this factor and hospitalization of young children cannot be well established through this study.

Another factor analyzed in this study was anthropometry during children's hospitalization. According to the literature, patients with low birth weight are more prone to a higher frequency of hospitalization[7]. Perhaps, weight is in fact a predictor of harm, either to motivate hospitalization or to delay healing time. Possibly, immunological factors involving this data could be able to explain, which could be harms due to early weaning, but more data in the literature on this topic would be needed. However, this relationship was not identified through the present study.

Also aiming at health prevention, our study showed that although many patients are able to have access to a basic healthcare unit, the majority do not have specialized monitoring, by a pediatrician or other trained healthcare professionals, indicated by the Ministry of Health[12]. This factor alone could already delay diagnoses and fail to prevent harms that could both motivate hospitalization and prolong hospitalization time.

CONCLUSION

Among the limitations of this study, we can stress the limited number of similar and current studies for comparative purposes, in addition to the very nature of the observational study, which does not allow for the determination of causal correlation. It was also not possible to determine whether the sample size was sufficient to determine some statistical relationships that have already been reported in the literature, such as the association of low birth weight with a higher rate of hospitalization.

In this study, we were able to raise the suspicion that pediatric patients who undergo surgical procedures, which may correspond to an aggravation of the admission diagnosis, tend to have prolonged hospitalizations, lasting more than 21 days. In addition, the use of vitamin D and contact with domestic animals were related to protective factors for intermediate hospitalizations.

The evaluation of a childcare service involves multiple factors, including accident prevention, development and anthropometry analysis, oral health, sleep hygiene, lifestyle habits, and others. Therefore, it is extremely difficult to determine whether the quality of care provided by a given health area is within the standards expected for society. However, through this study, it was possible to analyze several essential areas of a child's life and, even though it is difficult to analyze each variable separately, it is possible to perceive with the entire context that there are still flaws in the service that require interventions. The vaccination coverage rate was one of the main concerns of the analysis, which, when associated with the low rate of supplementation, childcare consultations and access to healthcare units, in parallel with the high rate of early weaning, shows that the basic health service urgently needs attention and improvements in order to promote a healthier society.

Although it was not possible to establish correlations with some risk factors classically described in the literature, we still believe that childcare is essential for monitoring the

growth and adequate development of children, enabling a better quality of life for families. Considering that the two main pillars of childcare are prevention and health education, these two lines will always be interconnected. Therefore, childcare is fundamentally preventive Pediatrics.

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