

Comparative study of drug utilization and drug expenses in Pediatric Intensive and Semi-intensive Care Units

Estudo comparativo do consumo e gasto com medicamentos em Unidades Pediátricas de Terapia Intensiva e Semi-intensiva

Estudio comparativo del consumo y gasto con medicamentos en Unidades Pediátricas de Terapia Intensiva y Semi-intensiva

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ABSTRACT

Objectives: To describe and compare the medication consumption and expenditure on medication at pediatric intensive and semi-intensive care units.

Methods: We conducted a retrospective, exploratory, descriptive study using a quantitative approach based on simple descriptive statistics. Data collection was conducted from June 2007 to May 2008 at the pediatric intensive and semi-intensive care units of a teaching hospital located in the state of São Paulo (Brazil). The ABC classification was used.

Results: The mean expenditures/bed of the Cardiology Unit was US\$ 880.50±0.16 bed/month. The mean expenditure/bed of the Neonatal Unit was US\$ 962.26±0.16 bed/month. The expenditure was lower in the Pediatric Intensive and Semi-intensive Care units (US\$ 163.52±0.08 bed/month). There was a significant variation in the monthly expenditure on medications regardless of the occupational rate. In Class A items, the ten most expensive medications accounted for 57.1, 54.3, and 46.3% of the Intensive Care Unit (ICU) budget, respectively, in the Cardiology, Neonatal, and Pediatric ICUs. At the Neonatal ICU, class C items corresponded to the ten most used medications, accounting for 6.6% of the Neonatal ICU budget, whereas at the other units, class C items corresponded to the eight most used medication, accounting for 7.8% of the Cardiology ICU budget and 7.7% of the Pediatric ICU budget.

Conclusion: The ABC classification enabled the identification of medication consumption and expenditures

on medication. This method enhances the management of resources at the units assessed.

Key-words: economics, nursing; hospital costs; drug price; intensive care units, pediatric; intensive care units, neonatal.

RESUMO

Objetivo: Descrever e comparar o consumo e gastos com medicamentos em Unidades de Terapia Intensiva (UTI) e Semi-intensiva Pediátricas.

Métodos: Estudo descritivo, exploratório, retrospectivo, com abordagem quantitativa por meio de estatística descritiva simples. A coleta de dados ocorreu no período de junho de 2007 a maio de 2008 nas UTI e Semi-intensiva Pediátricas de um hospital de ensino do interior do Estado de São Paulo, utilizando-se a classificação ABC.

Resultados: O gasto médio/leito da Unidade Cardiológica foi de R\$ 1.400,00±0,26 leito/mês e da Neonatal de R\$ 1.530,00±0,27 leito/mês, sendo menor na UTI e Semi-intensiva Pediátrica (R\$ 260,00±0,13 leito/mês). Houve variação significativa do gasto mensal com medicamentos independentemente da taxa de ocupação. Na Classe A, os dez medicamentos de maior custo representaram 57,1, 54,3, e 46,3% do orçamento das UTI e Semi-intensivas Cardiológica, Neonatal e Pediátrica, respectivamente. Na Neonatal, os dez medicamentos mais consumidos corresponderam à Classe C, com 6,6% do orçamento, enquanto que nas outras unidades se enquadram oito, responsáveis por 7,8% do orçamento da Cardiológica e 7,7% da Pediátrica.

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Conclusões: A classificação ABC permitiu conhecer o consumo e os gastos com medicamentos; esse método favorece a gestão desses recursos nas unidades avaliadas.

Palavras-chave: economia da enfermagem; custos hospitalares; preço de medicamento; unidades de terapia intensiva pediátrica; unidades de terapia intensiva neonatal.

RESUMEN

Objetivo: Describir y comparar el consumo y los gastos con medicamentos en Unidades de Terapia Intensiva (UTI) y Semi-intensiva Pediátricas.

Métodos: Estudio descriptivo, exploratorio, retrospectivo, con abordaje cuantitativo mediante estadística descriptiva simple. La recolección de datos ocurrió en el periodo de junio de 2007 a mayo de 2008 en las UTI y Semi-intensiva Pediátricas de un hospital de enseñanza en el interior del Estado de São Paulo, utilizándose la clasificación ABC.

Resultados: El gasto medio/lecho de las Unidades Cardiológicas fue de R\$ 1.400,00±0,26 lecho/mes y Neonatal de R\$ 1.530,00±0,27 lecho/mes, siendo menor en la UTI y Semi-intensiva Pediátrica (R\$ 260,00±0,13 lecho/mes). Hubo variación significativa del gasto mensual con medicamentos, independiente de la tasa de ocupación. En la Clase A, los diez medicamentos de mayor costo representaron 57,1, 54,3 y 46,3% del presupuesto de las UTI y Semi-intensivas Cardiológica, Neonatal y Pediátrica, respectivamente. En la Neonatal, los diez medicamentos más consumidos correspondieron a la Clase C, con el 6,6% del presupuesto, mientras que en las otras unidades se encuadran ocho, responsables del 7,8% del presupuesto de la Cardiológica y 7,7% de la Pediátrica.

Conclusión: La clasificación ABC permitió conocer el consumo y los gastos con medicamentos; ese método favorece la gestión de esos recursos en las unidades evaluadas.

Palabras clave: economía de la enfermería; costos hospitalarios; precio de medicamento; unidades de terapia intensiva pediátrica; unidades de terapia intensiva neonatal.

Introduction

In Brazil, the political and economic crisis that has affected the health services made its management a big challenge, leading to low quality and productivity of these services⁽¹⁾, transforming the management of resources in one of the major concerns related to the activity of nursing professionals⁽²⁾. Cost management leads to the adoption of rationalizing measures,

and the balance between service quality and costs becomes a clear challenge⁽³⁻⁶⁾. In hospitals, for example, the pharmacy is responsible for ensuring the safe and rational use of the medications prescribed by doctors considering the needs of hospitalized patients. Therefore, managing the monthly expenditures on medications is a complex task^(4,7).

Cost management in nursing is an administrative process focused on the nurses' decision-making process related to an efficient rationalization in the allocation of the available and limited resources in order to achieve results that comply with the health needs of the clients and the needs/goals of the hospitals^(3,5). The nursing team should play an important role in cost management because it uses a significant amount of resources^(8,9).

In the hospital setting, cost control is very complex due to the heterogeneity of the "products" offered to the "consumers". At university and teaching hospitals, this heterogeneity is even greater because there is consumption of resources with three purposes: meeting the population's demand, teaching future health professionals, and conducting academic research in various health areas^(6,10). Therefore, it is important that cost management is performed using systemic methods⁽¹¹⁾. The ABC classification is an example of a method that divides the items by level of participation in the budget. This type of classification shows the priority items for measures of cost management.

According to Donabedian⁽¹²⁾, strategies for assessing quality in health care are focused on three aspects: structure, process, and results. The structure approach considers the resources required for the health care process, the adequacy of facilities and equipment, the management structure and tax organization, the qualification of the medical staff and the institution, the information systems and technical and administrative regulatory instruments. An appropriate structure makes it possible to achieve a good performance in the process and result areas. This demonstrates the importance of proper management of financial and material resources to avoid negative interference in the other approaches and to ensure high quality services.

Intensive Care Units (ICUs) are focused on the care of severe or high-risk patients, offering non-stop medical and nursing care, using specific equipment, specialized human resources, with access to other technologies for diagnosis and therapy⁽¹³⁾. These units are aimed at the recovery of the patient in a timely manner, within an appropriate psychological and physical environment, where all professionals should be prepared for complex activities⁽¹⁴⁾. In ICUs, the cost of medications is very high due to the simultaneous use of many medications and the increased use of high cost medications⁽¹⁵⁾. A previous study found that ICU patients receive twice as many medications as the patients of general care wards⁽¹⁶⁾.

Pediatric ICUs were created based on the adult and neonatal ICUs⁽¹⁷⁾. Since then, pediatrics and the emergence of increasingly sophisticated technological resources have promoted more effective treatments against severe diseases⁽¹⁸⁾. However, ICU treatments involve costs that consume between 5 and 30% of the financial resources of a hospital^(19,20). Furthermore, expenditures on medications account for a greater financial amount, followed by employee compensation and performance of additional tests. The amount spent with patients in an ICU depends on the clinical picture and severity of their diseases⁽¹⁹⁾.

In this context, the objectives of the present study were to describe and to compare the consumption and costs of medication in pediatric ICUs and semi-intensive care units (SICU), according to the ABC classification.

Method

We conducted a retrospective descriptive exploratory study with a quantitative approach about the consumption and expenditures on medications at pediatric ICUs and SICUs.

The hospital chosen to be the research setting is a university hospital located in a city in the state of São Paulo. This hospital is a reference center, providing inpatient and outpatient care in various medical specialties, with an average of 2,500 hospitalizations and 2,000 small, medium and large surgeries per month.

Critical patient care is provided at three ICUs and SICUs according to the specialties as follows: Pediatric ICU (six beds), Neonatal ICU (ten beds), and Cardiology ICU (ten beds), and Pediatric SICU (four beds), Neonatal SICU (ten beds), and Cardiology SICU (four beds).

The hospital provides health care to users of the Brazilian Unified Health System (SUS), as well as different private health insurance plan holders and out-of-pocket clients. 2008 data show a prevalence of SUS users, accounting for 77.8 and 98.2% at the Pediatric ICU and SICU, 81.2 and 75.7% at the Neonatal ICU and SICU, and 87 and 88.4% at the Cardiology ICU and SICU, respectively. It is important to mention that the remaining health care services were provided to holders of private health care insurance plans, and there were no out-of-pocket clients during the study period. In addition, the units had the following mortality rates: 14.8 and 10.5% at the Pediatric ICU and SICU, 15.8 and 1.8% at the Neonatal ICU and SICU, and 15.3 and 5.6% at the Cardiology ICU and SICU, respectively.

Data collection was performed from June 2007 to May 2008 after the research project was approved by the hospital and the Research Ethics Committee. The study was compliant with the resolution CNS 196/96 (Report No. 151/2009). The technology information system of the hospital provided data on the units

investigated, as well as demographic and clinical profiles of patients – gender, age, treatment modality, and medical diagnostics according to the International Classification of Diseases (ICD) –, as well as data on the medications administered.

The procedure used to perform the ABC classification began with the design of a spreadsheet using the computer program Microsoft Excel® 2003 and selecting the ten most often used medications and the most expensive medications in each unit, which were later classified according to the ABC curve. We analyzed the following variables: product description, quantity consumed, total cost (Real), and percentage represented by each item on the annual cost. This variable was calculated based on the total annual expenditure on medications of each unit.

In order to design the ABC curve, we followed the steps described by Paterno⁽²¹⁾: 1) overall consumption values were calculated for each purchase item during the study period – the overall value was reached by multiplying the unit cost of the product by the number of units consumed during the period; 2) the values of the items were arranged in descending order; 3) the accumulated amount spent was calculated by adding to the overall values of each item, taking note of the values after the addition of each portion to obtain the total amount consumed; 4) we calculated the cost percentage of each item by dividing its cost by the total amount spent; 5) similarly to step 3, we performed the calculation of the accumulated percentages; 6) items A, B and C were defined.

In the ABC classification, the items are grouped into classes, taking into account their economic importance: Class A (20% of items accounting for more than 60% of costs), Class B (20 to 30% of items accounting for 20 to 30% of costs), Class C (50% of items accounting for 10% of stock value)^(11,21).

Data analysis was performed using descriptive statistics: frequency and percentage.

Results

Three thousand two hundred and forty-one patients were treated at the Cardiology ICU and SICU; 2,527 (78%) of these were clinical cases and 714 (22%) needed to undergo surgery. Among these, there was prevalence of males (2000 - 62%) and most patients were younger than one year old (1,976 - 61%). The top ten diagnoses, in descending order, were: ventricular septal defect (13.0%), tetralogy of Fallot (8.9%), unspecified heart malformation (5.8%), atrioventricular communication (5.0%), double inlet ventricle (4.6%), toxic shock syndrome (4.4%), coarctation of the aorta (4.1%), interatrial septal defect (3.3%), discordant ventriculo-atrial connection (2.6%), and unspecified respiratory failure (2.1%).

The number of patients treated at the Neonatal ICU and SICU was 6,613, with 6,059 (92%) clinical cases and 554 (8%) surgeries. Of these, 54% were males (3,572). The top ten diagnoses, in descending order, were: preterm newborns (42.4%), respiratory distress syndrome of the newborn (27.5%), patent ductus arteriosus (2.8%), other respiratory distresses of the newborn (1.7%), sequelae of inflammatory diseases of the central nervous system (1.6%), other specified types of pneumothorax (1.3%), *Streptococcus pneumoniae* pneumonia (1.2%), extreme immaturity (0.9%), lumbar spina bifida without hydrocephalus (0.8%), and unspecified infection in the perinatal period (0.8%).

At the Pediatric ICU and SICU (ten beds), 3,263 children were treated, with 2,582 (79%) clinical cases and 681 (21%) surgeries. Most patients were males (1,879 - 58%) and there was a prevalence of children younger than one year old (1,123 - 4%). The main diagnoses were: respiratory failure and pneumonia (17.4%), protein-calorie malnutrition (11.6%), muscular dystrophy (11.1%), sequelae of inflammatory diseases of the central nervous system (8.7%), gastroesophageal reflux disease (3.1%), toxoplasmosis (3.0%), and acute lymphoblastic leukemia (2.7%).

As for the distribution of expenditures per unit (Table 1) at the Cardiology, Neonatal and Pediatric ICUs and SICUs, the most often consumed medications accounted for, respectively, 54.2, 50.7, and 66.5% of the total amount used, representing only 15.2, 6.6, and 14.4% of the budget of these units. We found that distilled water and saline were widely used by the three units in the preparation of medications. Ranitidine and domperidone were also significantly consumed at the Pediatric ICU and SICU, both accounting for 17.8% of the total amount used.

At the Cardiology, Neonatal and Pediatric ICU and SICU, the most expensive medications accounted for, respectively, 57.1, 54.3, and 46.3% of the budget, although they represented only 8.8, 1.3, and 30.2% of the total amount of medications consumed (Table 2). At the Neonatal and Pediatric ICU and SICU, an impressive fact was that only the expenditures on prolonged parenteral nutrition (PPN) accounted for 26.8 and 19.0% of the total costs, respectively. Conversely, the expenditures on milrinone, a medication used for pulmonary vasodilation, accounted for 11.4% of total value at the Cardiology ICU and SICU.

We found that the ten most often consumed medications (Table 1) did not significantly participate in the budgets of the units as much as the ten most expensive medications (Table 2), with a mean difference of 40.5%. This occurred because the most widely used medications in the period had a low cost.

Graph 1 shows that during the period of twelve months, the Neonatal ICU and SICU had the highest amount spent on medications (R\$ 351,500), whereas the Cardiology and Pediatric ICU and SICU reached the amounts of R\$ 166,400 and R\$ 29,800, respectively. It is noteworthy that, the Neonatal ICU and SICU had the largest number of beds and patients in the period studied.

As shown in Graph 2, the mean monthly expenditure on medications were R\$ 1,400.00±0.26 bed/month, R\$ 1,530.00±0.27 bed/month and R\$ 260.00±0.13 bed/month at the Cardiology, Neonatal and Pediatric units, respectively. The monthly expenses for the Cardiology and Neonatal units were up to five times higher than those of the Pediatric units.

In Graph 3, there was no joint variation in the monthly expenditure at the pediatric unit according to its occupancy rate in the period studied: standard deviation of 6% from mean occupancy rate (94%), and standard deviation of 51% compared to the mean monthly expenditure (R\$ 2,500.00). An interesting fact is that in February, the expenditure was approximately three times higher than in April, whereas the occupancy rate remained constant. This shows that the occupancy rate is not an explanatory variable for the increase in the amount of medications used. A similar trend was also observed at the Neonatal and Cardiology units.

According to the ABC classification, Class A included the ten most costly medications, which accounted for 8.8, 1.3, and 30.2% of medications consumed, constituting 57.1, 54.3, and 46.3% of the budget of the Cardiology, Neonatal and Pediatric units, respectively.

Class C included the ten most frequently consumed medications at the Neonatal ICU and SICU, accounting for 50.7% of medications consumed and 6.6% of budget, whereas the Cardiology and Pediatric units included eight of the most consumed medications, which accounted for 47.6 and 37.1% of medications consumed and 7.8 and 7.7% of budget, respectively. We considered only eight medications because terbutaline sulfate and calcium gluconate, at the Pediatric unit, and ranitidine and domperidone, at the Cardiology unit, were included among the ten most costly medications and, therefore, they belonged to Class A. In the present study, we presented only the items belonging to Class A and C for its relevance regarding management.

Discussion

The consumption and expenditures on medications depend on the profile of the patients as well as their severity. Thus, we will first discuss the population included in our study.

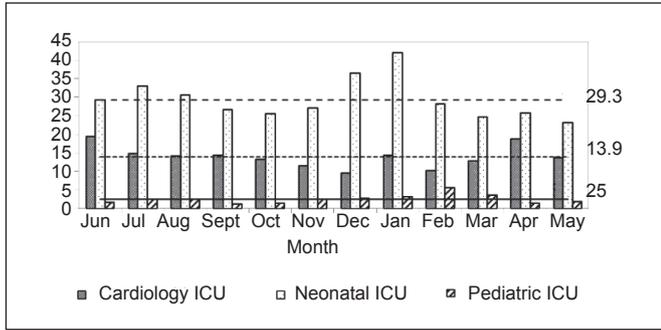
Table 1 - Description of the ten most common medications used at the Cardiac, Neonatal and Pediatric Intensive Care Units according to decreasing order of consumption from June 2007 to May 2008

Product	Cardiology Unit			Neonatal Unit			Pediatric Unit							
	Quantity n	Quantity (%)	Total value (R\$)	Product	Quantity n	Quantity (%)	Total value (R\$)	Product	Quantity n	Quantity (%)	Total value (R\$)			
Distilled water	23489	14.2%	2,035	1.2%	Distilled water	23,446	10.2%	2,031	0.6%	Domperidone	13,200	17.8%	1,043	3.5%
Saline	15912	9.6%	1,769	1.1%	Saline	21,003	9.1%	2,320	0.7%	Ranitidine	13,200	17.8%	844	2.8%
Chloral hydrate 10%	10100	6.1%	521	0.3%	Domperidone	13,000	5.7%	1,040	0.3%	Saline	8,637	11.6%	954	3.2%
Adrenalin	7957	4.8%	1,633	1.0%	Potassium Chloride 6%	12,900	5.6%	81	<0.05%	Distilled water	3,739	5.0%	325	1.1%
Furosemide	7544	4.6%	1,318	0.8%	Chloral hydrate 10%	10,700	4.7%	559	0.2%	Lactulose	2,520	3.4%	119	0.4%
Terbutaline sulphate	5935	3.6%	8,869	5.3%	Dextrose 5%	8,726	3.8%	4,956	1.4%	Chloral hydrate 10%	2,200	3.0%	116	0.4%
5% glucose solution	5422	3.3%	3,038	1.8%	Adrenalin	7,879	3.4%	1,614	0.5%	Furosemide	1,700	2.3%	57	0.2%
Ranitidine	5238	3.2%	869	0.5%	Distilled water	7,279	3.2%	5,415	1.5%	Potassium Chloride 6%	1,500	2.0%	9	<0.05%
10% Calcium gluconate	4912	3.0%	3,432	2.1%	Furosemide	5,923	2.6%	1,031	0.3%	5% glucose solution	1,433	1.9%	814	2.7%
0.9% saline	3318	2.0%	1,770	1.1%	10% Calcium gluconate	5,775	2.5%	4,045	1.2%	Sodium valproate	1,200	1.6%	26	0.1%
TOTAL	89827	54.2%	25,254	15.2%	TOTAL	11,6631	50.7%	23,092	6.6%	TOTAL	49,329	66.5%	4,307	14.4%

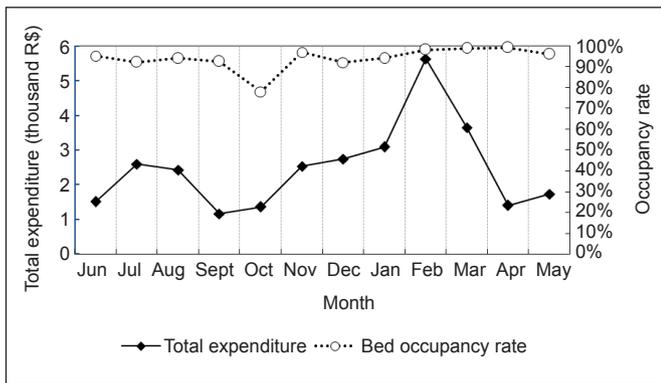
Table 2 - Description of the ten most costly medications used at the Cardiology, Neonatal and Pediatric Intensive Care Units according to descending order from June 2007 to May 2008

Product	Cardiology Unit			Neonatal Unit			Pediatric Unit		
	Quantity	Total value (R\$)	Product	Quantity	Total value (R\$)	Product	Quantity	Total value (R\$)	Product
Milrinone	215	18,952	11.4%	48	33,428	9.5%	31	2,184	7.3%
Prostaglandin	19	17,100	10.3%	446	31,403	8.9%	93	1,921	6.4%
20% Human albumin	133	15,701	9.4%	394	28,013	8.0%	74	1,761	5.9%
Sildenafil citrate	614	12,262	7.4%	299	21,595	6.1%	2	1,540	5.2%
Terbutaline sulphate	5,935	8,869	5.3%	40	19,983	5.7%	21	1,508	5.1%
10% Soy Lipids	341	8,116	4.9%	185	13,474	3.8%	15	1,105	3.7%
Meropenem	204	3,655	2.2%	549	11,614	3.3%	13,200	1,043	3.5%
Dobutamine	2,115	3,553	2.1%	18	11,178	3.2%	8,637	954	3.2%
Calcium gluconate	4,912	3,432	2.1%	451	10,734	3.1%	341	934	3.1%
PPN ped. / lipids 1	47	3,297	2.0%	543	9,360	2.7%	12	872	2.9%
TOTAL	14,535	94,937	57.1%	2,973	190,782	54.3%	22,426	13,822	46.3%

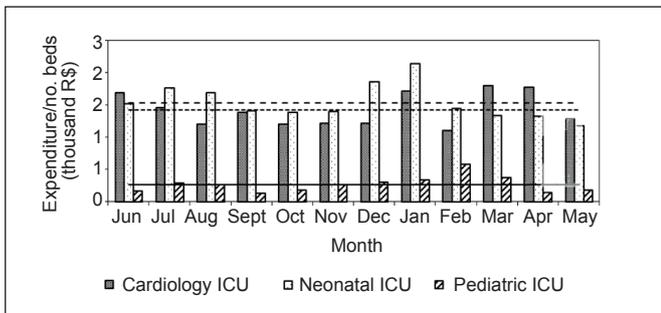
PPN ped.: Pediatric parenteral nutrition; IV: intravenous



Graph 1 - History of the monthly expenditures on medication at the Cardiology, Neonatal and Pediatric Intensive Care Units from June 2007 to May 2008



Graph 2 - History of monthly total expenditure on medication per bed at the Cardiology, Neonatal and Pediatric Intensive Care Units from June 2007 to May 2008



Graph 3 - History of monthly total expenditure on medication per occupancy rate at the Cardiology, Neonatal and Pediatric Intensive Care Units from June 2007 to May 2008

At the Cardiology ICU and SICU, there was male predominance (62%) and most patients were younger than one year old (61%). As for the diagnosis on admission, the main diagnosis was congenital heart defects. The distribution of heart disease in the present study was similar to that found

in the literature, in which interventricular communication is also the most frequent one (41.8%)⁽²²⁾. In general, congenital heart defects have an incidence of 8/1,000 live births, ranging from four to 50 cases per 1,000 live births, a wide variation explained in part by the presence of small defects that may go unnoticed in the routine examination⁽²³⁾.

Among the newborns of the neonatal unit, there was a prevalence of males (54%) and the main diagnoses were: prematurity, respiratory distress syndrome, and patent ductus arteriosus. A study conducted at the Neonatal ICU of the Children's Institute, Hospital das Clínicas, School of Medicine, Universidade de São Paulo, the authors found 53.1% of females and the most common diagnoses were: hyaline membrane disease (34.4%), unclassified respiratory distress (21.9%), risk of infection (18%), and gastrointestinal malformation (14%)⁽²⁴⁾.

At the Pediatric ICU and SICU, the predominant age group was younger than one year old (34%), and this finding was similar to that found in five Pediatric ICUs in Porto Alegre (45.7%)⁽²⁵⁾. In another study that evaluated the epidemiological profile of a Pediatric ICU, the authors showed that most children (40.4%) were younger than 12 months of age⁽²⁶⁾. In the studies mentioned above, as well as in the present investigation, there was predominance of male patients. The main diagnoses found at the Pediatric ICU and SICU were respiratory failure and pneumonia (17.4%). Among the indications for admission to the Pediatric ICU, respiratory problems are the most frequent ones (32.7%)⁽²⁵⁾.

With respect to Class A medications, expenditures on PPN are high at the Neonatal and Pediatric ICU and SICU, whereas the expenditure on milrinone is significant at the Cardiology ICU and SICU. At the Neonatal ICU, the role of nutrition in the management of premature infants is a priority, since immune, respiratory, hepatic and hemodynamic functions depend on the nutritional component for their performance⁽²⁷⁾. Parenteral nutrition is an essential procedure and is part of the routine of neonatal intensive care. In addition to the advances in knowledge and progress in legislation, several factors have contributed to reduce the morbidity and mortality of these infants and to increase safety regarding the use of this form of nutritional therapy, such as quality of the catheters used, adequate training of the professionals involved, multidisciplinary teams, and development of new inputs⁽²⁸⁾. Parenteral nutrition should be considered in metabolically stable newborns with birth weight lower than 1,800g and no prospect of receiving significant enteral nutrition for more than three days, or those

with birth weight lower than 1,800g and no prospect of receiving significant enteral nutrition for more than five to seven days⁽²⁹⁾. At Cardiology units, milrinone is used due to its action in the treatment of patients with myocardial contractility and reduced cardiac output and high systemic vascular resistance. Because it is a vasodilator, milrinone causes decreased systemic blood pressure, thus it may be necessary to administer volume or to use vasopressor use in order to correct or prevent hypotension⁽³⁰⁾.

In relation to Class C medications, we found that distilled water and saline were widely used by the units investigated. Domperidone had a high consumption at the Pediatric and Neonatal units, while ranitidine was mainly used at the Pediatric unit. Domperidone has the basic ability to decrease postprandial reflux, thus it is indicated to control regurgitations and vomiting. It is commonly used to treat gastroesophageal reflux and gastroesophageal reflux disease^(31,32). A study conducted at Pediatric ICUs in Porto Alegre pointed out that, in all units, ranitidine was the medication of choice for prophylaxis of stress ulcer, usually used during the entire period of hospitalization⁽²⁵⁾. In this study, the author emphasized the importance of having a care protocol with well-established indication criteria, resulting in lower prophylactic use, reducing costs for the institution and, above all, reducing the risks and complications caused by drug interactions in patients.

The use of sedative and analgesic agents in Pediatric ICUs is also a significant finding, and the most often used are benzodiazepines (midazolam and diazepam), chloral hydrate, opioids (morphine and fentanyl), barbiturates (thiopental), and ketamine⁽³³⁾. In the present study, chloral hydrate, which is a sedative-hypnotic agent without analgesic properties, was among the most consumed medications in all units investigated.

Based on the ABC classification, we were able to find the most frequently consumed medications, as well as the most expensive ones at the units investigated, which enabled the identification of units and management parameters regarding the reduction and control of costs, as well as reduction of waste. Thus, a tendency for service management is the pursuit of knowledge and the development of skills related to costs, becoming an additional tool to be used in the decision making processes^(34,35). Proper management of medications, from the planning phase to consumption by clients, is required to maintain the balance between the available resources and high quality care. This need is prompted by increased expenditures

on health, lack of resources, and difficulty to control expenses; and this is a worldwide phenomenon, affecting not only the developing countries^(36,37).

In the ABC method, the items belonging to Class A are important because they represent a large investment, thus requiring careful and frequent control⁽⁸⁾. The goals related to this class are: to reduce the time of supply, to reduce inventories and reserve stocks, to establish controls related to the use and search for better prices⁽¹¹⁾. With regard to class C items, it is possible to work with longer time of supply, increased reserve stocks, and more flexible controls⁽³⁸⁾.

Expenditures on medications, materials, and equipment are responsible for increasing hospital costs, being second only to the expenses on human resources⁽⁸⁾. Therefore, managers of health facilities need to work together with the other sectors in order to achieve rational and efficient use of the available resources⁽¹⁾. Faced with the need for rationalization of these resources, professionals should be involved with the management of processes to ensure the effectiveness of health care. The managers of health centers should know and follow-up the profile of consumption of materials, medications, and sterile material supplied to their health facilities^(36,37).

In our study, those medications with the highest consumption had a smaller influence on the budgets of the units than the most expensive medications. There was greater consumption of items with lower unit value. The neonatal unit showed the highest costs due to higher number of beds and patients. The monthly expenses/number of occupied beds for the Cardiology and Neonatal units were up to five times higher than those of the Pediatric ICU and SICU. There was a significant variation in the monthly expenditure on medications at the units in the study period, with these expenditures being independent of the occupancy rate, which indicates the importance of systemic control and monthly monitoring of the expenditures of these units. In order to create, implement, and monitor this system, the involvement of the administration and managers of the various units of the hospital is necessary, since each member of the staff should contribute their specific knowledge⁽⁸⁾. Thus, in order to achieve the improvement of the current situation, there is need to change health professionals' training, enabling them to appreciate the financial aspects of health care and to understand that the purpose of managing the economics is based on optimization of resources, accessibility and equity for users, and preservation of high quality care⁽³⁴⁾.

The present study has limitations, mainly the fact that the hospital information system did not provide data such as mortality rates, length of stay, and rate of bed replacement, in addition to not providing broken down information on the ICU and SICU, restricting our analysis (or making it impossible to perform an analysis by degree of complexity). It would be interesting for future studies to address these variables.

The present study describes the consumption and expenditures on drugs at Pediatric ICUs, a topic still little discussed in the literature, but of great importance in the search of health care quality and safety. We demonstrated the applicability of the ABC classification method in the management of expenses on health care, allowing for an objective systemic analysis of the data, which facilitates cost control at the health facilities assessed.

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