

# Clinical Epidemiological Profile of Children with Acute Respiratory Insufficiency in a Pediatric Intensive Care Unit

**ORIGINAL**

Sandra Beatriz Pedra Branca Dourado<sup>1</sup>,  
 Paulo Vicente Dourado<sup>2</sup>,  
 Marylane Viana Veloso<sup>3</sup>, Geandra Batista Lima Nunes<sup>4</sup>,  
 Hélida Lessa De Aragão Cardoso<sup>5</sup>,  
 Andreia Karla De Carvalho Barbosa Cavalcante<sup>6</sup>,  
 Verbenia Cipriano Feitosa<sup>7</sup>,  
 Milena France Alves Cavalcante<sup>8</sup>,  
 Danieli Maria Matias Coêlho<sup>9</sup>, José Francisco Ribeiro<sup>10</sup>,  
 Elizabeth Soares Oliveira De Holanda Monteiro<sup>11</sup>,  
 Diego Cipriano Chagas<sup>12</sup>

## Abstract

**Objective:** To know the epidemiological clinical profile of children admitted for acute respiratory failure (ARF) in the Pediatric Intensive Care Unit (ICU) of the Teresina Emergency Hospital (TEH), from 2010 to 2015.

**Method:** A quantitative approach, with a sample of 451 medical records obtained in the electronic system of hospitalization of the patients who were admitted to the Pediatric ICU of the Hospital. After approval by the Ethics Committee of Estácio Ceut Faculty, the study was started.

**Results:** Of the 721 hospitalizations due to ARF in children, 451 (62.6%) required clinical interventions in the ICU. Of these, 59.4% were male, in the age range of one to six years (61.9%), with a diagnosis in the ICD 10 by J96.0. In 99.7% of the cases, hospitalized for a period of more than ten days (72.4%), originating in the interior of Piauí (63.4%), whose discharge occurred by administrative closure (75.6%), followed by deaths, which were 19.3%.

**Conclusion:** Acute Respiratory Insufficiency is a serious problem of global, national and local public health, because it is a morbidity

- 1 MSc in Genetics and Toxicology at the Lutheran University of Brazil ULBRA Professor of the Undergraduate Nursing School of ECT.
- 2 Nursing Undergraduate Student from ECT.
- 3 Master's Degree in Nursing from UFPI Professor of the Nursing Graduate course at ECT and Camilo Filho Institute ICF. PhD student in Collective Health, UNICAMP.
- 4 PhD in Biotechnology Master's Degree in Nursing from the UFPI Professor of the NGC at ECT.
- 5 Master in Intensive Therapy and Intensive Therapy Specialist Professor of the NGC at ECT.
- 6 Master's in Nursing student from UFPI Professor of the NGC at ECT.
- 7 Master's Degree in Nursing from the UFPI Professor of the NGC at ECT.
- 8 Master's Degree in Nursing from the UFPI Specialist in Public Health and Psychosocial Care Professor of the NGC at ECT.
- 9 Professor of the NGC at ECT. Master in Science and Health at the UFPI
- 10 Master in Science and Health at the UFPI Professor of the NGC at ECT.
- 11 PhD student in Nursing, UFPI Master in Science and Health at the UFPI Professor of the NGC at ECT.
- 12 Specialist in Teaching Higher Education and Intensive Care Unit. Professor of the NGC at ECT.

ECT: Estácio College of Teresina.

NGC: Nursing Graduate Course.

UFPI: Federal University of Piauí, UFPI.

## Contact information:

Sandra Beatriz Pedra Branca  
Dourado.

 sandradourado3@gmail.com

that requires advanced technology for health treatment, with relative mortality. It is reasonable for therapeutic measures to prevent respiratory diseases to be systematically stimulated and implemented by health services to prevent them. Among the limitations of this work is the administrative nature of the HUT Information System database, as there may be possible errors in coding and filling in this information. In addition, there are the restricted number of similar and current searches for comparative purposes. The studies carried out in other municipalities occurred some years ago. Therefore, potential biases arising from these limitations may arise.

#### Keywords

Infant Mortality; Respiratory Insufficiency; Epidemiology.

## Introduction

Acute Respiratory Insufficiency (ARI) is a serious childhood disease that is multi-factorial and can lead to death, when not treated properly, and/or when diagnosed late. It became the leading cause of death among children under five years of age, in regions where access to basic health care was impaired or non-existent, and where primary caregivers did not recognize the severity of the respiratory condition [1].

For more severe cases, ARI requires more sophisticated forms of treatment with more advanced technologies. Therefore, in larger and well-equipped health services capable of offering this adequate support, which are generally located in the urban centers of capitals, such as Intensive Care Units (ICUs).

The ICU is the hospital sector responsible for the treatment of severe patients. Because of this exceptional nature, it is in this place where the resources are allocated with advanced technology, managed by a specialized multi-professional team to attend the target audience, that is, those with imminent risk of death [1].

According to the Resolution of the Collegiate Board of Directors (CBD) 7<sup>th</sup>, of February 24, 2010, pediatric ICU is a unit for the care of patients aged

29 days to 14 years, or 18 years, and this limit is defined according to the routines of the institution [2-3].

As for the pathologies that lead children to be admitted to the ICU, the ARI is cited. This event is quite frequent in Pediatrics and corresponds to 50% (fifty percent) of hospitalizations in pediatric ICU and one of the main causes of morbidity and mortality in this population [4].

The ARI is one of the most serious pathologies of the pediatric ICU because it is characterized by the inability of the respiratory system to perform the gas exchanges, which has as a consequence the inadequate supply of oxygen to the tissues or the inadequate elimination of carbon dioxide from the lungs. This disability has diverse endogenous and exogenous causes that, when combined, increase the risk of death, especially in children. By such a magnitude, the diagnosis of ARI should be fast and early, so that damages are minimized [3].

For family members who accompany severe childhood illness, the need for intensive treatment raises different feelings, such as: guilt, fears, uncertainties and different insecurities. One of the main uncertainties is the length of time the children stay in these places and the fear of death of the patients [4]. Furthermore, the impossibility of permanently

accompanying the patient becomes another obstacle for direct caregivers of the child to confide in and/or express satisfaction with the interventions provided in the ICU [5].

From this perspective, the Nursing team needs to consider that children with chronic and acute diseases require therapeutic interventions that go beyond the use of technical, technological and specialized clinical skills. Human care also involves emotional, touch, and religious characteristics that contribute to the improvement of the general state of the patient. Hence the need also for family participation, whether in the adoption of preventive measures of illness or in treatment [6].

For professionals dealing with pediatric intensive care, hospitalization for ARI raises several concerns. Although the causes are often known, other questions are uncertain such as: Is ARI a condition of childhood suffering prevalent in a particular age group of life? Does gender have any influence on severe childhood ARI? Can the geographical origin of children influence the occurrence of ARI cases that arrive in the pediatric ICU? How does the mortality of children by ARI behave in the general hospital with pediatric ICU behave?

In order to better clarify these issues, the study is justified and the following objective is outlined: to evaluate the clinical and epidemiological profile of children admitted to the Pediatric ICU at a Hospital de Urgência de Teresina (HUT) in the 2010 to 2015.

## Method

This is a quantitative, descriptive, retrospective, documental study in electronic medical records of children hospitalized at the Pediatric ICU of an emergency general hospital in the city of Teresina between 2010/2015.

Descriptive research aims to describe the characteristics of a given population or phenomenon or the establishment of relationships between variables. It involves the use of standardized techniques

of data collection: systematic observation. It generally takes the form of a survey [7].

Only the medical records of children aged between 29 days and 12 years old up to and including December 31<sup>st</sup>, 2015, admitted to the ICU by ARI with the International Classification of Diseases, 10th edition (ICD-10), were included in the study: J96.0 and J18.0, which refer to unspecified respiratory insufficiency elsewhere and unspecified bronchopneumonia, respectively.

Data collection was performed in November 2016. Tabulation and processing of this data was done in spreadsheets of the Microsoft Office Excel 2010 Computational Program. Absolute and relative frequencies of clinical, epidemiological and demographic data were calculated. We also used inferential statistics, using the Pearson's Chi-square test, with 95% CI, with statistical significance for  $p < 0.05$ , to determine whether or not the statistical association between gender, age group and length of hospital stay, as well as between the origin of the hospitalized child and the type of ICU discharge. The data was presented in graphs and tables, so the analysis was performed in light of the literature.

This research was appreciated and authorized by the Research Ethics Commission (REC) of the Faculdade Estácio/CEUT, with protocol number 7542/2016, thus complying with the recommendations of Resolution of the National Health Council 466/2012, which deals with research involving human beings.

## Results

The results were divided into two parts: in the first, a description of the epidemiological profile of children admitted to the pediatric ICU with ARI in HUT; in the second, the bivariate analyses were performed, with an association between the gender variable and the length of hospital stay, and the children's origin and ICU discharge type.

During the study period, 721 children entered the HUT by ARI. Of these, 421 (62.6%) were admitted to the ICU. Of the children admitted to the ICU, 241 (53.4%) were males, 279 (61.9%) were between one and six years of age, 450 (99.7%) had ICD 10 J96.0. Hospitalized for a period exceeding ten days totaled 349 (77.4%); From the interior of Piauí, 286 children (63.4%); 341 (75.6%) patients were discharged from the ICU due to administrative closures, when there was a change in diagnosis, permanence due to complications of the treatment or the initial clinical picture. Already 87 (19.3%) of the discharges occurred due to deaths, as shown in **Table 1**.

**Table 1.** Description of the epidemiological and demographic profile of children admitted to hospital and hospitalized in the pediatric ICU, in an emergency hospital in Teresina, from 2010 to 2015 (N = 451).

Variables	N	%
Gender		
Female	210	46.6
Male	241	53.4
Age group (in years)		
< 1	136	30.2
1 to 6	279	61.9
> 6	36	8.0

**Table 2.** Distribution of the variables gender and age, according to length of stay, in children hospitalized in the pediatric ICU, in an emergency hospital in Teresina, between 2010 and 2015 (N = 451).

Variables	Num of days						p	
	≤ 10			> 10				
	N	%	IC95%	N	%	IC 95%		
Gender								
Female	49	48.0	40.8-55.2	161	46.1	39.2-53.1	0.734	
Male	53	52.0	44.2-59.8	188	53.9	45.8-61.9		
Total	102	100.0	85.0-115.0	349	100.0	85.0-115.0		
Age Group								
< 1	64	62.7	53.3-72.2	72	20.6	17.5-23.7	0.001*	
1 to 6	27	26.5	22.5-30.4	252	72.2	61.4-83.0		
> 6	11	10.8	9.2-12.4	25	7.2	6.1-8.2		
Total	102	100.0	85.0-115.0	349	100.0	85.0-115.0		

\*: Significant at the 5% level.

**Table 3** Distribution of the type of hospital exit, according to the source, for children hospitalized in the pediatric ICU at an emergency hospital in Teresina, between 2010 and 2015 (N = 451).

Origin	Discharge		IC 95%	Transf.		IC 95%	Death		IC 95%	Others*		IC 95%	p**
	N	%		N	%		N	%		N	%		
Teresina	1	33.3	28.3-38.3	7	35	29.8-40.3	28	32.2	27.4-37.0	107	31.4	26.7-36.1	
Interior of Piauí	1	33.3	28.3-38.3	10	50	42.5-57.5	45	51.7	44.0-59.5	230	67.4	57.3-77.6	
Other States	1	33.3	28.3-38.3	3	15	12.8-17.3	14	16.1	13.7-18.5	4	1.2	1.0-1.3	0.001
Total	3	100			20	100	87	100.0		341	100		

**Source:** SAME HUT, 2016. \*: Administrative closures (changes in diagnosis, complications of the initial clinical picture or the treatment used). \* Significant p <0.005.

## Discussion

The ARI is a serious acute illness that, in children, can lead to ICU admission. In this study, it was verified that the majority of cases (62.6%) culminate in this care modality. This observation was observed in previous studies indicating that approximately 50% of hospitalizations in pediatric ICU occur due to the ARI, therefore, lower than that found in this trial [8].

Of the 451 children admitted with the ARI diagnosis in the ICU of the hospital studied, 53.4% were male, since it is similar to the study in Paraíba, published in 2013, showing that the majority of the children hospitalized in a public hospital were the with a total of 56%, as well as in another study carried out in São Paulo, with a sample of 315 patients, which showed a prevalence of 53% [8-9].

In order to explain this fact, researches were carried out in the United Kingdom and the latter reached the conclusion that the male gender is probably more affected, due to factors related to the lower caliber of the airways [10-11].

As for the age group, the most observed was that of children from one to six years of age, making up a percentage of 61.9%. However, the authors surveyed showed different results of these, with a greater hospitalization in children below one year. For example, a survey conducted in São Paulo showed that 50% of the children evaluated belonged to the age group between four and eight months [12].

It is also observed that studies that evaluated the mortality of children by ARI occurred in children un-

der one year of age to the anatomical, physiological and immunological differences. These differences increase vulnerability in this age profile [13].

An explanation for the fact that the results found in the current research are different from the literature found probably resides in the profile of the hospital studied, which only receives children under one year, when the specialized service in State Pediatrics cannot receive.

Regarding the initial diagnosis by ICD10-J96.0, it was noticed that, in this study, the percentage was 99.7%. This data surpassed the results of a survey conducted in Sobral, Ceará, in which 42.9% had non-specific respiratory failure [14]. It is believed that the result of the high percentage in this research is due to the source of the data collected. The patient's chart was recorded in the information system, after the implementation of the electronic system, i.e. between 2010 and 2015, all data were entered after the patient's hospitalization and not concomitant to their hospitalization. This may interfere with data quality.

A study carried out in the United States of America in 2015 indicates that, while developed countries have a significant contribution to morbidity in children under five years of age, in developing countries these infections tend to be more serious and operate as a morbidity, and mortality.

Regarding the origin, 77.4% of the children came from the interior of Piauí. A study carried out to analyze the socio-environmental risk for the invol-

vement of pneumonia in children in the State of Pernambuco in 2004 found a percentage of 44.4% of children under the same conditions [16].

Some factors can be listed to justify these results, such as: the difficulty of access to health services and the low socioeconomic conditions of these States, marked by deficiencies in basic sanitation, unemployment, low income, insufficient education, impaired nutrition and health care. Such factors, when associated, may aggravate the ARI [17].

It should be noted that this behavior differs between Brazilian regions and between developing and developed countries. In the latter and in the South and Southeast regions of Brazil, the hospitalization profile of children with ARI are predominant in urban areas, regions with low air quality, changes in climatic temperature and relative humidity. This geographical distribution of the disease also points to social and economic differences and tends to influence the occurrence in populations of different social development scenarios [15-18].

Still on the severity of the children, only 0.7% left this unit with an improved health status, while 19.3% evolved to death. The majority (77.4%) had an administrative closure, a term used for children who developed some co-morbidity during their hospitalization, which led to a change in the primary diagnosis of ARI, a fact that, consequently, increased permanence and, in this ten days of hospitalization.

These percentages are in agreement with Brazilian studies that have a mean hospitalization rate that varies between four to 11 days, however, differing from a survey conducted in the United Kingdom, where the permanence rate of children is less than two days. The authors are emphatic in stating that a longer dwell time culminated with a worse outcome. These still report that these high rates of stay in Brazilian ICUs are due to difficulties in conducting the clinical case by the medical team, as well as by poor quality of care by the rest of the team [19-20].

Regarding the death rate, revealed in the results above, both in the univariate tables and in the multivariate tables, some considerations have to be highlighted. Research shows that the vast majority of children who have died have some complications, and the prolonged length of stay mentioned above may increase these complications. Another factor is the delay in the referral of children to care in tertiary hospitals [21].

In this study, it can be added that the system of reference and counter-referral in the public health system is inadequate and does not even exist for this specific situation, since most of the regional health units in the interior do not have human, technical and technological resources to attend to the management of children in the recovery phase of ARI and its complications. This situation favors an increase in the length of ICU stay, the occurrence of iatrogenies, and infant mortality in children under six years of age.

Therefore, it is assumed that mechanisms of care regulation lack more equitable alternatives, in order to guarantee the access of children living in more distant geographic territories and living with greater signs of social inequality, factors that influence the occurrence of infectious diseases, as is the ARI.

## Conclusions

It was observed that the main characteristics of this population show a prevalence of males and between one and six years of age, different, therefore, from the vast majority of age groups admitted to ICUs in Brazil and the World, where there is a prevalence of younger than one year.

It is worth mentioning that the health service studied represents the second option for the hospitalization of children who need hospitalization in the ICU, and may conclude that this would be an explanation for the difference between the reality investigated and the studies analyzed.

The predominance of hospitalized children coming from the interior of the State is possibly due to the difficulties inherent in primary and secondary care in the cities of the interior, as well as in the problem of regulation in the referral system. This situation favors the high stay of hospitalization in pediatric ICU, thus reducing the low turnover of beds and restricted access of other children in similar conditions of gravity.

Faced with this sum of negative effects, then clinical signs of somber prognoses and infant deaths appear. Notably, possible reversal. It is also demonstrated that there are important regional differences in the provision of health services between the most distant regions of the centers, in the distribution of qualified health professionals, and in access to health care alternatives in scenarios of social and economic inequality.

The ARI is an infectious disease that manifests itself with greater prevalence in less developed regions and unassisted by public health services. Even so, it is recommended that future analyses can contemplate the family income, schooling and death rate by ARI, in order to avoid possible biases of information.

Among the limitations of this work is the administrative nature of the HUT Information System database, as there may be possible errors in coding and filling in this information. In addition, there are the restricted number of similar and current searches for comparative purposes. The studies carried out in other municipalities occurred some years ago. Therefore, potential biases arising from these limitations may arise.

Finally, it was verified, as in Brazil and in the world, in Teresina, that the ARI constitute a serious public health problem, especially in childhood, since it represents a high prevalence of hospitalizations in specialized treatment units, requiring high technology and high costs and, when they produce complications, translate high morbidity and mortality, hospitalization time, compromising the prognosis

of children attending emergency and emergency services.

It is recommended that individual and collective educational and preventive actions be implemented through more equitable health care policies, in order to reduce social inequalities in health care coverage to populations far from urban centers, in order to interrupt the cycle of severity of the causes of ARI in children and thus improving the prognosis of cure and reduction of hospitalizations and ICUs for this same cause.

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