ANALYSIS OF COSTS ASSOCIATED WITH THE LATE VESICAL CATHETERIZATION IN HOSPITALIZED PATIENTS: INTEGRATIVE REVIEW

ANÁLISIS DE COSTOS ASOCIADOS CON LA DEMORA DE CATETERIZACIÓN VESICAL EN PACIENTES HOSPITALIZADOS: REVISIÓN INTEGRATIVA

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Objective: to find articles that assess the costs related to the catheterization urinary catheter (CVD) in the hospital (AH) and its related complications. Method: an integrative review, with the search for answers to the following questions: a) What is the cost of vesical catheterization in the hospital? b) What is the cost of complications related to catheterization of delay in hospital? We selected 25 articles. Results: The costs associated with complications involve not only antimicrobial treatment, but all procedures that are needed for the diagnosis and control of infection. Conclusion: costs to patients with urinary tract infection (UTI) were 1,42 times greater than the average cost for patients without infection. Other bladder catheters, such as those coated with antimicrobial agents, although with higher unit cost, feature actual results and decreased length of stay, reduce UTI rates and reduced length of hospital stay for treatment of related complications.

Descriptors: Cost and Cost Analysis; Nursing; Health Economics; Urinary Catheterization.

ABSTRACT

Objective: to find articles that assess the costs related to the catheterization urinary catheter (CVD) in the hospital (AH) and its related complications. Method: revisión integrativa, con la búsqueda de respuestas a las siguientes preguntas: a) ¿Cuál es el costo de cateterismo vesical de demora en el ambiente hospitalar? b) ¿Cuál es el costo de las complicaciones relacionadas al cateterismo vesical de demora en el ambiente hospitalar? Foram selecionados 25 alguns. Resultados: os custos relacionados a complicações envolvem não somente o tratamento antimicrobiano, mas todos os procedimentos que são necessários para o diagnóstico e controle da infecção. Conclusão: custos com pacientes com infecção trato urinário (ITU) foram de 1,42 vezes maiores que o custo médio em pacientes sem a infecção. Outros cateteres vesicais, como os revestidos com antimicrobianos, embora com custo unitário maior, apresentam resultados efetivos quanto à diminuição do tempo de internação, redução das taxas de ITU e redução do tempo de internação para tratamento de complicaciones relacionadas.

Descriptors: Custo e Análise de Custo; Enfermagem; Economia da Saúde; Cateterismo Urinário.

RESUMEN

Objetivo: encontrar los artículos que evalúan los costos relacionados con el catéter urinario cateterismo (ECV) en el hospital (AH) y sus complicaciones relacionadas. Método: revisión integradora, con la búsqueda de respuestas a las siguientes preguntas: a) ¿Cuál es el costo de cateterismo vesical en el hospital? b) ¿Cuál es el costo de las complicaciones relacionadas con el cateterismo de retraso en el hospital? Se seleccionaron 25 artículos. Resultados: Los costos asociados con complicaciones implican no sólo el tratamiento antimicrobiano, pero todos los procedimientos que son necesarios para el diagnóstico y control de la infección. Conclusión: los costos para los pacientes con infección del tracto urinario (ITU) fueron 1,42 veces mayor que el costo promedio para los pacientes sin infección. Otros catéteres vesicales, como los recubierto con agentes antimicrobianos, aunque con mayor coste unitario, los resultados reales y disminución de la función de la duración, reducir las tasas de infección del tracto urinario y la duración de la estancia hospitalaria reducida para el tratamiento de las complicaciones relacionadas.

Descriptors: Costos y Análisis de Costos; Enfermería; Economía de la Salud; Cateterización Urinaria.

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English/Portuguese
INTRODUCTION

The use of economic analysis as a management tool and resource allocation helps in choosing the best and most cost-effective technology, becoming a necessity to decrease costs of the Brazilian health system and patient/user.

According to the Ordinance of the Ministry of Health, health technologies are considered medicines, materials, equipment and procedures, organizational systems, education, information and support, programs and care protocols, by which the attention and care health are provided to the population. Within this perspective, there is a Health Technology Assessment, as a management tool, bringing a new model of health care in relation to the cost of using these technologies, which have been recommended for some decades by international agencies to collect systematic information about their properties: safety, efficacy, effectiveness and validity for different scenarios of service, making it important to reduce the costs of health care and patient in the short, medium and long term increased average life expectancy, the new technologies that come to market, the shortage of skilled labor, lack of professional training in managing healthcare facilities, has led to an increase in these expenses, and the search for efficient allocation of financial resources a concern growing among managers in deciding the fate of them.

Nurses are important decision-making level in the allocation of these resources when deciding on their work units, priorities for their services, and decide which resources will be employed in its realization. This is already a reality in some private and public hospitals where the nurse manager of a business unit, assesses the needs related to material resources, physical, human and financial, conducts critical analysis of monthly expenditure unit, comparing the real and budgeted, and participating in next year's budget planning.

Some technologies are able to reduce costs due to increased efficiency and effectiveness of care, citing that some equipment may facilitate certain actions taken by nurses, freeing it for other activities. However, the International Council of Nurses, recognizes that these technologies are expensive.

In order to build an effective economic relationship, make up more studies on costs in healthcare, aiming always tweak them, facilitating thereby the choice of the best options for delivering care and quality treatment. How nursing, participates in procedures and interventions that use technological resources, should delve into studies of economic evaluation so you can evaluate the results of their actions based on the costs and compare the best options for care.

Economic evaluation in health is defined as a comparative analysis in terms of costs and outcomes between two or more alternatives that compete with each other. Thus, we can identify the aggregates technologies and decide whether the value assigned to these justify the investment. They are studies of economic evaluation in health: economic evaluation of cost-minimization, cost-effectiveness, cost-benefit and cost-utilization. If this analysis is not comparative, we get a partial cost analysis.

Among the interventions performed by nursing, indwelling catheters is one of the most invasive devices used in health care, about 10% of hospitalized patients and their insertion procedure is the major contributor to the development of hospital infection depending on the technique and the drainage system employee, which greatly burdens the health system.

Some studies show Americans that the direct costs of hospital infections are related to pneumonia and urinary tract infection (UTI), and these last, cited as the most frequent and longer hospital accounting, with a mean of 24 to 26 days. Each episode of UTI costs about US$2.800, and those associated with bladder catheterization have its cost increased by US$600.

In Brazil, data on hospital infection are poorly disclosed. Furthermore, they are consolidated by many hospitals, which hinders the knowledge of the magnitude of the problem in this country. However, in a prospective study conducted in 2006 during the months from February to July in the city of Ribeirão Preto, among 71 patients hospitalized in the Intensive Care Unit (ICU), 47 hospital acquired infection being 43 (91.5%) associated the indwelling catheters.

Regarding the assessment of costs, it was found that there is a gap for the catheterization of delay within the Brazilian health units. The high cost of health care, through the emergence of new and expensive treatments and diagnoses, makes it necessary to investigate the costs related to health technologies, especially those used by nursing staff, allowing it to avoid waste, losses and complications of interventions undertaken by it, minimizing thus the hospital expenses. Therefore, this study aims to present an
integrative review on the cost analysis of vesical catheterization in the hospital environment, identifying what has been produced on the subject in the last ten years, the search for answers to the following questions a) What is the cost of vesical catheterization in the hospital? b) What is the cost of complications related to catheterization of delay in hospital?

METHOD

It is an integrative review, which sought to articles that assess the costs related to vesical catheterization in the hospital environment. Searches were conducted in MEDLINE via PubMed, EMBASE, LILACS, between the months of July and August 2012. For the literature review, the structure was used in PICO format, as shown in Figure 1, which is a strategy for the construction of the research question in evidence-based practice and represents an acronym for Patient, Intervention, Comparison and "Outcomes." The survey was conducted during July and August 2012. The inclusion criteria for study selection were: a) publications between the years 2002 and 2012, b) in English, Spanish, Polish, Portuguese, c) present the text d) address the issue of costs and analysis catheterization costs of delay. Exclusion criteria, the articles brought, as a subject, pregnant women, because use indwelling catheters for short period of time, that focused on intermittent catheterization and related to immunocompromised patients. We have not found theses or dissertations from the selected descriptors and proposed inclusion criteria.

The analysis of the publications was conducted through thorough reading of the work, and your organization has been built in accordance with Figure 4, relating the quantity of papers published in the database, the database, year of publication, the professional involved in publication of the article and the type of cost analysis used.
RESULTS

There were 490 articles found and after application of inclusion and exclusion criteria, 25 were selected, all in English. According to Figure 4, 24 (96,0%) of the articles were found in PubMed and an article (4,0%) in the LILACS database, and the years 2007 and 2008, showed that most publications, totaling 8 (32,0%).
<table>
<thead>
<tr>
<th>No.</th>
<th>Article Title</th>
<th>Author</th>
<th>Database</th>
<th>Year of Publication</th>
<th>Professional Category Involved</th>
<th>Type of Cost Analysis Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of silver-hydrogel urinary catheters on the incidence of catheter-associated urinary tract infections in hospitalized patients.</td>
<td>Lai²</td>
<td>LILACS</td>
<td>2002</td>
<td>Medical and Nursing</td>
<td>Total</td>
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<tr>
<td>2</td>
<td>Modeling the Costs of Hospital-Acquired Infections in New Zealand.</td>
<td>Graves³</td>
<td>PubMed</td>
<td>2011</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>3</td>
<td>Comparison of effectiveness of two urinary drainage systems in intensive care unit: a prospective, randomized clinical trial.</td>
<td>Garvey³⁸</td>
<td>PubMed</td>
<td>2005</td>
<td>Medical and Nursing</td>
<td>Partial</td>
</tr>
<tr>
<td>4</td>
<td>Catheter-Associated Urinary Tract Infections in Intensive Care Units Can Be Reduced by Prompting Physicians to Remove Unnecessary Catheters.</td>
<td>Huang¹</td>
<td>PubMed</td>
<td>2004</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>6</td>
<td>Using silver to reduce catheter associated urinary tract infections.</td>
<td>Iorio²⁴</td>
<td>PubMed</td>
<td>2005</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>7</td>
<td>The Utility of Bladder Catheterization in Total Hip Arthroplasty.</td>
<td>Inan¹³</td>
<td>PubMed</td>
<td>2005</td>
<td>Unknown</td>
<td>Partial</td>
</tr>
<tr>
<td>8</td>
<td>Daily antibiotic cost of nosocomial infections in a Turkish university hospital.</td>
<td>Jain²¹</td>
<td>PubMed</td>
<td>2006</td>
<td>Unknown</td>
<td>Total</td>
</tr>
<tr>
<td>9</td>
<td>Decline in ICU adverse events, nosocomial infections and cost through a quality improvement initiative focusing on teamwork and culture change.</td>
<td>Johnson¹⁷</td>
<td>PubMed</td>
<td>2006</td>
<td>Medical and Nursing</td>
<td>Total</td>
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<tr>
<td>11</td>
<td>Audit of catheter-associated UTI using silver alloy-coated Foley catheters.</td>
<td>Anderson¹⁹</td>
<td>PubMed</td>
<td>2007</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>12</td>
<td>Under resourced Hospital Infection Control and Prevention Programs: Penny Wise, Pound Foolish?</td>
<td>Apsirathanarak²⁰</td>
<td>PubMed</td>
<td>2007</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>13</td>
<td>Effectiveness of Multifaceted Hospitalwide Quality Improvement Programs Featuring an Intervention to Remove Unnecessary Urinary Catheters at a Tertiary Care Center in Thailand.</td>
<td>Apsirathanarak²¹</td>
<td>PubMed</td>
<td>2007</td>
<td>Medical and Nursing</td>
<td>Total</td>
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<tr>
<td>14</td>
<td>Initial inappropriate urinary catheters use in a tertiary-care center: Incidence, risk factors, and outcomes.</td>
<td>Graves²⁵</td>
<td>PubMed</td>
<td>2007</td>
<td>Medical and Nursing</td>
<td>Total</td>
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<tr>
<td>16</td>
<td>Additional direct medical costs of nosocomial infections: an estimation from a cohort of patients in a French university hospital.</td>
<td>Hemmila²⁴</td>
<td>PubMed</td>
<td>2008</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>17</td>
<td>Real Money: Complications and Hospital Costs in Trauma Patients.</td>
<td>JoanNa Briggs Institute²⁵</td>
<td>PubMed</td>
<td>2008</td>
<td>Unknown</td>
<td>Total</td>
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<tr>
<td>18</td>
<td>Removal of short-term indwelling urethral catheters.</td>
<td>Schumm²⁸</td>
<td>PubMed</td>
<td>2008</td>
<td>Unknown</td>
<td>Total</td>
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<tr>
<td>19</td>
<td>Types of Urethral Catheters for Management of Short-Term Voiding Problems in Hospitalized Adults: A Short Version Cochrane Review.</td>
<td>Barsanti²⁷</td>
<td>PubMed</td>
<td>2009</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>20</td>
<td>Incidence Rate and Variable Cost of Nosocomial Infections in Different Types of Intensive Care Units.</td>
<td>Chen²⁸</td>
<td>PubMed</td>
<td>2009</td>
<td>Medical and Nursing</td>
<td>Total</td>
</tr>
<tr>
<td>21</td>
<td>Cost of hospital-associated infections in Massachusetts.</td>
<td>Stone²⁹</td>
<td>PubMed</td>
<td>2009</td>
<td>Medical and Nursing</td>
<td>Partial</td>
</tr>
<tr>
<td>24</td>
<td>Urethral catheters: can we reduce use?</td>
<td>Broek²²</td>
<td>PubMed</td>
<td>2011</td>
<td>Unknown</td>
<td>Total</td>
</tr>
</tbody>
</table>

Figure 4. List of selected studies according to the database, year of publication, professional category and type of cost analysis.
The publications that have addressed the issues related to the overall cost (economic evaluation) were the most frequent, with 15 articles (60.0%) (26.7% of the type being cost-effectiveness and cost-minimization 73.3% ) and 10 articles (40.0%) partial assessment of costs, allowing us to observe that jobs are scarce cost analysis in health care. The professional category that most published work on this topic was medical, with 6 articles (24.0%), followed by nurses, with 2 articles (8.0%). Found 6 (24.0%) articles produced jointly by the two professional categories, other categories and / or unidentified category with 11 publications (44.0%).

For a better analysis of the articles found, the results were divided into two categories namely: analysis of partial cost analysis and total cost (economic evaluation). Of all of the selected studies, we chose to describe those that were developed by category or by other nursing professionals produced jointly with nursing.

† First category: partial analysis of costs

In one study, the authors conducted a simulation of Monte Carlo, where estimated costs provided nosocomial infection in surgical and medical admissions (UTI, wound, chest, bloodstream, other sites and multiple sites of infection) from literature data applied to the data of clinical and surgical admissions in hospitals in the district of Auckland (New Zealand). The incidence of UTI was 1.40 (1.14% -1.67%) and 2.54 (2.27% / 2.81%) in clinical medicine and surgery, respectively. The median for the prolongation of hospital stay for patients with UTI was 1.00 (0.50 to 5.10) and 4.70 (3.60 to 5.10) days in clinical medicine and surgery, respectively. The average cost of UTI from the simulation model was US$ 247,685. In hospital surgical infection in the surgical wound was the most expensive, followed by infection in multiple sites, UTI, chest, others and blood infection (US$1,466,317; US$888,786; US$709,637; US$397,944; US$277,729 e US$160,605, respectively). In patients with multiple sites of nosocomial infection, the costs incurred are lower than those of patients with infection in the surgical wound, but higher than that of patients with urinary tract infection.

Another study estimated the impact of nosocomial infections (blood infection, UTI and surgical site) costs in the ICU, clinical units, medical-surgical and surgical. A total of 401 nosocomial infections occurred in 320 patients, a total of 2757 patients screened. The incidence rate of UTI was 3.0%, 2.4% and 5.5% in units, surgical and medical-surgical, respectively (p <0.001). Costs for UTI were U$ 1955 (1.42 times [95% CI, 1.18 to 1.72 times] the average cost compared to patients without UTI). The medical ICU had the largest increase in cost (US$13,456, which was 3.52 times the average cost for patients without nosocomial infection), followed by medical-surgical ICU (US$ 6,748, which was 2.74 times the average cost for patients without nosocomial infection) and surgical ICU (US$ 5,433, which was 2.46 times the average cost of patients without nosocomial infection). 28

An expert panel sponsored by the public health department of the state of Massachusetts (USA), presented a study to estimate the economic burden of nosocomial infections in intensive care at a hospital in the state in 2006, attributable to site infections surgical, bloodstream infections, ventilator-associated pneumonia and UTI. We registered 752.126 admissions. The incremental cost of UTI from electronic data system presented US$4,205 vs US$ 4,032 compared to the national incremental cost, the frequency of UTI was 13,407 vs. frequency of 11.028 national. Regarding costs with ITU-state values were US$56.379.076 vs. US$ 44.464.896 nationally. 29

† Second category: Total analysis of costs

In another article, we evaluated the use of silver-coated urinary catheter in the incidence of urinary tract infection related to urinary catheter (Cauti) in hospitalized patients. The authors showed that the rate of Cauti to catheters without the silver coating was 4.9/1.000 patient-days, followed by 2.7/1.000 patient-days after the use of silver-coated urinary catheter, a reduction of 45% (p = 0.1. average cost (calculated on hospital charges) for a Cauti was estimated at US$ 1,214,42, with an average of US$613,72. Estimates of cost savings ranged from US$ US$12.563,52 to 142.314,72. 8

In an article that evaluated the efficacy, cost effectiveness, and antimicrobial resistance of catheters covered by silver, showed that the cost rate of infection dropped Cauti of 6.13 / 1,000 days of bladder catheterization, during the period 1999-2000, to 2.62/1,000 catheter-days during the period 2001-2002 (p = 0.002). The additional cost of the catheter covered by silver was obtained from hospital records and purchases totaled US$64,281 in 2001 and US$65,307 in 2002.

In an overall cost in order to determine whether the use of indwelling catheters coated silver reduce the incidence of Cauti when compared to standard protocols catheterization. Furthermore, we evaluated
the cost-effectiveness in relation to urinary catheter without the silver lining, length of stay and whether there was the possibility of a specific group of patients be benefitted more than others who were not making use of the new catheter. We evaluated 133 patients admitted to the ward medical and surgical general hospital belonging to the British health care system in the town of Worcestershire during the period of one year. There was a reduction in rates of Cauti from 7.7% to 5.1%, representing an overall reduction of 33.5%. With the assumption that two Cauti were potentially avoided during the evaluation period of the study, there was a saving of £ 2,654, suggesting possible future savings, suggesting the British health care system the possibility of its incorporation. Regarding the length of hospitalization, the authors estimated that a patient with a UTI acquired in the hospital environment remains hospitalized six days longer than those who showed no infection.13

In another article, the overall cost, which discusses the merits of the use of silver-coated urinary catheter in reducing the risk of Cauti in a general hospital; a project of pre- and post-intervention was used to audit rates Cauti; during the pre-intervention period of 10 weeks, the standard British health agency. Catheters were used and rates Cauti captured. The bladder catheters coated silver have been introduced and their use monitored for an additional period of 10 weeks. The 117 newly catheterized patients were actively monitored for signs and symptoms of Cauti, having met and exceeded its audit goal of reducing the rate of 20% Cauti. There was a decline in the rate of risk of Cauti during the evaluation period. The authors presented an estimated additional cost of Cauti and bacteremia when compared to the control group of 12,032 pounds. Additional costs were estimated for Cauti of £ 2,654, with a cost reduction of £ 9,140. Having regard to the audit results, the authors recommended that the silver-coated urinary catheter was the catheter of choice for use in patients whose acute admission requires a short-term catheterization.18

In a prospective study of the "before and after", there was an overall cost for evaluating the effectiveness of a program to improve hospital quality, which included an intervention to remind physicians to remove unnecessary urinary catheters. A total of 2,412 patients were included in the study. After the intervention, a reduction in the rate of insertion of unnecessary urinary catheter (20.4% average rate vs the pre-intervention. At 11% post-intervention [p = 0.04]), the rate of Cauti (rate mean 21.5 vs. 5.2 infections per 1,000 catheter-days [p <0.001]), duration of catheterization (mean 11 vs. 3 days [p <0.001]), and duration of hospitalization (mean 16 vs. 5 days [p <0.001]). A linear relationship was observed between the average monthly rate Cauti and catheterization (r = 0.89, p <0.001). Hospital costs monthly antibiotics to treat Cauti were reduced by 63% (average of US$3,739 to US$1,378 [p <0.001]), and hospitalization costs for each patient during the intervention was reduced by 58% (average of US$366 vs. $ 154 [P <0.001]).20

**DISCUSSION**

In recent years the epidemiology of nosocomial infections has received attention in the medical literature, being a public health issue worldwide and its relation to the assessments of cost has been worked to seek an alternative to costly procedures and treatments with health.

Whereas catheterization has become the most common intervention performed in the urinary tract, the ITU is the second leading cause of infection in the hospital environment, related mainly with the insertion and prolonged bladder catheter. This type of infection is predictable, currently entering the list of complications which are not reimbursable by health systems, as in the case of the American health care system.34

As the results presented there are other types of bladder catheters, such as those coated with antimicrobial agents, which although higher unit cost when compared to conventional urinary catheter, have effective results and decreased length of stay, reduce UTI rates and reduced length of hospital stay for treatment of related complications.8,10,12,13,17,18,26,30

Regarding costs of urinary catheter-related UTI (Cauti), in addition to catheters coated with antimicrobial approach to cultural change in the health, such as improving service quality, hand hygiene, nursing staff reminders to physicians regarding the time of catheter use and bladder training programs and continuing education showed positive outcomes in reducing rates of UTI and other nosocomial infections, as well as reducing costs and length of stay. The adoption of intervention programs that focus on reducing the use of urinary catheter, also showed a positive outcome regarding hospital costs related to urinary catheter and the development of UTI.31

The unnecessary use of urinary catheters is also associated with a greater tendency to
develop a UTI, since the cost of antibiotic treatment generates a large burden of the costs of hospitalization, as well as increased length of stay in hospital for carrying out the treatment properly said.19,21,25

Costs related to complications such as UTI involve not only antimicrobial treatment itself, but all the procedures that are necessary for the diagnosis and control of infection, such as laboratory testing, exploratory testing, direct medical costs and overtime costs of hospitalization. Nevertheless, the studies addressing the costs of antibiotics for the treatment of IN including the ITU were more prevalent in the search, with the results pointing to a significant increase in hospital costs. 8,9,11,15

In another study, patients with UTI costs were 1.42 times greater than the average cost for patients without infection. Despite the studies previously presented, which showed positive results in increased costs related to catheterization, another study showed no UTI with rising costs or length of stay.

**CONCLUSION**

It is unquestionable the importance of assessing health-related costs, especially considering the aging population thanks to the numerous treatment alternatives and medical advancement. Admissions constitute itself as a major financial burden to the healthcare system, it is public or private.

Still become necessary to review specific studies relating to hospital costs with complications related to catheterization of delay. Considering the size of Brazil as a country of continental proportions, multicenter studies in various regions could eventually provide a diagnosis of the situation and of the ITU IN themselves, the treatments, as well as a database of complication rates, mortality and the destination of the funds in complications that are possible to be avoided.

From the perspective of nursing care, dealing with in their daily professional practice that is invasive catheterization, this study illustrated that the actions performed with the patient and generate consequences that generate these costs; when the nurse presents alternatives that may add values to the health care practice and that adds a greater effectiveness, generating lower costs for the institution, the professional becomes more valued by the market.

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