

The cost of the urinary catheterization in patients admitted to the intensive care unit¹

O custo do cateterismo vesical de demora nos pacientes internados na Unidade de Terapia Intensiva

El costo de la sonda vesical en pacientes hospitalizados en la Unidad de Cuidados Intensivos

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ABSTRACT

Urinary catheters are one of the most widely used invasive devices in Intensive Care Units (ICUs), and its insertion is a major contributor to the development of complications, increasing hospitalization time and costs. **Objectives:** The study seeks to evaluate the direct cost of the Bladder Catheterization (BC) procedure, and also to carry out its partial economic evaluation in ICU hospitalized patients who were either bearing or not bearing a Urinary Tract Infection (UTI). **Methods:** It is a descriptive study that has used partial economic evaluation by analyzing patients' records. **Results:** 48.45% of the BC costs are due to the urine collection system, followed by lidocaine hydrochloride (20.38%) and Foley catheter (12.70%). The costs' increase of the BC procedure, coupled with the UTI treatment, represent more than 18 times the cost increase in ICUs, which extrapolates the value of UTI treatments in R\$3,537,692.79 considering the Brazilian healthcare system. **Conclusion:** The costs of UTI treatment associated with the BC procedure have a large impact on the hospital budget, requiring an economic analysis in order to implement a rational allocation of resources.

Keywords: Costs, cost analysis, urinary catheterization, nursing economics, nursing.

RESUMO

Objetivos: Valorar os itens do custo direto do cateter vesical de demora (CVD) e realizar sua avaliação econômica parcial nos pacientes internados nas Unidades de Terapia Intensiva (UTIs) com e sem infecções do trato urinário (ITU). **Método:** Trata-se de estudo descritivo

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do tipo série de casos, que utilizou a avaliação econômica parcial para estudar os custos diretos do cateterismo vesical de demora, analisando prontuários dos pacientes. **Resultados:** 48,45% do custo do CVD deve-se ao sistema coletor de urina, seguido do cloridrato de lidocaína (20,38%) e cateter Foley (12,70%). O aumento dos custos do CVD, associado ao tratamento da ITU, representa um aumento do custo em 18 vezes em ambas as UTIs, extrapolando o valor dos tratamentos em R\$ 3.537.692,79, abrindo possibilidades para trabalhos de avaliação do custo-efetividade.

Conclusão: A ITU associada ao CVD traz grande impacto no orçamento hospitalar, cabendo à análise econômica a alocação racional de recursos.

Descritores: Custos e análise de custo, Cateterismo urinário, Economia da enfermagem, Enfermagem.

RESUMEN

Los catéteres urinarios (CAU) son uno de los dispositivos invasivos más ampliamente utilizados en las unidades de cuidados intensivos (UCI), y su inserción es un importante contribuyente al desarrollo de complicaciones, hospitalización y costos. **Objetivos:** Evaluar el coste directo de la CAU y desarrollar una evaluación económica parcial en pacientes hospitalizados en la UCI con y sin infección del tracto urinario.

Métodos: Estudio descriptivo mediante el análisis de los archivos de los pacientes. **Resultados:** 48,45% del costo de la UC se deben al sistema de recolección de orina, seguido de clorhidrato de lidocaína (20,38%) y el catéter de Foley (12,70%). El aumento de los costos de la CAU, asociados con el tratamiento en la UCI representan >18 veces. Extrapolando el valor de los tratamientos UCI para el sistema de salud brasileño, la diferencia sería R\$ 3,537,692.79. **Conclusión:** ITU asociada al catéter tiene un gran impacto en el presupuesto de hospital.

Descriptores: Costos y análisis de costo, Cateterismo urinario, Economía de la enfermería, Enfermería.

INTRODUCTION

Nowadays, the health system is undergoing an important financial crisis that threatens the survival of hospital organizations, considering the aging of the population and the appearance of new therapies and diagnostic tests, raising the costs of treating various pathologies.¹⁻³

In the United States, the government's concern about hospital costs forced the Centers for Medicare & Medicaid Services to create some rules to reduce costs. The ten complications displayed in the high-cost, high-volume hospital environment were selected and that were reasonably simple complications to be avoided with the application of evidence-based guidelines. Under these rules, if a patient developed any complications that were not present at admission - such as a Urinary Tract Infection (UTI) caused by the Urinary Catheter (UC) - hospital billing would not include this type of complication, as if it was not present.⁴

The UC is one of the most used invasive devices in health care, and it is the insertion procedure that contributes the most to the development of complications, depending on the technique, the drainage system used, the care applied, the duration of catheterization, the presence of comorbidities and old age.⁵

In a particular study, it was presented that the surgical center is the area of the hospital where the majority of the UCs were inserted (71.3%), followed by the Intensive

Care Unit (ICU) (16.9%) and emergency room (5.9 %). About 12% to 16% of patients within ICU had a UC inserted at some time during hospitalization period. According to epidemiological data, 35% to 45% of all infections acquired in the hospital are ICUs, 80% of which are related to the UC use.⁸⁻¹⁰

In a prospective study, which has had 2,412 participating patients and performed in a Thai hospital, a full cost evaluation was carried out and the efficacy of a quality-of-care program was evaluated, with an intervention performed in order to remind physicians to remove unnecessary UCs. After the intervention, there was a reduction in the unnecessary insertion rate of the UC, in the ICU average rate associated with UC from 21.5 to 5.2 infections per 1,000 catheters per day ($p < 0.001$), in the duration of UC use by 11 ($p < 0.001$) and in the hospitalization time (average of 16 vs. 5 days, $p < 0.001$). The monthly hospital costs of antibiotics to treat the UTI associated with UC were reduced by 63% ($p < 0.001$) and the hospitalization costs for each patient during the intervention were reduced by 58% ($p < 0.001$).¹¹

Knowing that the UC insertion is a type of intervention in which the nursing acts directly and actively, in addition to being an invasive and potentially traumatic procedure capable of attacking the lower urinary tract, it is necessary for the professional to have scientific knowledge and technical ability, seeking a balance between patient safety and cost-effectiveness.¹²

According to the Methodological Guidelines for Studies about Economic Evaluation and Health Technology, from the Health Ministry, it is possible to identify the values added to technological alternatives towards health care, as well as to decide about the rational allocation of the investment, becoming a valuable administrative tool in the decision-making process for managers of health institutions.^{12,13} In order to investigate the economic aspects related to nursing care, we target to analyze the cost of the Bladder Catheterization (BC) procedure in patients admitted to ICU.

METHOD

It is a descriptive study with a case series approach type, which used the partial economic evaluation to study the direct costs of the BC procedure. This type of evaluation has been widely used in the health area, being limited in the calculation of direct and indirect costs for different health interventions.

The study was conducted in two ICUs in two large university hospitals (identified in the study by "ICU A" and "ICU B"), located in *Rio de Janeiro* city. These institutions were chosen because both belong to the public health education system, and also because the source of data collection about the value of cost items was the same.

Regarding the UC insertion procedure, it is performed exclusively by the nurse in the sector in the ICU A, except when the patient is submitted to a surgical procedure and the UC is inserted inside the surgical center by the attending

physician. In the ICU B, the same procedure occurs, with the difference that, within the surgical center, the procedure is performed by the circulating nurse.

The average data collection time in each institution was of 60 days, from Monday to Friday, during the daytime period. The sample consisted of two groups, the first one by the patients hospitalized within the two ICUs, who used the UC during data collection, and the second by the coordinating nurses of the ICUs.

For the first group, those older than 18 years old that did not undergo prophylactic therapy with antibiotics for ICU stay prior to the insertion procedure of the UC and were submitted to it during the current ICU stay were considered eligible. Those excluded from the study were those who were part of a clinical trial and/or had a history of bacteriuria, as they could have altered the costs due to the use of extra resources in these cases. Considering the 57 hospitalized patients during data collection, 33 belonged to ICU A and 24 to ICU B. From the application of the inclusion and exclusion criteria, the sample consisted of 27 sick patients.

The second group was composed by nurses from the routine ICU service to obtain information about the BC procedure, because the nurse performed most of the invasive procedures in both institutions. Those nurses who were part of the routine of the unit were included in the study, outside of the effective ICU for at least one year; and excluding those who are on vacation, on medical leave or maternity leave. Thus, 02 nurses were included in the sample, with 01 of each unit.

For the calculation of the procedure costs, the inputs costs and human resources cost were taken into account, concerning the time spent by the those in the accomplishment of the procedure. The salary of ICU A nurse was taken from the website of the Foundation for Support towards Research, Teaching and Care and that of ICU B was withdrawn from the Public Contest Notice for the post of Higher University Technician - nurse profile.^{14,15}

A form was used to collect data on cost items: nurse's wage (adapted according to the time spent in the procedure), inputs used in the insertion of the UC and inputs used in the case of UTI treatment. This information was collected from the pricing banks that were made available by the Health Ministry.^{16,17}

The cost of the inputs was calculated from the average costs found, using the simple rule of three. Adding the cost of the inputs and the wage of the professional, the total cost of the procedure was obtained. Only direct costs were considered.

The documentary analysis of the medical records of the hospitalized patients in the ICU who were using UC for the collection of clinical and epidemiological data were employed, using a specific form. The data collected was organized into electronic databases by typing in spreadsheets of the application Microsoft Excel 2007, from where they were exported. The analysis model used was the partial economic evaluation, using simple statistics.

For the analysis of the main complication related to UC, as well as the partial cost analysis, due to lack of treatment protocol in both institutions, the leaflets of the respective medicines administered and analyzed with the costs of the treatments performed in both places were used. The project is under the *Certificado de Apresentação para Apreciação Ética (CAAE)* [Certificate of Presentation for Ethical Appraisal] No. 04626512.9.0000.5285, Legal Opinion No. 95.220, in the Ethics Committee in Research from the Federal University of the State of Rio de Janeiro.

RESULTS AND DISCUSSION

Data were analyzed for 27 patients, 11 men and 16 women in both units. It was observed that the largest number of hospitalized patients was female (59.3%), with an average age of 67.38 years (Dp=17.0). Males accounted for 40.7% (n=11), with a average age of 54.3 years (Dp=22.2), corroborating the fact that the UTI is the second nosocomial infection in the population, predominantly among adults of advanced age (above 65 years) and females.^{18,19}

It was observed that the average time of the UC use was 8 to 15 days (37%), in the two institutions. A group of researchers demonstrated an UTI risk of 2.5% for one day of catheterization, 10.0% for 2 to 3 days, 12.2% for 4 to 5 days, reaching 26.9% for the same duration or greater than six days.¹⁹ When we correlated the data, it was observed that 63% of patients who used UC for more than 6 days presented a 26.9% risk of developing UTIs. The surgical center was the area of the hospital where most of the UCs were inserted (55.6%), followed by the ICU (44.4%). In relation to the professional who inserted the UC, the nurse is the professional who most performs the procedure (63%), followed by the physician (29.6%) and the nursing technician (7.4%).

It was not possible to identify UTI associated to UC in the sample, and it may be questioned about possible masked infection, since the drugs used have a broad spectrum and cover the microorganisms that are normally involved in UTIs.^{20,21} Perhaps this is one of the most significant factors in which they cover the presence of the UTI in these patients, which present numerous predisposing factors and not by prophylactic antibiotic therapy, according to guidelines of the Brazilian Society of Urology.²²

Table 1 shows the costs of the inputs used in the BC procedure collected at the Health Pricing Bank from the Health Ministry. It was observed that 48.45% of the procedure cost for insertion of the UC is due to the closed collector system (most expensive item), followed by lidocaine hydrochloride and Foley catheter, which represent 20.38% and 12.70%, respectively.

Table 1 - Cost of the inputs utilized in the BC procedure. Brazil, 2013.

Inputs	Average quantitative by procedure	Major cost* (R\$)	Minor cost* (R\$)	Average cost by procedure † (R\$)	SD	%
Syringe, 20 mL	01	0.49	0.46	0.22	0.02	3.25
Syringe, 10 mL	01	0.31	0.17	0.18	0.10	2.66
Procedure glove	02	0.26	0.22	0.25	0.03	0.30
Sterile glove	01	1.75	0.45	0.58	0.92	8.57
Disposable needle, 25 mm x 7 mm	01	4.35	0.02	0.03	3.06	0.44
Foley probe, No. 20	01	2.35	0.69	0.86	1.18	12.70
Urine collector, closed system	01	6.90	0.02	3.28	4.86	48.45
Surgical Mask†	0.02	5.00	3.82	0.002	0.83	0.03
Distilled water	01	0.36	0.02	0.08	0.24	1.18
Tape, 100 mm x 4,50 m†	10 cm	8.01	0.04	0.06	5.64	0.89
Lidocaine hydrochloride, 2%§	01	3.39	0.76	1.38	1.86	20.38
Chlorhexidine digluconate 2%, antiseptic†	10 mL	20.08	5.59	0.08	10.25	1.18
Total				R\$6.78		

Source: *Values rounded to two decimal places, referring to the highest and lowest values paid by the health institutions supported by the *Sistema Único de Saúde (SUS)* [Unified Health System]; †Values proportional to the quantity used in the procedure; ‡Values consulted for 01/24/2013; §The use of one tube per procedure was considered. ||Product specifications have been simplified.

Regarding the procedure's hand labor, we have observed that the nurse from the ICU A receives R\$3.84 for the procedure, 40.74% less than the nurse from the ICU B (R\$6.48). Among the various procedures that the nurse performs, the BC takes from 20 to 40 minutes, according to its difficulty and time of professional experience. These data were collected from the interview with the nurses of the units in order to calculate the cost with human resources, regarding the time spent during the procedure accomplishment.

When analyzing **Table 2**, we can observe the difference in the values referring to each dose of antibiotic. In the ICU B, the value of the antimicrobial treatment for UTI is R\$11.61, while in the ICU A this amount is R\$13.72, representing an increase of R\$2.11 or 18.17%. Although these values do not correspond to the same antibiotic, it is known that there are other types of treatment for the UTI that could be considered, from the point of view of their effectiveness until the creation of specific regional protocols that would be applied in all institutions with the purpose of standardizing and reducing costs.²²

Table 2 - Cost of the inputs utilized in the UTI antibiotic treatment in the ICU A and ICU B (per dose). Rio de Janeiro, RJ, Brazil, 2013.

Inputs	Average quantitative by procedure	Major cost* (R\$)	Minor cost* (R\$)	Average cost by procedure † (R\$)	SD	%
Cefepime hydrochloride, 2 g, injectable lyophilic powder	01	12.25	8.35	9.44	2.76	68.80
Equipment for infusion of NaCl 0.9% solution	01	1.93	1.48	1.71	0.32	12.46
Intravenous catheter	01	82.5	0.05	0.81	58.30	5.90
Procedure glove	02	0.27	0.23	0.25	0.03	1.82
Gauze compress (pack with 10 un.)	01	22.96	0.03	1.49	16.21	10.86
Hydrous ethyl alcohol, 70%	5 mL	4.23	0.33	0.02	2.76	0.15
Total				R\$13.72		
Piperacillin 4 g, plus tazobactam 500 mg, injectable	01	10.63	4.02	7.33	2.34	63.14
Equipment for infusion of NaCl 0.9% solution	01	1.93	1.48	1.71	0.32	12.46
Intravenous catheter	01	82.5	0.05	0.81	58.30	5.90
Procedure glove	02	0.27	0.23	0.25	0.03	1.82
Gauze compress (pack with 10 un.)	01	22.96	0.03	1.49	16.21	10.86
Hydrous ethyl alcohol, 70%	5 mL	4.23	0.33	0.02	2.76	0.15
Total				R\$11.61		

Source: *Values rounded to two decimal places, referring to the highest and lowest values paid by the health institutions supported by the *Sistema Único de Saúde (SUS)* [Unified Health System]; †Values proportional to the quantity used in the procedure; ‡Values consulted for 01/24/2013;

It was observed that the cost with the antibiotic amounts to 63.14% in the cost of BC with infection in the ICU B and 68.80% of costs in the ICU A. So, the concern with hospital costs becomes evident.

Considering that the professional's hand labor represents a fixed cost for the institution and that the treatment for the UTI is administered several times a day (according to prescription and protocol), it becomes evident what this cost represents for the public payer.

Considering the fact that there were no UTI bearing patients in the sample and expecting to be able to perform

an analysis of the costs of BC between the groups of patients without UTI and with the disease, it was decided to rely on the literature in order to perform such analysis.

The costs of the UC insertion procedure were calculated from the list of input costs, as presented previously, and the cost of the hand labor concerning the time spent by the professional. In order to obtain the total cost of the UC insertion procedure, the sum of these values was performed, and when there was a UTI, the costs with the disease treatment were added, as shown in **Table 3**.

Table 3 - Partial economic assessment of the BC with and without UTI, per institution. Rio de Janeiro, RJ, Brazil, 2013.

		Cost per institution (R\$)			
		ICU A		ICU B	
BC cost	Inputs utilized in the UC insertion	6.78	10.62	6.78	13.26
	Nurse's hand labor	3.84		6.48	
Treatment cost of the UTI	Antibiotic treatment (piperacillin 4g + tazobactam 500mg) 3 times per day, over 7 days*	-	-	-	243.81 (11.61 x 3 doses x 7 days)
	Antibiotic treatment (Cefepime hydrochloride 2g) 2 times per day, over 7 days†	-	192.08 (13.72 x 2 doses x 7 days)	-	-
Total cost per institution		R\$202.70		R\$257.07	

*7 days of treatment every 8 hours; †7 days of treatment every 12 hours.

By analyzing **Table 3**, we have observed a robust difference in the values referring to each dose of antibiotic. In the ICU B, the procedure cost, including seven days of antimicrobial treatment, is R\$257.07, while in the ICU A this amount is R\$202.70, representing an increase of R\$54.37 (26.82%) between these two institutions. We can argue over the cost differences in each ICU, the choice of the most expensive treatment, if both antibiotics can be used for the UTI treatment.

The costs for the treatment of the UTI represent 1.42 times the average cost in relation to patients without the infection. As we can observe, the increase in costs of the BC procedure, when associated with the treatment of the UTI, reaches 18.09 times in the ICU A and 18.37 times in the ICU B. From the valuation of inputs and hand labor involved, it was estimated that the value to perform the insertion procedure of the UC in both units would correspond to 2% of the total cost of the UTI procedure. It is worth mentioning that these values correspond to one patient over seven days of treatment.

The partial economic evaluation data, collected in the study, allow it to be applied to real data. In order to visualize the possible consequences in the use of each treatment for the UTI in the Brazilian scenario, a small extrapolation of the data collected for the national scenario was performed.

In the UHS database, it was possible to select the number of hospitalizations of high complexity patients in public hospitals during 2012 (since there were no data for the year 2013) and the average time of permanence, according to each federative region.²³ About 16.9% of patients admitted to ICUs use UC. Considering the data collected in the aforementioned database, we would have represented 102,102 patients in the Brazilian territory who used UC in ICU.

The incidence of UTI associated with UC is 6.13%. Therefore, complementing the reasoning, we could estimate that 65,067 of these patients would present UTI as a complication related to UC use ([604.154 patients * 16.9%] - 6.13%).²⁴

When we used these data based on the scientific literature, with those collected in the UHS database and when we applied in each unit studied (ICU A and ICU B), we could estimate the value for the Brazilian health system, if one of the treatments economically evaluated was applied. **Table 4** shows the difference of R\$3,537,692.79 that draws a lot of attention, which allows other work possibilities that can evaluate the cost-effectiveness of each treatment for the UTI, and in different protocol types.

Table 4 - Incremental cost of UTI treatment associated to UC use according to the number of hospital admissions in Brazil in 2012.

Treatment of the UTI	Procedure cost with no infection (R\$)	Procedure cost + Treatment of the UTI over 7 days (R\$)	Total number of UTI cases related to UC use during 2012 (R\$)	Total cost (R\$)
According to the ICU A	10.61	202.70	65.067	13,189,080.90
According to the ICU B	13.25	257.07		16,726,773.69
Incremental*				-R\$3,537,692.79

*Additional cost.

In the case of the ICU A, the cost of the UTI treatment over seven days seems to be of lower value (R\$202,70). By extrapolating this value to the Brazilian scenario, we see how much public money is being spent. The same would apply to the ICU B (R\$257.07). And from these data, it can be asked: is this treatment cost-effective? This question remains open, creating new possibilities for economic studies.

Although economic analysis studies in the nursing area are not yet frequent, these are extremely important for rational decision making as a management tool, where all scenarios and possibilities are evaluated, as well as serve as a tool to enable the professional to ground his/her choices on inputs, machinery, among other resources used in health care.²⁵

In closed units such as those here studied and especially in relation to the BC procedure, the nurse occupies a position of extreme relevance. It was observed in the data presented that a neglected nursing care towards the patient with UC could lead to possible clinical complications, exemplified here by the UTI as the most common among them, with the consequent increase in hospital costs. The participation of nurses and their awareness of their work value can avoid consequences that might be prevented, as well as an indispensable contribution to the rational allocation of health resources.

CONCLUSION

The study showed that, with regards to the cost of UC use in patients admitted to the ICU in two university hospitals located in *Rio de Janeiro* city, the value paid by the nurse's labor costs less than the inputs used. The relevance of this data to the management area, especially related to the economics of public health services, should be treated as an object of additional studies within the nursing research field, as well as other related areas.

The analysis of the projections and the verification of the data collected in the field bring a concern with the future of the health system and how much it is necessary to plan the action of preventive campaigns. In the case of a society with a prominently elderly future, the current timing for these types of campaigns provides time to be interpreted as "long-term investment" in reducing future social spending.

As this was a new study, some difficulties were encountered, especially with regards to either the lack or limited national information available on the topic; studies related to the UC insertion and permanence procedure; the identification and treatment of UTI and the expected results

after treatment. In this sense, the instruments of collection and the contribution of the professionals of the units involved in the accomplishment of the procedures, as well as those experts in this type of analysis, were of great value for this study.

The study is relevant because of the reflections raised about the cost and consequences of the necessary care for the UTI prevention, as well as the contribution it may generate for the implementation of protocols in the public health network.

The economic evaluation of health technologies is a relatively current topic in nursing, demanding development and reinvigoration within the lines of research. The information generated from this research method serves as a guide for health professionals and researchers in the area so that they are more qualified to innovate and seek the knowledge needed to reduce costs within the health system, through the choice of the best technological option for rational allocation of costs in any area of activity, or in the health promotion environment at either hospital or home level.

When the professional, regardless of his/her working field, knows the economic value of his work, he/she becomes able to assist in the planning, acquisition and maintenance of resources. In the case of nurses, their orientation is of great value because at the moment that alternatives that can add value to the care practice are present, there is a return to the institution caused by the greater effectiveness and cost reduction, in addition to becoming more attractive for the market needs.

Although the difference in costs of the BC with UTI between ICU A and ICU B was "only" R\$54.37, it was possible to carry out another projection with the data collected. Based on the "real-world" data available on the Health Ministry website, a possible savings of R\$3,537,692.79 with high complexity patients hospitalized in 2012 was identified. Despite the small difference in the treatments, there is robustness when these are quantified at the national level, expanding new possibilities of works that can evaluate the cost-effectiveness of each treatment for UTI in different types of protocols.

It was concluded that the cost of the BC procedure without UTI in the institutions surveyed was R\$10.62 in ICU A and R\$13.26 in ICU B, and that the treatment of UTI added R\$192.08 and R\$243.81, representing an important public financial impact, which allows the reallocation of these resources to double the attendance, to acquire new technologies, to qualify the labor force, among others suitable actions.

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