

## Profile of hospitalizations in Pediatric Intensive Care Units of the Brazilian Unified Health System in the state of Pernambuco, Brazil

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**Abstract** *In Brazil, the distribution of pediatric intensive care units (PICUs), causes of admission, costs incurred and how care is provided are still poorly understood. The objective was to describe the profile of hospitalizations in the PICUs of the Brazilian Unified Health System in the state of Pernambuco, in 2010. A cross-sectional study was performed, with 1,915 hospitalizations in the six PICUs, collected in the Hospital Information System. The variables were compared by age group. There was a predominance of male hospitalizations (58.1%), an age range of between one and four years old (32.5%), the use of philanthropic units (64.1%) and type III PICUs (59.2%) and admissions due to neoplasms (28.9%). The mean hospital stay was 14.4 days, and the mean cost was BRL 6,674.80. The mean distance between the municipality of residence and the PICU ranged from 8.7 to 486.5 km. There were 207 deaths (10.8/100 admissions), of which 30% were due to infectious and parasitic diseases. Differences were identified between the age groups ( $p < 0.05$ ), except regarding gender. In conclusion, admissions to PICUs in Pernambuco show differences in geographical access and sociodemographic characteristics, admissions, and causes of hospitalization and death among age groups.*

**Keywords** *Pediatric intensive care units, Hospital information systems, Morbidity, Hospital costs, Access to health services*

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## Introduction

Pediatric intensive care emerged approximately 50 years ago<sup>1</sup>. However, it was only with the technical, therapeutic, and scientific advances from the 1980s that the expansion of pediatric intensive care occurred, which led to the implementation of specific units for the treatment of critically ill children in various parts of the world<sup>2</sup>, including Brazil<sup>1</sup>. Pediatric intensive care units (PICUs) with continuous specialized professional attention, specific materials and technologies necessary for diagnosis, monitoring and treatment<sup>3</sup> have contributed to significant changes in the treatment and prognosis of children with severe conditions<sup>4</sup>, saving and prolonging lives<sup>5</sup>. In turn, they represent one of the main consumer sectors of the hospital budget<sup>6</sup>.

In Brazil, despite the increase of intensive care in recent decades, inequalities persist in the distribution of beds and in the quality of care provided<sup>7</sup>. The distribution and structure of the PICUs, the main causes of admission, the costs incurred and the way in which intensive care is provided in the country are poorly understood<sup>1</sup>. Moreover, among studies that have addressed the admissions characteristics in PICUs, most involve a single tertiary referral center, both in the national<sup>2,4,5,8-10</sup> and in the international<sup>11-14</sup> scientific literature.

To adequately manage the health care network for children, it is essential to characterize PICUs and the care they provide. In this sense, the Hospital Information System (SIH)<sup>15</sup> enables the analysis of several aspects of pediatric intensive care practiced in the Brazilian Unified Health System (SUS) network, although the SIH is still rarely used for this purpose. This study, based on the PICUs hospitalizations from the SIH database, can contribute to the planning and management of the SUS pediatric intensive care network and, consequently, to the organization of services and the quality of care to critically ill patients. The objective of the study was to investigate the profile of hospitalizations in the PICUs of the SUS network in the state of Pernambuco, in 2010, regarding sociodemographic characteristics, geographic access to care, reason for admission, causes of hospitalization and death, and verification of any differences between the age groups of the users.

## Methods

A cross-sectional study was performed on the PICU hospitalizations that occurred in Pernambuco in 2010. This year, the SUS network of Pernambuco had six PICUs, all of which were located in the city of Recife, the state capital. Two PICUs belonged to the philanthropic network and four to SUS's own network, totaling 55 beds. These PICUs admit pediatric patients who are in a critical health state and who live in one of the 184 municipalities of Pernambuco, in the district of Fernando de Noronha, or in neighboring states.

All hospitalizations occurring in SUS care network PICUs that were listed in the SIH databases in 2010 were included in the study regardless of age or any other characteristic. In addition to the Hospital Hospitalization Authorization (AIH), admission to an SUS PICU requires a special procedure report whose data are entered into the SIH database. SIH considers the amount of AIH paid as hospitalizations; this excludes the amount due to an extension of hospitalization, which is issued to long-term patients. This amount was used as an approximation of the number of hospitalized patients because transfers and readmissions generate new AIHs<sup>16</sup>. The monthly databases of the SIH were collected from the page of the Department of Informatics of the SUS (Datusus; <http://www2.datusus.gov.br/DATASUS/index.php?area=0901>).

From the total 2010 admissions in SUS hospitals ( $n=543,720$ ), hospitalizations with ICU daily rates ( $n=14,965$ ) were selected, followed by those that occurred in PICUs ( $n=1,915$ ). Variables were studied that related to the sociodemographic characteristics of the patients (sex, age group, place of residence), the geographic access to intensive care, the nature and type of the PICU, costs, length of stay, assistance procedures and causes of admission and death. PICUs were classified into three types (I, II and III) in increasing order of complexity according to the availability of services at the hospital and the human resources, materials and equipment in the unit, as recommended by the Ministry of Health<sup>17</sup>.

All variables studied, except for the geographical distribution of hospitalizations, were described for four age groups; absolute and relative frequencies were obtained, and the hypothesis of homogeneity of proportions was verified

by means of the Pearson chi-squared test with a 5% level of significance. The following results were obtained: mean monthly number of hospitalizations, mean stay (in days), amounts paid by SUS (costs in BRL) and lethality rate (number of deaths per 100 admissions).

For the geographical distribution of hospitalizations, which was assessed according to the place of residence of the patients, a total of 131 admissions were excluded due to the patient residing in a municipality of another state or in the district of Fernando de Noronha. A choropleth map of hospitalizations according to the municipality and the mesoregion of residence was created. For each mesoregion of the state (Sertão, Agreste, Mata and Metropolitan Region of Recife-MRR), the mean euclidian distance between the municipal seats of residence and hospitalization (Recife) was calculated. This distance (in km) was used to indicate the geographical access to PICU care by SUS users who resided in the state.

The causes of hospitalization and death were grouped according to the chapters on morbidity and mortality of the International Statistical Classification of Diseases and Related Health Problems - Tenth Revision (ICD-10)<sup>18</sup>, and those with the greatest magnitude were specified. The primary diagnosis that justified the admission was used as a cause for hospitalization, which was defined after PICU discharge according to the standardization of SIH-SUS<sup>16</sup>. The study was approved by the Ethics Committee on Human Research of the main institution to which the work is linked. The study was carried out exclusively with secondary data without information that could identify the individuals and respected the ethical principles contained in the Resolution of the National Health Council (CNS) No. 466 of December 12, 2012.

## Results

In 2010, there were 1,915 PICU admissions in the SUS network in the state of Pernambuco, corresponding to a mean monthly hospitalization of 160 (Table 1). The 1-4-year-old age group presented the highest proportion of hospitalizations, followed by children less than one year old. A total of 58.4% of PICU hospitalizations occurred in these two groups, with respective mean monthly hospitalizations of 52 and 41. For the age groups of 5-9 years and  $\geq 10$  years, the mean monthly hospitalizations were 34 and 32, respec-

tively. The mean length of stay in the PICU for the total hospitalizations was 14.4 days, ranging from 18.7 days for children under one year old to 11.7 days for children  $\geq 10$  years old. In the 1-4 and 5-9-year-old age groups, the mean stays were 14.3 and 11.9 days, respectively.

The total hospitalization cost was BRL 12.8 million, which corresponded to a mean of BRL 6,674.80 per hospitalization paid by SUS (Table 1). The cost decreased with increasing age and corresponded to BRL 8,361.50, BRL 7,089.23, BRL 5,563.79 and BRL 5,022.60 for children under one year old, 1-4 years old, 5-9 years old, and  $\geq 10$  years old, respectively. There were 207 deaths, corresponding to a monthly mean of 17 deaths. The highest occurrence of deaths was observed in children under one year old (40.1%), and the lowest was in the 5-9-year-old children (14.0%). Regarding the mortality rate, 10.8 children died per 100 admissions. However, there were differences in relation to age group: the mortality rate in children under one year old (16.7/100 admissions) was 2.4 times higher than the lowest observed rate (7.1/100 admissions), which was found for the 5-9 year olds.

Among patients residing in Pernambuco (Figure 1), 23 municipalities (12.4%) had no hospitalized residents. In turn, 75 municipalities (40.5% of the total) contributed one to four hospitalizations, 45 municipalities (24.3%) contributed five to nine hospitalizations, and 42 municipalities (22.8%) contributed 10 or more hospitalizations. Regarding the mesoregions, 44.7% of the hospitalizations corresponded to residents from MRR municipalities, followed by residents from Agreste (24.6%), Mata (16.3%) and Sertão (14.0%). All PICUs were located in the state capital, and patients residing in the MRR had the lowest displacement, with a mean euclidian distance between the municipal seat of residence and the PICU of 8.7 km. In contrast, this distance was 486.5 km for residents of Sertão. Intermediate distance values were found for residents in Agreste and Mata, which were 152.4 km and 77.0 km, respectively.

The majority of patients admitted to PICUs were male (58.1%), but there was no statistically significant difference ( $p = 0.967$ ) among the studied age groups (Table 2). Hospitalizations were predominant in the philanthropic network units (64.1%) and type III PICUs (59.2%). A higher frequency of hospitalizations in SUS network PICUs and type II PICUs occurred in children less than one year old. The distribution of hospitalizations according to the nature and

**Table 1.** Characteristics of the hospitalizations and deaths in PICUs by age group. Pernambuco, 2010.

Variables	Age group				Total
	< 1 year	1-4 years	5-9 years	≥ 10 years	
Hospitalizations					
Nº (%)	496 (25.9)	622 (32.5)	411 (21.5)	386 (20.2)	1915 (100.0)
Average monthly (Nº)	41	52	34	32	160
Average stay (in days)	18.7	14.3	11.9	11.7	14.4
Average cost (in BRL)	8,361.50	7,089.23	5,563.79	5,022.60	6,674.80
Deaths					
Nº (%)	83 (40.1)	53 (25.6)	29 (14.0)	42 (20.3)	207 (100.0)
Average monthly (Nº)	7	4	2	4	17
Lethality rate (%)*	16.7	8.5	7.1	10.9	10.8

\* Lethality rate: number of deaths per 100 hospitalizations

type of PICU presented differences between the age groups ( $p < 0.001$ ). When the length of stay was categorized, it was observed that 68.7% of admissions lasted up to 14 days, with differences between the age groups ( $p < 0.001$ ).

Differences were also observed between age groups ( $p < 0.001$ ) regarding the procedures performed in hospitalizations (Table 2). There was predominance of clinical procedures, except for those under one year old, in which 52.8% of the procedures were surgical. Among the 1,095 hospitalizations in which clinical procedures were performed, cancer therapy was the most frequent (40.1%). Regarding the 809 hospitalizations with surgical procedures, the highest frequency was found for surgery of the circulatory system (37.7%).

Regarding the causes of hospitalization and death (Table 3), differences between age groups were observed ( $p < 0.001$ ). The leading cause of hospitalization (ICD-10 chapter) was due to neoplasms (28.9%), followed by congenital malformations (19%), infectious and parasitic diseases (13.7%), the respiratory system (13.7%) and the digestive system (9.4%). From one year of age, there was no difference between the age groups regarding the ranking occupied by the first three causes of hospitalization. In children under one year of age, congenital malformations were the most frequent cause of hospitalization, while neoplasms were the sixth most frequent cause.

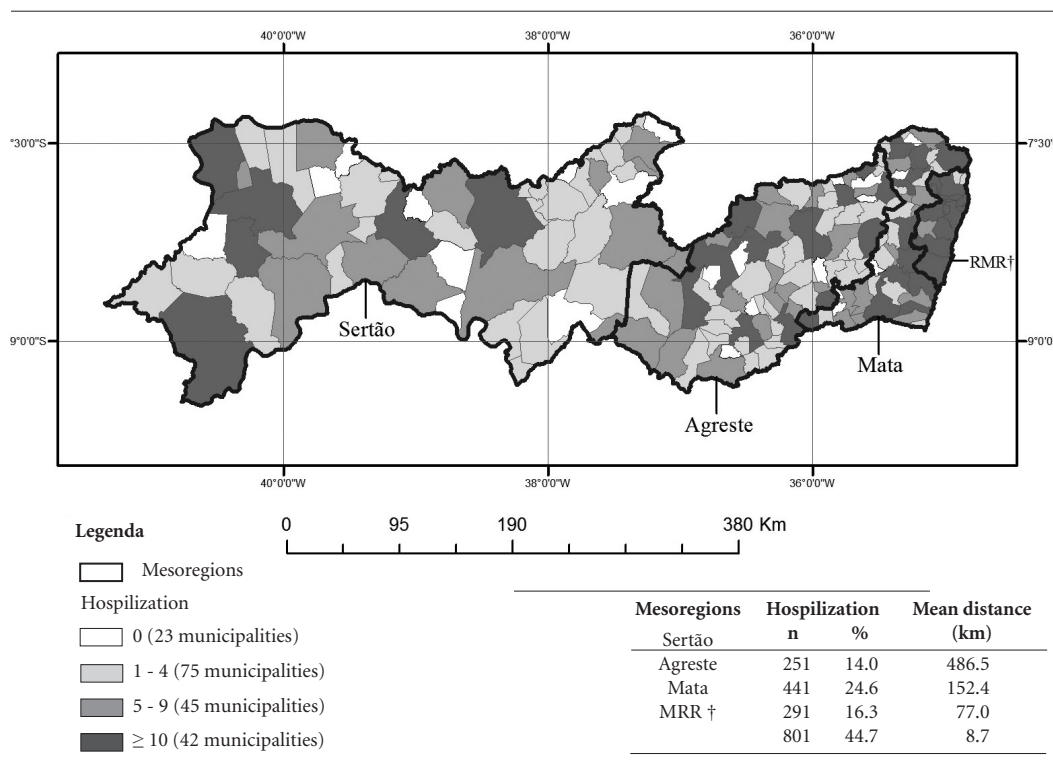
Infectious and parasitic diseases predominated as the cause of death (30%) (Table 3), followed by neoplasms (14%), congenital malformations (13.5%) and diseases of the respira-

tory system (12.6%). In all age groups, infectious and parasitic diseases were also the main cause of death with the exception of the 5-9 year-olds, in which infectious and parasitic diseases occupied the second place after neoplasms.

## Discussion

This study identified the magnitude of hospitalizations and deaths in all SUS PICUs in Pernambuco and showed differences among the age groups regarding their characteristics. The study also revealed the spatial concentration of PICUs in hospitals located in the state capital and indicated the existence of inequality regarding geographical access to intensive care by the pediatric population residing in more distant areas.

Information about the PICU characteristics of a given region is scarce<sup>1,19,20</sup>, and no studies of this nature in the states of the northeastern region of Brazil have been identified. In this regard, it is emphasized that the inclusion of all PICUs in the SUS-PE network in the study was possible due to the availability of information in the SIH/SUS regarding the characteristics of the users and the care provided. The use of this system as a source of data for investigations is increasing due to its agile production and improvements of the database quality, in addition to the ease of access<sup>21</sup>. An exception to this is the primary diagnosis for admission and death, which is less reliable, especially when the cause is best specified<sup>22,23</sup>. To minimize the possibility of bias, it is recommended that the main diagnosis be grouped ac-



**Figure 1.** Characteristics of the geographical distribution of PICU hospitalizations by municipality and mesoregion of residence. Pernambuco, 2010.

A total of 129 hospitalizations of residents in municipalities of other states and two hospitalizations of residents in the territory of Fernando de Noronha were excluded. \* Mean euclidian distance between the municipal seats of residence and location of the PICU (Recife). † Metropolitan Region of Recife.

ording to the chapters of ICD-10<sup>24</sup>, which was the strategy used in the current study.

A comparison of the findings across several studies of PICU hospitalizations has limitations because different units have different characteristics, such as the age of the admitted patients, causes of admission, availability of resources in the hospital and attributes of the local population. Nevertheless, it has been found that the majority of PICU admissions are for infants<sup>2,4-6,8,11,13,25-27</sup> and are due to characteristics inherent to this age group, in which the immune system is still not fully developed, making them more susceptible to diseases and complications requiring intensive care<sup>4,5</sup>.

In the current study, hospitalizations of children between one and four years of age predominated, which corroborated observations from a unit in Uruguay<sup>28</sup> and from a unit in the capital of São Paulo state<sup>9</sup> where admissions of children in this age group were higher than those

observed in children under one year. Notably, approximately 60% of hospitalizations occurred in children under five years of age, with a subsequent decrease with the increase of age. This differs from the profile of a PICU in Ethiopia, where the predominant age range was 10 to 14 years of age<sup>29</sup>.

The mean length of stay (14.4 days) was higher than that observed in other studies in Brazil (5.5 days in Botucatu-São Paulo<sup>8</sup>; 7.3 days in Maringá-Paraná<sup>5</sup>; 6.6 to 8.9 days in Porto Alegre-Rio Grande do Sul<sup>4</sup> and 9.7 days in São Paulo city<sup>9</sup>) and Colombia (5.0 days in Medellín<sup>13</sup>). However, these studies took into account only one unit, whose characteristics of demand and service may have contributed to the shorter observed hospitalization times. Children under one year of age had longer stays and higher hospitalization costs. This finding corroborates that described by Chalom et al.<sup>30</sup>, who found that hospital stay time is the variable with the highest correlation to the

**Table 2.** PICU hospitalizations according to sex, characteristics of the units, length of stay and procedures performed by age group, Pernambuco, 2010.

Variables	<1 year		1-4 years		5-9 years		≥10 years		p*	Total	
	n	%	n	%	n	%	n	%		n	%
	(496)	(100.0)	(622)	(100.0)	(411)	(100.0)	(386)	(100.0)		(1915)	(100.0)
Sex											
Male	290	58.5	365	58.7	237	57.7	221	57.3	0.967	1113	58.1
Female	206	41.5	257	41.3	174	42.3	165	42.7		802	41.9
Nature of the PICU											
SUS's own network	257	51.8	203	32.6	99	24.1	128	33.2	<0.001	687	35.9
Philanthropic Network	239	48.2	419	67.4	312	75.9	258	66.8		1228	64.1
Type of PICU											
PICU II	288	58.1	239	38.4	115	28.0	139	36.0	<0.001	781	40.8
PICU III	208	41.9	383	61.6	296	72.0	247	64.0		1134	59.2
Length of stay											
≤3 days	63	12.7	76	12.2	67	16.3	44	11.4	<0.001	250	13.1
4 - 7 days	89	17.9	168	27.0	114	27.7	107	27.7		478	25.0
8 - 14 days	133	26.8	195	31.4	125	30.4	133	34.5		586	30.6
15 - 21 days	82	16.5	61	9.8	45	10.9	58	15.0		246	12.8
22 - 28 days	35	7.1	37	5.9	15	3.6	22	5.7		109	5.7
29 days and more	94	19.0	85	13.7	45	10.9	22	5.7		246	12.8
Procedures performed †											
Clinical procedures	234	47.2	352	56.6	273	66.4	236	61.1	<0.001	1095	57.2
Surgical Procedures	262	52.8	270	43.4	135	32.8	142	36.8		809	42.2
Organ, tissue and cell transplants	-	-	-	-	3	0.7	8	2.1		11	0.6

\* p value is derived from a Pearson chi-square test. † Pearson chi-square test was applied to the clinical and surgical procedures by age group.

**Table 3.** Causes of hospitalization and death in PICUs by age group. Pernambuco, 2010.

Variables	< 1 year		1-4 years		5-9 years		≥ 10 years		p*		Total	
	N°	%	N°	%	N°	%	N°	%	N°	%	N°	%
Main cause of hospitalization (Chapter ICD-10)												
Neoplasms	37	7.5	201	32.3	173	42.1	142	36.8	< 0.001	553	28.9	
Congenital malformations	118	23.8	127	20.4	60	14.6	59	15.3		364	19.0	
Infectious and parasitic diseases	88	17.7	80	12.9	50	12.2	45	11.7		263	13.7	
Diseases of the respiratory system	66	13.3	68	10.9	18	4.4	28	7.3		180	9.4	
Diseases of the digestive system	74	14.9	26	4.2	8	1.9	10	2.6		118	6.2	
Diseases of the nervous system	17	3.4	49	7.9	29	7.1	9	2.3		104	5.4	
Diseases of the circulatory system	18	3.6	15	2.4	17	4.1	15	3.9		65	3.4	
Diseases of the genitourinary system	3	0.6	14	2.3	14	3.4	25	6.5		56	2.9	
External causes	1	0.2	13	2.1	16	3.9	22	5.7		52	2.7	
Other chapters †	74	14.9	29	4.7	26	6.3	31	8.0		160	8.4	
Total	496	100.0	622	100.0	411	100.0	386	100.0		1915	100.0	
Cause of death (Chapter ICD-10)												
Infectious and parasitic diseases	22	26.5	15	28.3	10	34.5	15	35.7	< 0.001	62	30.0	
Neoplasms	2	2.4	4	7.5	11	37.9	12	28.6		29	14.0	
Congenital malformations	19	22.9	5	9.4	2	6.9	2	4.8		28	13.5	
Diseases of the respiratory system	9	10.8	10	18.9	1	3.4	6	14.3		26	12.6	
Other chapters ‡	31	37.3	19	35.8	5	17.2	7	16.7		62	30.0	
Total	83	100.0	53	100.0	29	100.0	42	100.0		207	100.0	

\* p value is derived from a Pearson chi-square test. † In children under one year of age, perinatal conditions have overcome neoplasms, being the fifth cause of hospitalization. Endocrine, metabolic and nutritional diseases represented the ninth most frequent hospitalization cause in the age range of 5-9 years, overcoming diseases of the digestive system; and in the age group ≥ 10 years, represented the seventh cause, more frequent than diseases of the circulatory system. ‡ In children under one year of age, diseases of the digestive system have overcome diseases of the respiratory system as the cause of death. After 10 years of age, the external causes exceeded the congenital malformations.

hospitalization costs, which are associated with a greater disease severity and the appearance of complications.

The mortality rate described in PICUs<sup>2,4,5,8,11-14,20,28,31</sup> ranges from 6.7%<sup>12</sup> to 36.1%<sup>14</sup>, which is a very wide range; the value observed in the PICUs of Pernambuco (10.8%) lies within this range. This rate was influenced by the PICU, which accounted for approximately 60% of hospitalizations in Pernambuco; in previous studies the mortality rate of this unit was found to be 9%<sup>32</sup> and 10.2%<sup>33</sup>. The greatest mortality was observed in the youngest patients<sup>4,5,13</sup>, which differed from a study carried out in the PICU of Porto Alegre-Rio Grande do Sul<sup>10</sup> where the mortality rate increased with increasing age. The predominance of admissions in males<sup>4,5,8-14,29</sup>, previously described by several authors, was also observed in this study for all age groups, but with no significant difference between them.

Regarding the place of residence, approximately 45% of the admissions were of residents from the Metropolitan Region of Recife. This mesoregion is composed of 14 municipalities and contains 42% of the population of the state; all the PICUs in the SUS network are located in its municipal seat (Recife). As a result of this geographical concentration of PICUs, users residing in 147 of the 170 municipalities of the other mesoregions of the state traveled considerable distances to obtain intensive care. Although it is desirable to locate PICUs in municipalities that have hospitals with better structures, resources and qualified personnel, in the case of Pernambuco the PICUs are all located in the capital, which represents an important inequality regarding access to intensive care.

Patients living in the municipalities of Sertão traveled over 480 km on average, and those living in Agreste traveled more than 150 km to access intensive care. If the measured distances had considered the road network, which was not possible with the secondary data used, these values would be even higher. An example of this is the municipality of Sertão, which is located 730 km from the state capital and had a mean of three residents per month admitted to PICUs located in the city of Recife.

The regionalization of tertiary care, more specifically of pediatric intensive care, requires evaluation by the state to assure patient access to the required care without the barriers of large distances to be covered in order to access care. The lack of equality in the geographical distribution of PICUs limits the access of patients residing in

municipalities more distant from Recife and penalizes a large portion of the population. In the municipality of São Paulo, de Souza *et al.*<sup>1</sup> refers to the inadequate public transportation of critically ill children, which undermines their clinical condition. Although this issue was not investigated in this study, it is likely that this situation is commonplace in Pernambuco, which increases the inequality in the geographical distribution of PICUs in the state. It is therefore important to have an effective system to control vacant spaces and transport options for critically ill children to minimize the negative effects of the geographical concentration of PICUs. In addition, the implementation of programs for the prevention and management of childhood illnesses and accidents can contribute to reduce the need for PICU hospitalizations.

Most of the admissions were made in the two PICUs of the philanthropic network, one of which houses the largest number of beds and is the only type III unit in the state. The type of procedures performed in a PICU depends on the characteristics of the hospital and the intensive care units located within them, which influences the profile of the admitted patients. In this study, the higher frequency of clinical procedures is compatible with that found in some PICUs<sup>4,5,9,11</sup>. However, in others, there was a predominance of surgical procedures<sup>6,8,14,25</sup>. In all of the studied units, surgical procedures only predominated in children under one year of age, although three PICUs are located in hospitals with pediatric surgery capability and three others are located in hospitals that perform heart surgery in children. In children under one year of age, the higher frequency of surgical procedures, among which circulatory surgeries predominate, probably stems from the fact that congenital malformations are the primary cause of admission to the PICU in this age group.

Among the causes of admission to PICUs, neoplasms ranked first both overall and in all groups of patients older than one year. This characteristic was also observed in a Greek PICU<sup>11</sup>, but differs from that found in other units<sup>5,9,12,28</sup> in which respiratory causes predominated. The higher occurrence of chronic diseases in all PICUs studied in Pernambuco may be related to the characteristics of the units and the hospitals in which they are located, in addition to the inequality of geographical access. Therefore, one should investigate the possibility of patients who do not live in the state capital but who need intensive care due to acute illnesses not being trans-



ferred to the capital where the PICUs are located.

Infectious and parasitic diseases represented the most common cause of death, except for patients between five and nine years old. This differs from what was observed in Maringá-Paraná<sup>5</sup> and in Botucatu-São Paulo<sup>8</sup>, where respiratory diseases were more frequent. In the PICU of the capital of São Paulo<sup>9</sup>, neoplasms were the main cause of death, and in an Ethiopian unit<sup>29</sup>, trauma was the main cause of death (external causes).

In general, when the diagnosis is early, most infectious and respiratory diseases are easier to manage and do not require many resources and advanced technology when compared to chronic conditions<sup>5</sup>. Infectious and parasitic diseases as the main cause of death in the PICU suggest deficiencies in the health care network and in the social structure of the state because they are extremely dependent on better living conditions and are sensitive to primary prevention.

It should be emphasized that the findings of this profile can contribute to the management of the Pernambuco health care network, influenc-

ing decisions about the most appropriate locations and structures of the PICUs, the allocation and qualification of personnel, and the provision of equipment and supplies, improving access and quality of care provided in the state. To guarantee good quality of pediatric intensive care, it is not sufficient to only adjust the bed supply and the structure of the units (physical, material, human and financial resources). It is also necessary to improve care processes, with sustained investment in the training and continuing education of the entire health care team, and to invest in specific research areas for the sector.

In conclusion, in Pernambuco, PICU hospitalizations predominate in philanthropic and type III units, are most prominent for 1-4-year-olds, and are primarily due to neoplasias. There are inequalities in the geographical access to hospitalization and the characteristics of the age groups. Clinical procedures outperform surgical procedures, and infectious and parasitic diseases are the main cause of death in PICUs.

## Collaborations

JG Mendonça participated in the design, data collection, analysis and interpretation of data and writing of the article. VG Mendonça participated in the design, interpretation of data and revision of the article. MJB Guimarães participated in the design, analysis and interpretation of the data and writing of the article. CG Mendonça participated in the data collection and revision of the article. JL Portugal participated in the analysis and interpretation of the data and revision of the article.

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