DIRECT COST OF HEMODIALYSIS IN AN ADULT INTENSIVE CARE UNIT

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ABSTRACT: The present study aimed to identify the average direct cost of conventional hemodialysis performed by nursing technicians on patients with acute kidney injury in Adult Intensive Care Unit. Quantitative analysis in case study research conducted in a public teaching and research hospital, between January and April 2014. The average direct cost of the stages of hemodialysis was calculated by multiplying the time needed to perform the procedure by the unit cost of direct labor and adding this value to the cost of materials, solutions and drugs. The total direct cost obtained was R$ 434,83 (SD= 65.10), which was impacted by the average direct costs of the "monitoring" steps" (R$ 205,58), "preparation of the machine and extracorporeal circuit" (R$ 120,96) and "internal disinfection and machine cleaning" (R$ 42,10). It is concluded that the proposed methodology can be reproduced in other Intensive Care Units to assist in the decision making regarding allocative efficiency of the resources involved in the procedure of conventional.
DESCRIPTORS: Acute kidney injury; Intensive care units; Hemodialysis hospital units; Nephrology nursing; Costs and cost analysis.

CUSTO DIRETO DA HEMODIÁLISE EM UNIDADE DE TERAPIA INTENSIVA ADULTO

RESUMO: Objetivou-se identificar o custo direto médio total da hemodiálise convencional realizada por técnicos de enfermagem a pacientes com lesão renal aguda em Unidade de Terapia Intensiva Adulto. Pesquisa quantitativa em estudo de caso, realizada em hospital público de ensino e pesquisa, entre janeiro e abril de 2014. Calculou-se o custo direto médio das etapas constituintes da hemodiálise multiplicando-se o tempo despendido na sua execução pelo custo unitário da mão-de-obra direta, somando-se ao custo dos materiais, soluções e medicamentos. Obteve-se o custo direto médio total de R$ 434,83 (DP= 65,10) que foi impactado pelos custos diretos médios das etapas "monitorização" (R$ 205,58), "preparo da máquina e do circuito extracorpóreo" (R$ 120,96) e "desinfecção interna e limpeza da máquina" (R$ 42,10). Conclui-se que a metodologia proposta poderá ser reproduzida em outras Unidades de Terapia Intensiva subsidiando a tomada de decisões com vistas à eficiência alocativa dos recursos envolvidos na consecução da hemodiálise convencional.
DESCRITORES: Lesão renal aguda; Unidades de terapia intensiva; Unidades hospitalares de hemodiálise; Enfermagem em nefrologia; Custos e análise de custo.

COSTO DIRECTO DE HEMODIÁLISIS EN UNIDAD DE TERAPIA INTENSIVA ADULTO

RESUMEN: Estudio cuya finalidad fue identificar el costo directo medio total de la hemodiálisis convencional realizada por técnicos de enfermería a pacientes con lesión renal aguda en Unidad de Terapia Intensiva Adulto. Investigación cuantitativa en estudio de caso, realizada en hospital público de enseñanza e investigación, entre enero y abril de 2014. Se calculó el costo directo medio de las etapas de la hemodiálisis multiplicándose el tiempo empleado en su ejecución por el costo unitario de la mano de obra directa, sumándose al costo de los materiales, soluciones y medicamentos. Se obtuvo el costo directo medio total de R$ 434,83 (DP= 65,10) que fue impactado por los costos directos medios de las etapas "monitorización" (R$ 205,58), "preparo de la máquina y del circuito extracorpóreo" (R$ 120,96) y "desinfección interna y limpieza de la máquina" (R$ 42,10). Se concluye que la metodología propuesta podrá ser reproducida en otras Unidades de Terapia Intensiva subsidiando las decisiones para llegar a la eficiencia alocativa de los recursos presentes en la consecución de la hemodiálisis convencional.
DESCRIPTORES: Lesión renal aguda; Unidades de terapia intensiva; Unidades hospitalares de hemodiálisis; Enfermería en nefrología; Costos y análisis de costo.

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INTRODUCTION

In Brazil, the number of patients that require renal replacement therapy (RRT) increases every year causing growing concerns for the public authorities that manage the Brazil's Unified Health System (SUS) regarding its cost effectiveness, since it comprises highly complex and, thus, expensive procedures[1]. This is also perceived in other countries that have faced the challenge of managing the high costs involved in the maintenance of patient in different dialysis modalities [2-4].

The critical patients admitted to Intensive Care Unit (ICU) who develop acute kidney injury (AKI) require a modality of periodical RRT: intermittent (conventional hemodialysis - CIHD - or peritoneal dialysis) or continuous (hemodialysis, hemofiltration or hemodiafiltration)(5), whose indication will depend on the patient's clinical status, medical knowledge and availability of resources[6].

Historically, conventional hemodialysis (CHD) has been the preferred option of treatment for patients requiring RRT[7]. This dialysis modality requires the maintenance of a pathway of access to bloodstream; the use of specific solutions, materials and equipment; and the availability of experts and structural resources that contemplate the resolutions and ordinances established by the Ministry of Health[8].

According to the current Brazilian legislation, the members of the healthcare team (nephrologist, nurse, nutritionist, psychologist, social worker, occupational therapist, nursing technicians) must remain in the Dialysis Center (DC), throughout the session, taking responsibility for care during the hemodialysis procedure [9] and although it is not a prerogative of nursing professionals, they are present during pre, trans and post dialysis.

In hospital institutions, CHD for critical patients with AKI is usually performed by nurses or renal dialysis nursing technicians who transport the dialysis equipment to the ICU. The participation of nurses or nursing technicians is conditioned and determined by the dialysis facility capacity and physical space, relationship between the number of nursing professionals, by category, and clinical status of the patients assisted. In most cases, CHD in ICU is performed by properly trained and highly qualified nursing technicians, under offsite supervision of the nephrologist and of the nurse at the DC.

The decision-making process related to human, material, structural and economic resources necessary to ensure the CHD procedure can be continuously improved based on knowledge on the costs involved in the stages of the dialysis procedure. Thus, the calculation of the costs of inputs used in the dialysis procedure is of key importance to ensure an effective allocation of these resources and facilitate comparison with the amounts currently transferred by the SUS, of R$ 261,41 per session of CHD performed on acute renal patients and patients with acute manifestations of chronic renal disease, who have not started dialysis treatment[10].

It should be stressed that comparison of the values incurred and financed would make it possible for health organizations, especially public hospitals, to plead for adjustments, as these institutions have been contracting with the public authorities (Federal Government, States, Federal District and Municipalities) since 2004, and results-based targets and indicators to be met, as well as the transfer of financial resources[11].

Studies related to the management of costs of the different modalities of RRT are still scarce, especially in Brazil. Therefore, investments in the application of methodologies for the calculation of the costs of dialysis procedures are needed to support the assessment of economic sustainability, without damage to healthcare quality.

Such studies in public teaching and research hospitals are crucial, since knowledge of the costs of services, of assistance actions related teaching and research activities condition and determine cost increase[12]. Under this perspective, nurses should be involved in the change of work processes for the following purposes: achieving better results, rational use of resources and cost optimization, collaborating to the financial sustainability of health institutions.

In view of the aforementioned, this study aimed to identify the average total direct cost (ATDC) of CHD performed by nursing technicians on patients with AKI admitted to an Adult Intensive Care Unit (A-ICU).

METHOD

This is a quantitative, exploratory and descriptive single-case study, a method that allows the research to investigate a contemporary phenomenon within its real-life context in order to answer "how" and "why" questions in a real

situation in which the researcher has "little control" over the events[13].

The study was conducted in a public teaching and research hospital following approval by the Research Ethics Committees of the proposing institution under no 489.961 and the field hospital – HCE, under no 492.808.

Due to the unpredictability of the occurrence of AKI in critical patients and the variability in indication of CHD as the dialysis modality of choice, convenience sampling was used. Thus, data was collected from January 26 to April 26, 2014, and aimed to obtain the maximum possible number of observations of the procedure investigated. In the referred period, 23 patients admitted to A-ICU had AKI and all of them were included in the sample.

HCE was selected due to its good nursing practices, adequate structure, technology and human resources. It belongs to a public university maintained by the State of São Paulo and attached to the State Department of Economic Development, Science and Technology.

The A-ICU has 12 beds for intensive care and eight beds for semi-intensive care for patients aged above 15 years, most of them elderly, with acute manifestations of chronic illnesses, from several units of the HCE and from other health institutions.

The DC provides assistance to chronic patients with end-stage renal disease (ESRD) and AKI, Mondays through Saturdays, in two shifts: from 7 a.m. to 1 p.m. and from 1 p.m. to 7 p.m. The nursing team is composed by three nurses and four nursing technicians distributed in such a way as to ensure at least one nurse and two nursing technicians per shift. Structurally, the DC is prepared to perform dialysis procedures on six patients per shift, as follows: four patients with ESRD and two patients with AKI.

The nephrologists examine the patients at risk of developing AKI admitted to the HCE and, if CHD is indicated, the procedure will be scheduled in the operating hours of the facility. For patients admitted to the A-ICU that after assessment by the nephrologist or intensivist physician were found to be in critical medical conditions that prevent them from being removed to the dialysis center, the dialysis nurse will appoint a nursing technician to perform CHD procedures on the patients lying in their ICU beds, under offsite supervision. So, an exclusive dialysis machine, different from the others, and a shuttle car containing the specific materials, solutions and drugs will be used to transport the dialysis equipment.

Direct costs were used in the calculation of the costs related to the use of materials, solutions and skilled labor. Direct cost refers to an expenditure or sacrifice made to generate a product or a service that can be identified, measured and clearly quantified[14].

The unit cost of direct labor (DL) of renal dialysis nursing technicians was calculated based on average wages at the time of data collection, informed by the Financial Director of the hospital. DL concerns the personnel who work directly on a product or service delivered, as long as it is possible to measure the time spent on the procedure and identify the technician who performed the referred procedure. It consists of salaries, social security contributions, holiday pay and Christmas bonus[14].

The employee in charge of the Warehouse of HCE informed the figures related to the latest acquisition of materials, solutions and drugs foreseen in the quota of the DC.

To accelerate the record of the time (measured) spent by the nursing technicians and the consumption of materials, solutions and drugs, without interfering with CHD sessions at A-ICU, an instrument was constructed, tested and validated with the presence of the renal dialysis nurses and nursing technicians.

The first part of the instrument concerned the record of date, shift, number of the patient record, and the second part, consisting of seven stages, concerned the record of the time of duration, quantity of materials, solutions and drugs consumed and observations. The stages and inputs of the second part of the instrument are shown in Chart 1.

In the 3rd stage called "Administration of solutions/drugs during CHD", only the solutions/drugs specifically related to the dialysis process were recorded. Thus, the costs of other drugs administered to the A-ICU patients were not accounted for. At this stage, the time needed to perform the procedure and the cost of direct labor (renal dialysis nursing technician) were excluded, since we chose to account for these variables only once in the 5th stage "Monitoring".

The average direct cost (ADC) of each stage was obtained by multiplying the time (measured) spent by nursing technicians in the procedure by the unit cost of direct labor, and adding this value

Chart 1 – Stages of the conventional hemodialysis procedure and respective inputs - São Paulo, SP, Brazil, 2014

Stage	Inputs	
1ª – Preparation of the machine and extracorporeal circuit	Renal Dialysis Nursing Technician Capillary dialyzer Arterial blood lines Venous blood line Bottle of 0.9% saline solution - 1000 ml Serum catheter	Pressure conductor insulator Procedural gloves Bottle of hydrogen peroxide reagent 8.4% sodium bicarbonate solution (gallon - 5 liters) Polyelectrolyte solution (gallon - 5 liters)
2ª - Installation	Renal dialysis Nursing Technician Sterile gloves Long sleeved apron Protective face mask Non-sterile procedure gloves Masks 20 ml syringe 10 ml syringe 03 ml syringe Alcoholic chlorhexidine (100 ml) Fenestrated sterile field	Sterile gauze package 50 mm micropore tape (100 cm) 100 mm micropore tape (30 cm) Surgical dressing package Sterile tray Bottle of saline solution - 10 ml Heparin vial Mupirocin ointment (1.2 grams) 30x8 needles TEGO connectors
3ª – Administration of solutions/drugs during CHD	Bottle of 0.9% saline solution - 1000 ml Potassium chloride 20 ml syringe 10 ml syringe	03 ml syringe 30x7 needle Alcohol cotton ball
4ª – Removal	Renal dialysis Nursing Technician Sterile gloves Long sleeved apron	Protective face mask Mask Heparin vial (ml)
5ª – Monitoring	Renal dialysis Nursing Technician	
6ª – Exterior cleaning and internal disinfection of the dialysis machine	Renal dialysis Nursing Technician Puresteril Puracetic Acid (300 ml)	70% alcohol (50 ml) Multipurpose cloth
7ª – Total time spent in the transport of the dialysis machine	Renal Dialysis Nursing Technician	

to the cost of the materials, solutions and drugs used. The Brazilian currency Real (R$) was used in the calculations. The numerical variables were described by the absolute and relative number of responses, and the values were shown in tables.

RESULTS

In total, 57 sessions of CHD for 23 patients with AKI, with dual-lumen catheters for access to bloodstream, admitted to an adult ICU, in the morning and afternoon shifts. The number of CHD sessions ranged from one to three, with a prevalence (78.3%) of three sessions per patient.

Two nursing technicians (75%) who performed CHD sessions were women with an average age of 38.5 years (Standard Deviation - SD=6.81) and the average time spent working with hemodialysis was 10.25 (SD=4.03). The average monthly salary for a workload of 144 hours corresponded to R$ 7.249,07, with R$ 50,34 corresponding to DL/hour and R$ 0,84 to DL/minute.

In Table 1, the seven stages of the CHD procedure according to the time of duration, costs of personnel, material solutions/drugs is demonstrated. The direct cost per CHD session ranged from R$ 308,93 to R$ 741,48, resulting in an average total direct cost (ATDC) of R$ 434,83 (SD= 65.10), with an average duration time of 338.84 minutes (6.65 hours).

The stages "monitoring" and "internal disinfection and exterior cleaning of the machine" showed the highest ADC with labor (personnel) R$ 205,58 (72.69%) and R$ 33,24 (11.75%); "preparation of the machine and extracorporeal circuit" and "installation" the highest ADC with materials, R$ 84,04 (88.77%) and R$ 13,12 (13.86%) and "preparation of the machine and extracorporeal circuit" and "administration of solutions/drugs during CHD" showed the highest

Table 1 – Distribution of the stages of conventional hemodialysis procedure, according to the time of duration and direct costs of personnel, material and solutions/drugs. São Paulo, SP, Brazil, 2014

CHD stages‡	n	Average	SD	Median	Min-Max	Mode
1st Preparation of dialysis machine and extracorporeal circuit						
Duration (minutes)	57	16.95	4.82	15	Oct-30	15
Cost of personnel	57	14.24	4.05	12.60	8.40-25.20	12.60
Cost of materials	57	84.04	19.17	82.40	2.18-166.49	82.40
Cost of solutions/drugs	57	22.68	6.24	21	1.90-40.10	21
ADC† of the 1st stage	57	120.96	20.29	116.84	54.88-209.39	116
2nd Installation						
Duration (minutes)	57	8.11	3.77	6	Apr-20	5
Cost of personnel	57	6.81	3.17	5.04	3.36-16.80	4.20
Cost of materials	57	13.12	9.44	12.87	2.42-24.98	3.05
Cost of solutions/drugs	57	8.63	0.41	8.54	7.96-10.36	8.54
ADC† of the 2nd stage	57	28.56	9.39	29.12	15.06-45.76	19.99
3rd Administration of solutions/drugs						
Cost of materials	57	1,71	0,86	2,07	0-3.80	2.28
Cost of solutions/drugs	57	9,08	0,99	8.54	7.96-13.29	8.54
ADC † of the 3rd stage	57	10.79	1.46	10.82	7.96-15.57	10.82
4th Removal						
Duration (minutes)	57	8.00	2.82	8	Apr-16	8
Cost of personnel	57	6.72	2.36	6.72	3.36-13.44	6.72
Cost of materials	57	0.90	0.48	0.75	0-3.72	0.75
Cost of solutions/drugs	57	1.17	2.54	0	0-6.56	0
ADC † of the 4th stage	57	8.79	2.98	7.80	1.08-17.16	7.47
5ª Monitoring						
Duration (in minutes)	57	244.73	65.71	240	80-480	240
ADC † of personnel in the 5th stage	57	205.58	55.20	201.60	67.20-403.20	201.60
6th Internal disinfection and exterior cleaning of dialysis machine						
Duration (minutes)	57	39.57	8.47	40	20-70	40
Cost of personnel	57	33.24	7.11	33.60	16.80-58.80	33.60
Cost of materials	57	0.33	0.12	0.28	0.28-0.84	0.28
Cost of solutions/drugs	57	8.53	1.60	8.85	0-8.85	8.85
ADC † of the 6th stage	57	42,1	7.41	42.73	21.85-68.21	42.73
7th Total time ª Total time spent in transport of dialysis machine						
Duration (minutes)	57	21.48	6.48	20	Jun-35	20
ADC † of personnel at the 7th stage	57	18.05	5.44	16.80	5.04-29.40	16.80
ATDC§ of CHD procedure‡	57	434.83	65.10	426.70	308.93-741.48	-

ADC with solutions/drugs, R$ 22,68 (48.04%) and R$ 9,08 (19.23%).

Table 2 shows the higher impact of the ADC of the stages "monitoring", R$ 205,58 (47.28%), "preparation of dialysis machine and extracorporeal circuit", R$ 120,96 (27.82%) and "internal disinfection and exterior cleaning of the machine", R$ 42,10 (9.68%) on the composition of the ATDC of CHT (R$ 434,83).

It should be stressed that in the stage "monitoring" only the Direct Labor (DL)/minute (R$ 0,84) of the renal dialysis nursing technician was accounted for. This technician stood by the side of patient for an average time of 244.73 minutes, representing 72.69% of the ADC of personnel.

In "preparation of the dialysis machine and extracorporeal circuit", the high ADC is explained

Table 2 – Distribution of direct costs of personnel, materials and solutions/drugs according to the stages of the conventional hemodialysis procedure. São Paulo, SP, Brazil, 2014

Stages of CHD††	ADC‡‡ of personnel R$	ADC‡‡ of materials R$	ADC‡‡ of solutions/drugs R$	ATDC§§ R$	%
1st Preparation of dialysis machine and extracorporeal circuit	14.24	84.04	22.68	120,96	27.82
2nd Installation	6.81	13.12	8.63	28.56	6.57
3rd Administration of solutions/ drugs	-	1.71	9.08	10.79	2.48
4th Removal	6.72	0.90	1.17	8.79	2.02
5th Monitoring	205.58	-	-	205.58	47.28
6th Internal disinfection and exterior cleaning of the machine	33.24	0.33	8.53	42.10	9.68
7th Total time spent in transport of the machine	18.05	-	-	18.05	4.15
ATDC §§ of CHD procedure††	284.64	100.10	50.09	434.83	100

by the costs of materials (R$ 84,04 – 69.48%), specifically the unit costs of the components of the extracorporeal circuit (arterial blood line/ R$ 6,30, capillary dialyzer/R$ 66,72, venous blood line/R$ 7,20), which were discarded after use, followed by the costs of solutions/drugs (R$ 22,68 – 18.75%), with emphasis to the gallons of 8.4% sodium bicarbonate solution (5 liters/R$ 8,30) and electrolyte solution (5 liters/R$ 9,34).

The ADC of stage "internal disinfection and exterior cleaning of the machine" was determined by the cost of DL related to the nursing technician, 11.68% of the cost of personnel, followed by the cost of solutions/drugs specifically related to the use of hydrogen peroxide (300ml/R$ 8,28) for internal disinfection of the machine.

In the composition of the ADC of "installation", the highest costs concerned the item materials, R$ 13,12, particularly those related to tube connectors of dual lumen catheters (DLC) (R$ 10,00/pair) and transparent film dressing (R$ 2,97/ unit) and in drugs/solutions, R$ 7,35, the highest costs concerned the use of heparin (R$ 1,31/ml), 0.9% saline solution (R$ 0.10/vial) and application of mupirocin ointment (R$ 0,58/10 mg) for dressing of the site of insertion of the dual-lumen catheters.

During the CHD procedure, the ADC of the stage "administration of solutions and drugs" was determined by the prescription of potassium chloride vials (R$ 0,12/vial), to the gallon of polyelectrolyte solution, ranging from five to 16, most often eight vials, and infusion of 0.9% saline solution (R$ 1,90/1000 ml vial) for the cleaning of the extracorporeal circuit in the case of patients with contraindication of systemic anticoagulation with heparin.

The ADC of the stages "removal" and "total time spent by the nursing technician to transport the dialysis machine to the ICU" was conditioned by costs of personnel, R$ 6,72 (76,45%) and R$ 18,05 (100%).

DISCUSSION

Many countries recognize that healthcare services are expensive and, consequently, health expenditures are high [15-16]. Because of the increasing costs of the different care needs in hospital organizations, studies on financial aspects are required to provide strategies that contribute to the rational use of resources, in order to balance the supply of health services and their economic viability[17-18].

The increase in health expenditures and costs related to the use of one modality of RRT, often hemodialysis, is consistent with shifts in population trends, such as aging, changing the epidemiological profile, with increased prevalence of chronic and degenerative diseases, especially hypertension and diabetes[19]. The decision making process in the health care field, e.g. regarding the selection of dialysis procedures, depends on financial aspects and refunding by the government. Thus, such decision depends on the available resources and evaluation of the benefit generated[20].

The ATDC of CDH corresponded to R$ 434,83 (SD= 65.10), ranging between R$ 308,93 a R$ 741,48. Surprisingly, the average value obtained is 1.64

higher than the value established by the Ministry of Health (MS), of R$ 265,41 per dialysis session performed on acute renal patients/patients with acute manifestations of chronic renal disease, who have not started dialysis treatment [10]. This value was readjusted in November 2013, indicating the need for negotiation of the resources transferred by the MS to the HCE. The ATDC would be higher if it had been possible to identify the indirect costs required for the calculation of the total cost of CDH[14], e.g. the costs related to water and electricity consumption, hours of preventive and corrective maintenance of the CHD machine and reverse osmosis.

Studies[17,21-22] on the direct costs of procedures performed by nursing professionals in other health organizations have also demonstrated the difficulties in accessing information to support the calculation of indirect costs, relating them to the inexistence of a formal mechanism to collect, organize and report financial statements[23].

Although the calculation of the total cost of CHD has not been the focus of this study, analysis of its direct costs generates knowledge that can facilitate the efficient allocation of the resources required by the HCE. Moreover, the methodology proposed represents an important step forward in obtaining economic information that will favor the negotiation between public teaching and research hospitals operating under the SUS and the state or municipal authority regarding the adjustment of financial resources.

Such adjustments were necessary, notably because they involve procedures whose values, even after the readjustments, cannot keep up with the intrinsic inflation of the health sector where, according to data from the Instituto de Estudos de Saúde Suplementar, the prices grow faster than the rate of economic growth[24]. Such negotiations are viable, since the public authorities are legally authorized to adopt values other than the amounts charged in the SUS Table of Procedures, though not below the values established by the SUS for the payment of health services, provided the difference is complemented by its own resources, state and/or municipal[25].

Unlike the findings of other studies in which the costs of materials, solutions/drugs prevailed over the costs of personnel[17,21-22], the ADC of direct labor (DL) related to the renal dialysis nursing technician, which corresponded to 65.04% of the ATDC of CHD, was expected in this study. Tis can be explained by the fact that in Brazil the current legislation requires the presence of skilled professionals for performing dialysis procedures[9].

Therefore, the participation of nursing technicians, especially in the "monitoring of CHD sessions", since they are required to continually observe the signs and symptoms of patients, monitor the materials and equipment used, make decisions and take immediate action for handling medical emergencies or minimizing their consequences[8].

Knowledge of the costs of procedures is vital for future estimates and is the basis of the basis of the budgeting and funding process of each unit in health institutions[26].

Accordingly, hospital organizations need reliable information on the costs incurred in the delivery of their services to be able to optimize the use of their scarce resources, notably in public hospitals that operate entirely under the SUS. Therefore, it is agreed that nursing professionals can improve the performance of these organizations by obtaining information on costing methods, identifying and monitoring the elements and stages of the health care process that increase costs and that can be eliminated without causing harm to health quality [27].

CONCLUSIONS

The ATDC of the CHD procedure corresponded to R$ 434,83 (SD=65.10), and the ADC of the stages "monitoring" (R$ 205,58), "preparation of the dialysis machine and the extracorporeal circuit" (R$ 120,96) and "internal disinfection and cleaning of the machine" (R$ 42,10) were the most important in its composition.

It is expected that the results obtained in this study stimulate the development of similar studies in other ICUs of public and private organizations, since the proposed methodology may support decision-making processes related to the increase of the financial resources involved in CHD procedures performed on patients with AKI.

Given the lack of and/or difficulty to access the information needed to calculate the indirect costs that compose the total costs of CHD, the present study was restricted to its direct costs. Thus, further studies are needed to overcome the current challenges in the identification of the indirect costs necessary for calculating the total costs of CHD, since these elements will contribute to improve the economic and financial

management of this modality of RRT.

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