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ORIGINAL ARTICLE

Economic costs of healthcare-related infections acquired in an Intensive Care Unit

Economic costs of healthcare-related infections acquired in an Intensive Care Unit

Costos económicos de las infecciones relacionadas con la asistencia en salud adquiridas en una Unidad de Terapia Intensiva

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RESUMO

Justificativa e Objetivos: Reduzida quantidade de publicações em países em desenvolvimento acerca do impacto econômico das infecções relacionadas à assistência à saúde (IRAS) adquiridas em Unidade de Tratamento Intensivo (UTI). Avaliar a magnitude dos custos econômicos de pacientes que adquiriram IRAS durante suas internações em uma UTI. **Métodos**: Estudo retrospectivo, de pacientes que estiveram internados na UTI de um hospital da rede pública, com no mínimo 72 horas de permanência, no período de janeiro a março de 2018. **Resultados**: 78 pacientes estiveram internados na UTI. O tempo médio de internação foi de 26,4 dias (pacientes com IRAS adquiridas na UTI), de 8,4 dias (pacientes que já internaram com infecção), e de 6,4 dias (pacientes sem infecção). Os custos de internação foram respectivamente de 38,4%, 35,7% e 25,9% do total. **Conclusões**: a média de dias de internação no grupo de 12 pacientes com IRAS adquiridas na UTI foi 3,1 vezes maior em relação ao grupo de 33 pacientes que já apresentavam infecção à admissão, e 4,1 vezes maior em relação ao grupo de 33 pacientes que não apresentaram infecção. Essa média de permanência prolongada foi acompanhada por uma elevação nos custos com as internações, onde 15,4% dos pacientes (os doze com IRAS adquiridas na UTI) corresponderam a 38,4% dos custos totais com os 78 pacientes do estudo.

Descritores*: Custos econômicos, Unidade de Terapia Intensiva, Infecções Relacionadas à Assistência em Saúde.*

ABSTRACT

Justification and Objectives: Small number of publications in developing countries about the economic impact of healthcare-associated infections (HAI) acquired in Intensive Care Unit (ICU). Evaluating the magnitude of the economic costs of patients who acquired HAI during their hospitalizations in an Intensive Care Unit. **Methods**: Retrospective study of patients who were admitted to the ICU of a public hospital with a minimum of 72 hours of stay from January to March, 2018. **Results**: 78 patients were admitted to the ICU. The mean time of hospitalization was 26.4 days (patients with HAI acquired in the ICU), 8.4 days (patients already hospitalized with infection) and 6.4 days (patients without infection). The hospitalization costs were respectively 38.4%, 35.7% and 25.9% of the total. **Conclusions**: the mean number of hospitalization days in the group of 12 patients with HAI acquired in the ICU was 3.1 times higher than in the group of 33 patients who

already had infection at admission and 4.1 times higher in the group of 33 patients who did not present infection. This prolonged average length of stay was accompanied by a rise in hospitalization costs, where 15.4% of the patients (the twelve with HAI acquired in the ICU) corresponded to 38.4% of the total costs with the 78 patients in the study.

***Keywords**: Economic costs, Intensive Care Unit, Healthcare-Associated Infections.*

RESUMEN

Justificación y Objetivos: Reducida cantidad de publicaciones en países en desarrollo acerca del impacto económico de las infecciones relacionadas con la asistencia sanitaria (IRAS) adquiridas en Unidad de Tratamiento Intensivo (UTI). Evaluar la magnitud de los costos económicos de pacientes que adquirieron infecciones relacionadas con la IRAS durante sus internaciones en una UTI. **Métodos**: Estudio retrospectivo, de pacientes que estuvieron internados en la UTI de un hospital de la red pública, con al menos 72 horas de permanencia, en el período de enero a marzo de 2018. **Resultados**: 78 pacientes estuvieron internados en la UTI. El tiempo promedio de internación fue de 26,4 días (pacientes con IRAS adquiridas en la UTI), de 8,4 días (pacientes que ya internaron con infección), y de 6,4 días (pacientes sin infección). Los costos de internación fueron respectivamente del 38,4%, 35,7% y 25,9% del total. **Conclusiones**: el promedio de días de internación en el grupo de 12 pacientes con IRAS adquiridas en la UTI fue 3,1 veces mayor en relación al grupo de 33 pacientes que ya presentaban infección a la admisión, y 4,1 veces mayor en relación al grupo de 33 pacientes que no presentaron infección. Esta media de permanencia prolongada fue acompañada por una elevación en los costos con las internaciones, donde el 15,4% de los pacientes (los doce con IRAS adquiridas en la UTI) correspondieron al 38,4% de los costos totales con los 78 pacientes del estudio.

***Palabras clave**: Costos económicos, Unidad de Tratamiento Intensivo, Infecciones Relacionadas con la Asistencia Sanitaria.*

INTRODUCTION

The probability for beeing sick due to a healthcare-associated infection (HAI) in intensive care unit (ICU) is 5-10 times higher than the others in the same hospital.[1]

North American data says that HAI are the fifth cause of mortality on acute patients at Emergency Hospitals. Around two million people are affetcted by these infections annually in United States and 90,000 (4.5%) die. It was estimated that the anual US hospitality costs involved with diagnoses, treatment and prevention of these infections were US$ 28-45 billion. According to this author, the most commons hospital acquired infections are bloodstream infections (BSI), surgical site infections (SSI), urinary tract infections (UTI) associated with the use of bladder catheters and mechanical ventilator-associated pneumonias (VAP).[2]

In Brazil, there is still a lack of data regarding to the economic impacts of acquired infections in the ICU. Isolated data from an institutional survey carried out in a philantropic hospital shows a higher hospitalization staying and a higher hospital costs in ICU.[3]

Owing to the longer hospitalization time due HAI acquired in ICU, prevention measures are too important, mainly in Brazil, where there are approximately 45,000 ICU beds distributed among 24% of country's hospitals.[4,5] Brazilian Intensive Care Medicine Association (AMIB) suggests that the ideal ammount is 1-3 beds/10,000 inhabitants. This shortage of ICU beds requires that the management of this sector of Brazilian hospitals has to be extremely efficient, specially due these hospital sector peculiarities.[4]

The hospital from wich this casuistic was raised, is a medium-sized public hospital, in Resende, Rio de Janeiro state, with 70 beds of which nine in ICU.

METHODS

All patients were initially admitted to the ICU and were followed up by the hospital's epidemiological service during the 2018 year in the months of january, february and march. 44 patients were excluded because they were hospitalized for less than three days (or 72 hours). To be considered a ICU infection, HAI must be reported clinically and/or laboratorially after this time.[6,7] If a patient, for instance, had been hospitalized for na infection condition treatment and during this ICU stay, he or she developed another infection, his or her classification would be as HAI acquired in ICU.

For the diagnoses of SSI, BSI and healthcare-related pneumonia, associated or not with mechanical ventilation, the Anvisa's "Diagnostic Criteria for Healthcare-Associated Infection" were followed.[8]

Economic costs from HAI patients during ICU hospitalization will be compared to the same costs from patients who were already been presented infection before the ICU admission and compared to others who had not presented infections during ICU hospitalization.

RESULTS

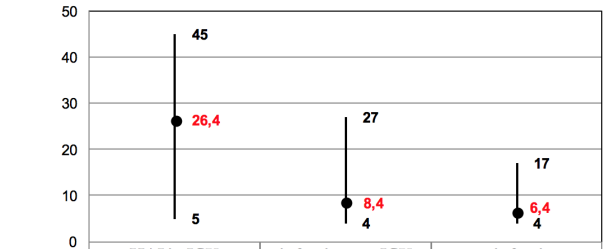
One hundred and twenty two patients were admitted to the ICU from january 1 through March 31, 2018. Forty four patients who stayed less than 72 hours (three days) in the hospital were not included in this study as outlined in study methodology.

The age of the 78 patients ranged from 16 to 83 years old, with a mean of 58 years old. The basic causes for ICU admission were clinical ones (30 infections, 23 cardiovascular, two pancreatitis, one acute respiratory failure, acute renal insufficiency and exogenous intoxication) and surgical ilnesses (seven postoperative, four gunshot injuries, three polytrauma, three cranioencephalic injuries and a perforated gastric ulcer). It was not possible defining the basic cause for two patients because their medical records were not available.

Twelve patients who developed some type of HAI in ICU were intercharged in a range of five to 45 days, with an average of 26.4 days. For 33 patients who already had an infectious condition before admission to the ICU, staying interval was shorter, from 4 to 27 days, with a mean of 8.4 days. To the 33 patients who did not present an infectious condition during the ICU stay, the residence interval was the lowest of the three groups, ranging from four to 17 days, with an average of 6.4 days (Graph 1).

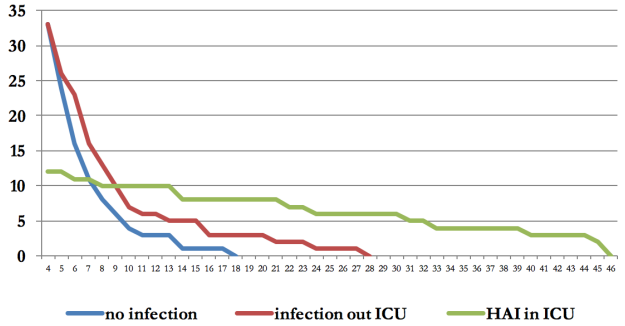
Graph 2 shows the time periods in wich patients from the three groups were discharged from ICU. It is possible observing that patients who acquired infection after admission to ICU, although they were in a smaller quantity, they were the ones who remained a longer hospitalization time.

Pneumonia was the most common infection, whether it was acquired before or after admission to ICU. With lower frequencies, infections of the bloodstream, urinary tract, intra-abdominal or surgical site, skin or soft tissues occurred (Graph 3).

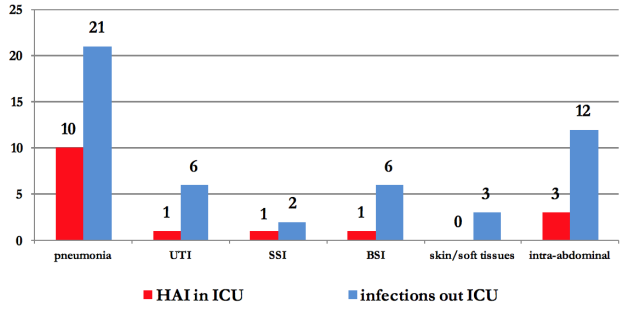


	HAI in ICU	infection out ICU	no infection
max	45	27	17
min	5	4	4
●average	26,4	8,4	6,4

Graph 1. Dwell days in ICU.



Graph 2. Dwell time in ICU.

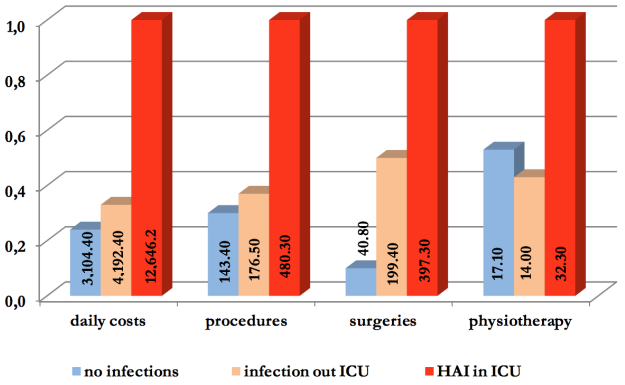


Graph 3. Infectious process topographies.

The ICU hospital admissions costs showed at this study had three componentes: hospital daily; diagnostic and therapeutic procedures and surgeries performed; and physiotherapy sessions.

Daily costs were US$ 478,72 regardless mechanical ventilation use, medications (including antimicrobials) or disposable material, wich is the most relevant cost component. On the other hand, diagnostic and therapeutic procedures (eg, computadorized tomography, radiography, ecocardiography, lower members ecocardiography, endoscopy, obstetrical ultrasound, hemodialysis and surgeries) and physioterapy corresponded to a lower participation in the costs. Daily costs with physioterapy were, respectively R$ 382,549.44; R$ 29,506.97; R$ 1,415.01; resulting in a total amount of R$ 423,471.42.

Graph 4 shows the average costs of the three groups (HAI acquired in ICU, infections present at ICU admission and without infection) with each hospitalization costs componente (hospital stays,diagnostic procedures, surgeries and physioterapy). For this grah construction, we considered the group of admitted ICU patients as a reference for 100% of average costs.



Graph 4. Average costs (R$) of each group of patients with the cost components.

DISCUSSION

Hospital infections are the most frequent hazards.[7,9] The incidence of these infections may vary from 4.5 to 15%.[7,9,10] ICU infection rate acquired in the presente study was 15.4%, similar to the ohers cited.

Several authors correlated HAI with increased hospital stay time, increased costs, and even increased morbidity and mortality. ICU infection acquired is significantly associated with the lenght os stay, wich is not verified with other variables related to the status of the disease evaluated by APACHE II, emergency surgeries, nor even with acquired conditions prior to admissions to this treatment unit.[11]

A prolonged ICU stay study through economic bias, one study pointed out that only reducing the staying length woud be an adequate mesure to economize. Fixed costs correspond to 80% of total costs and, therefore, using the dwell time (wich is variable according to pacient) as the main cost measure would be erroneous.[12] Another study also showed similar values (84–89%) for fixed hospital costs.[13]

Three studies considered all topographies of infections in costs evaluation. The first study was based on three hospitals between 2006 and 2012, comparing patients with infections with non-infected patients (control group).[14] The second study was based on a meta-analysis in US hospitals between July 2011 and April 2013, the costs of each type of infection, and the overhead costs for each type of infection in the US.[15] The third study also used the control method, but just in a single hospital in India.[16] In all three studies, pneumonia and bloodstreeam infections were the most costly infections per person.

However, considering the affected patient group from a particular hospital infection, the infections wich produced the highest costs were firstly SSI, followed by VAP, BSI, *Clostridioides difficile* infections and UTI's, in this sequence order.[15]

Multidrug-resistent microrganisms (MDR) are independente factors for hospitalization time and hospital costs. These increases may be due to a delay in treatment with effective antimicrobials or also due to the need to perform surgeries and other procedures.[17,18] Three patients with a history case presented Staphylococcus aureus bacteremia. Two methicillin–sensitive agentes (MSSA) were from infections prior to admissions to the ICU, and the third, methicillin-resistent (MRSA) was from an ICU HIA. The two patients with MSSA remained for four and seven days in the ICU, while the MRSA patient was hospitalized for 39 days.

The acquired HIA during ICU stay are not the only fator for a hospitalization increasing time and, consequently,

costs. Invasive mechanical ventilation i salso associated with prolonged hospital stay, and approximately ⅓ of ICU admitted patients require this mode of ventilatory support.[19] From the 76 patients in this study, 43 patients had used mechanical ventilation and remained in an average of 12.4 hospitalized days. The other 33 patients who did not use an invasive ventilatory prothesis had an average of 7.2 hospitalized days.

Finally, it is important to note that several researchers have been working to directly or indirectly improve the clinical outcomes of nosocomial ICU acquired infections and thus, reducing their economic impact. Some researchers working with epidemiology, others with antimicrobial stewardship programs (ASP), others with improvements in techniques applied to laboratory diagnosis.[1-3,7,9-25]

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