REVISTA ENFERMAGEM ATUAL IN DERME

## PROFILE OF PATIENTS AND INFECTIONS IN INTENSIVE CARE UNITS

## PERFIL DE PACIENTES E INFECCIONES EM UNIDADES DE CUIDADOS INTENSIVOS

## PERFIL DOS PACIENTES E DAS INFECÇÕES EM UNIDADES DE TERAPIA INTENSIVA

[1]Djennyfer do Nascimento Morais
[2]Nayara Kalila dos Santos Bezerra
[3]Layane Rodrigues Nunes
[4]Helenira Macedo Barros Machado
[5]Fabrício Barreto
[6]Paulo Sérgio da Silva
[7]Raquel Voges Caldart

[1]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: https://orcid.org/0009-0005-5754-3473
[2]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: http://orcid.org/0000-0003-2312-1203
[3]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: https://orcid.org/0009-0002-9034-6410
[4]Universidade Estácio, Boa Vista, Roraima, Brazil. Orcid: https://orcid.org/0000-0003-1452-1256
[5]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: https://orcid.org/0000-0003-2974-7864
[6]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: http://orcid.org/0000-0003- 2746-2531
[7]Universidade Federal de Roraima, Boa Vista, Roraima, Brazil. Orcid: http://orcid.org/0000-0001-8679-9519

**Corresponding Author**
**Nayara Kalila dos Santos Bezerra**
Av. Cap. Ene Garcês, 2413 - Aeroporto, Boa Vista - RR, Brazil. 69310-000
Telefone: +55 (95) 991145867 E-mail: nayara.kalila@gmail.com

**ABSTRACT**
**Introduction:** The Intensive Care Unit is the hospital sector with the highest rates of healthcare-associated infections, significantly surpassing those of other sectors. **Objective:** to determine the profile of patients and infections in the intensive care units of a significant adult referral hospital in the extreme north of Brazil. **Methods:** a quantitative, observational, cross-sectional study was conducted involving 45 patients admitted to the intensive care units of the aforementioned hospital. Individuals of both sexes and over 18 years old were included. A structured form with demographic, clinical, and microbiological variables of the patients was used. Data were collected directly from the patients' medical records in the first quarter of 2023. Simple descriptive analysis of the data was performed. The study was approved by the Research Ethics Committee. **Results:** of the 45 medical records analyzed, 64,4% were men, 50,6% were elderly, 66,7% were hospitalized for more than 15 days, 82,2% used three or more invasive devices, 86,7% used at least one antibiotic, 45,6% had a diagnosis of infection, with a highlight on pathogens from the ESKAPE group (81,0%). **Conclusion:** the presented data reinforce the need for infection prevention and control measures in the hospital environment, particularly emphasizing hand hygiene, implementation of precautionary measures and isolation, management of antimicrobial use, and the utilization of infection prevention protocols.
**Keywords:** Cross Infection; Intensive Care Units; Nursing Care.

**RESUMEN**
**Introducción:** la Unidad de Cuidados Intensivos es el sector hospitalario con mayores tasas de infecciones asociadas a la asistencia sanitaria, superando significativamente a las de otros sectores. **Objetivo:** determinar el perfil de pacientes y infecciones en las unidades de cuidados intensivos de un importante hospital de referencia para adultos en el extremo norte de Brasil. **Métodos:** estudio cuantitativo, observacional, transversal, realizado con 45 pacientes ingresados en las unidades de cuidados intensivos del hospital antes mencionado. Se incluyeron individuos de ambos sexos y mayores de 18 años. Se utilizó un formulario estructurado con variables demográficas, clínicas y microbiológicas de los pacientes. Los datos se recogieron directamente de los registros de los pacientes, en el primer trimestre de 2023. Se realizó un análisis descriptivo simple de los datos. El estudio fue aprobado por el Comité de Ética en Investigación. **Resultados:** de las 45 historias clínicas analizadas, el 64,4% eran hombres, el 50,6% eran ancianos, el 66,7% permaneció hospitalizado por más de 15 días, el 82,2% utilizó tres o más dispositivos invasivos, el 86,7% utilizó al menos un antibiótico, el 45,6% tenía un diagnóstico de infección, con énfasis en patógenos del grupo ESKAPE (81,0%). **Conclusión:** los datos presentados refuerzan la necesidad de medidas para prevenir y controlar infecciones en el ambiente hospitalario, con énfasis en la higiene de manos, aplicación de medidas de precaución y aislamiento, manejo del uso de antimicrobianos y uso de protocolos de prevención de infecciones.
**Palabras clave:** Infección Hospitalaria; Unidad de Cuidados Intensivos; Atención de Enfermaría.

**RESUMO**
**Introdução:** a Unidade de Terapia Intensiva é o setor hospitalar com as taxas mais altas de infecções relacionadas à assistência à saúde, superando significativamente as de outros setores. **Objetivo:** determinar o perfil dos pacientes e das infecções nas unidades de terapia intensiva de um importante hospital de referência para adultos do extremo norte do Brasil. **Métodos**: estudo quantitativo, observacional, de corte transversal, realizado com 45 pacientes internados nas unidades de terapia intensiva do referido hospital. Foram incluídos indivíduos de ambos os sexos e maiores de 18 anos de idade. Utilizou-se um formulário estruturado com variáveis demográficas, clínicas e microbiológicas dos pacientes. Os dados foram coletados diretamente do prontuário dos pacientes, no primeiro trimestre de 2023. Procedeu-se com análise descritiva simples dos dados. O estudo foi aprovado pelo Comitê de Ética em Pesquisa. **Resultados:** dos 45 prontuários analisados, 64,4% eram homens, 50,6% idosos, 66,7% permaneceram hospitalizados por mais de 15 dias, 82,2% utilizaram três ou mais dispositivos invasivos, 86,7% faziam uso de pelo menos um antibiótico, 45,6% tinham diagnóstico de infecção, com destaque para patógenos do grupo ESKAPE (81,0%). **Conclusão:** os dados apresentados reforçam a necessidade de medidas de prevenção e controle das infecções em ambiente hospitalar com destaque para a higienização das mãos, aplicação de medidas de precaução e isolamento, gerenciamento do uso de antimicrobianos e utilização de protocolos de prevenção de infecções.
**Palavras-chave:** Infecção Hospitalar; Unidade de Terapia Intensiva; Cuidados de Enfermagem.

## INTRODUCTION

Scientific and technological advances in the health field over time have provided longer survival rates for patients, supported by advanced life support, the use of invasive devices, organ transplants, immunosuppressive therapies, and powerful medications. However, despite the benefits, these procedures make patients more vulnerable, resulting in consequences such as the occurrence of infections acquired in the hospital environment, which, combined with increased bacterial resistance to drugs, make these infections difficult to control, despite efforts to prevent them[1,2].

In this context, the Intensive Care Unit (ICU) stands out, as it is a sector characterized by high complexity and the provision of care to people in critical health conditions using high-tech equipment, which requires a specialized multidisciplinary team to provide uninterrupted care. Special emphasis is given here to the nursing team, responsible for continuous, comprehensive, and thorough monitoring of the patient. In order to ensure safety and quality in care, the care offered to this population requires technical and scientific knowledge and preparation[3,4].

It is also worth noting that the ICU is the sector with the highest rates of healthcare-associated infections (HAIs), significantly higher than in other hospital sectors. This is due to the greater vulnerability of patients and the frequent use of invasive procedures. As a consequence, there is an increase in hospitalization time, hospitalization costs, and higher morbidity and mortality rates, considerably compromising the quality of care and patient safety[5,6].

In these circumstances, determining the profile of patients undergoing intensive care, the procedures to which they are subjected, as well as the infections they acquire is essential, as this is consistent data that allows better planning of the care provided. Knowing the characteristics of patients treated in these sectors directs care measures, especially with regard to treatment, prognosis, and risk factors to which they are exposed. Considering the duties of the nursing team in the ICU, such data can support the care plan for critically ill patients, in addition to enabling the creation of assessment instruments, indicators of the quality of care, and measures to prevent and control infections aimed at this population[7].

Considering that knowledge about the profile of patients and infections in the hospital environment contributes to the understanding of the dynamics of the population served in these sectors, as well as hospital infections in a region with its own characteristics that are different from other regions of the country. And taking into account that these data aggregate information related to a region that has a shortage of research focused on this topic, especially in the post-COVID-19 pandemic period, which led to a considerable increase in ICU beds in the region, this study was proposed to determine the profile of patients and infections

in the intensive care sectors of a major referral hospital for adults in the far north of Brazil.

## METHODS

Quantitative, observational, cross-sectional study, guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) tool8, developed in the first quarter of 2023, in the ICUs of a referral hospital for adults in the far north of Brazil. These are general ICUs, which together have 40 beds and exclusively serve patients from the Unified Health System (SUS) from the capital and the interior, as well as those from neighboring states and bordering countries.

The study population consisted of patients who were hospitalized in the ICUs during the data collection period. Individuals of both sexes and over 18 years of age were included. Indigenous patients, those from other nationalities and medical records of patients with incomplete information for this research were excluded.

A structured form was used to collect the data that contained variables related to the demographic, clinical and microbiological characteristics of the patients, namely: age; sex; reason for admission; length of hospital stay; number and type of invasive device used by patients; use of antibiotics; presence of infection; type of clinical sample collected for culture; and; microorganism identified.

Data collection took place in the first quarter of 2023, through visits made on weekdays (Monday to Friday) by students from the 7th and 9th periods of the nursing course, who were previously trained to standardize the collection. Data were collected through consultations of hospital infection notification forms, patient records, and direct observation of the patient. Data analysis was performed using simple descriptive statistics, whose variables were analyzed through absolute and relative frequencies, measure of central tendency (mean) and dispersion (standard deviation). This research was approved by the Research Ethics Committee under opinion No. 5,791,380.

## RESULTS

A total of 45 patients participated in the study, of which 64.4% (n=29) were men and the mean age was 50.6 ($\pm$22.2) years. However, when distributed by age group, there was a predominance of patients aged 60 years or older (46.7%; n=21).

Regarding the cause of admission, 37.8% (n=17) of the patients were admitted for traumatological conditions, 33.3% (n=15) for surgical conditions and 28.9% (n=13) for clinical causes. The mean length of hospital stay was 35.1 ($\pm$42.1) days, with 66.7% (n=30) of the patients remaining hospitalized for a period longer than 15 days.

Regarding the use of invasive devices, 82.2% (n=37) of patients used three or more devices, resulting in an average of 3.5 ($\pm$1.1) devices per patient.

Regarding antibiotic therapy prescribed to patients admitted to ICUs, 86.7% (n=39) were using at least one antibiotic at the time of data collection. The presence of infection was observed in 46.6% (n=21), who had a medical diagnosis of infection recorded in the medical records and/or culture with a positive antibiogram for infection. Table 1 shows the demographic and clinical characteristics of the patients participating in the study.

Table 1 - Demographic and clinical characterization of patients admitted to the Intensive Care Units of a referral hospital in the far north of Brazil, according to infection diagnosis, Boa Vista, RR, Brazil, 2023.

| Variables | With infection (n=21) n (%) | Without infection (n=24) n (%) | Total (n=45) n (%) |
|---|---|---|---|
| **Gender** | | | |
| Male | 15 (51,7) | 14 (48,3) | 29 (64,4) |
| Female | 6 (37,5) | 10 (62,5) | 16 (35,6) |
| **Age range** | | | |
| < 20 years old | 2 (66,7) | 1 (33,3) | 3 (6,7) |
| 20-29 years old | 6 (54,5) | 5 (45,5) | 11 (24,4) |
| 30-39 years old | 1 (33,3) | 2 (66,7) | 3 (6,7) |
| 40-49 years old | 1 (33,3) | 2 (66,7) | 3 (6,7) |
| 50-59 years old | 1 (25,0) | 3 (75,0) | 4 (8,9) |
| 60 and up | 10 (47,6) | 11 (52,4) | 21 (46,7) |
| **Reason of admission** | | | |
| Trauma | 7 (41,2) | 10 (58,8) | 17 (37,8) |
| Surgical | 6 (40,0) | 9 (60,0) | 15 (33,3) |
| Clinic | 8 (61,5) | 5 (38,5) | 13 (28,9) |
| **Length of hospital stay** | | | |
| ≤ 15 days | 5 (33,3) | 10 (66,7) | 15 (33,3) |

| | | | |
|---|---|---|---|
| > 15 days | 16 (53,3) | 14 (46,7) | 30 (66,7) |
| **Number of invasive devices** | | | |
| 0 to 2 | 1 (12,5) | 7 (87,5) | 8 (17,8) |
| 3 or more | 20 (54,1) | 17 (45,9) | 37 (82,2) |
| **Antibiotic use** | | | |
| Yes | 18 (46,2) | 21 (53,8) | 39 (86,7) |
| No | 3 (75,0) | 1 (25,0) | 4 (8,9) |
| Average age of patients (years) (±DP) | | 50,6 (±22,2) | |
| Average length of hospital stay (days) (±DP) | | 35,1 (±42,1) | |
| Average number of devices invasivos (±DP) | | 3,5 (±1,1) | |

Source: authors, 2023.

DP: standard deviation.

Table 2 shows the distribution of invasive devices used by patients admitted to the ICUs. It can be seen that the 45 patients underwent 159 different invasive procedures. Overall, the most commonly used device was the indwelling urinary catheter, identified in 91.1% (n=41) of patients. The highest percentages of use of invasive devices were among patients with infection (51.6%; n=82) when compared to those without infection (48.4%; n=77). In patients with infection, indwelling urinary catheter (95.2%; n=20) and orotracheal/tracheostomy tube (95.2%; n=20) prevailed, followed by central venous access (90.5%; n=19).

**Table 2** - Distribution of the main invasive devices used in patients admitted to Intensive Care Units of a reference hospital in the extreme north of Brazil, according to infection diagnosis, Boa Vista, Roraima, Brazil, 2023.

| **Invasive devices** | Infection (n=21) n (%) | Without infection (n=24) n (%) | Total (n=45) n (%) |
|---|---|---|---|
| Indwelling urinary catheter | 20 (95,2) | 21 (87,5) | 41 (91,1) |

| | | | |
|---|---|---|---|
| Orotracheal tube, tracheostomy | 20 (95,2) | 16 (66,7) | 36 (80,0) |
| Central venous access | 19 (90,5) | 15 (62,5) | 34 (75,6) |
| Nasogastric tube, nasoenteral tube, gastrostomy | 16 (76,2) | 10 (41,7) | 26 (57,8) |
| Peripheral venous access | 4 (19,0) | 11 (45,8) | 15 (33,3) |
| Others | 3 (14,3) | 4 (16,7) | 7 (15,6) |
| **Total** | **82 (51,6)** | **77 (48,4)** | **159 (100,0)** |

Source: authors, 2023.

Regarding antibiotic therapy prescribed to patients, there was a predominance of the cephalosporin class (37.7%), followed by glycopeptides (19.7%) and carbapenems (14.8%), as shown in figure 1.

**Figure 1** - Main classes of antibiotics prescribed to patients admitted to Intensive Care Units of a reference hospital in the extreme north of Brazil, Boa Vista, Roraima, Braz il, 2023.
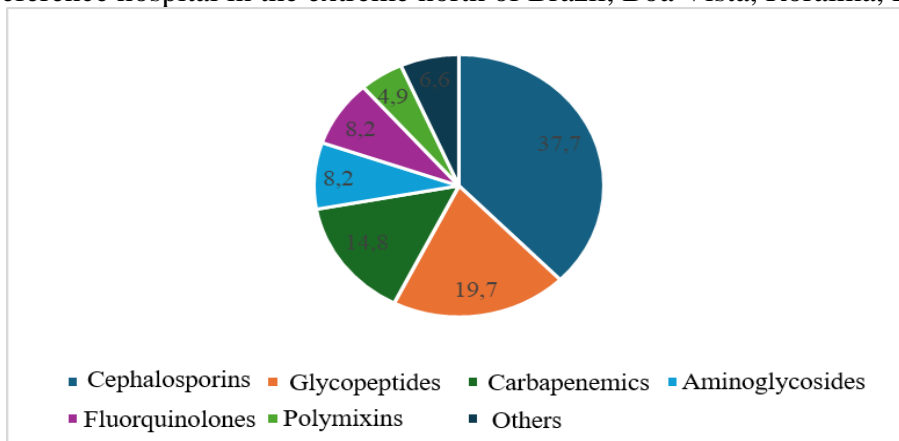


Source: authors, 2023.

Analysis of the results of the microbiological tests showed that 21 samples were collected for culture, of which the predominant samples were those from the respiratory tract (61.9%; n=13), followed by samples from the catheter tip (33.3%; n=7). Table 3 shows the main pathogens identified in the samples collected from the patients participating in the study.

**Table 3** - Main pathogens identified in the culture tests performed on patients diagnosed with hospital infection in the intensive care units of a referral hospital in the far north of Brazil, according to the type of sample collected, Boa Vista, RR, Brazil, 2023.

| Pathogen | Respiratory tract (n=13) n (%) | Catheter tip (n=7) n (%) | Liquor (n=1) n (%) | Total (n=21) n (%) |
|---|---|---|---|---|
| **ESKAPE Group** | | | | |
| *Klebsiella pneumoniae* | 3 (14,3) | 3 (14,3) | 1 (4,8) | 7 (33,3) |
| *Acinetobacter baumannii* | 3 (14,3) | 1 (4,8) | 0 (0,0) | 4 (19,0) |
| *Pseudomonas aeruginosa* | 3 (14,3) | 1 (4,8) | 0 (0,0) | 4 (19,0) |
| *Enterobacter spp* | 2 (9,5) | 0 (0,0) | 0 (0,0) | 2 (9,5) |
| Subtotal | 11 (52,3) | 5 (23,8) | 1 (4,8) | 17 (81,0) |
| Others species | | | | |
| *Serratia marcescens* | 1 (4,8) | 1 (4,8) | 0 (0,0) | 2 (9,5) |
| *Proteus mirabillis* | 1 (4,8) | 0 (0,0) | 0 (0,0) | 1 (4,8) |
| *Staphylococcus epidermidis* | 0 (0,0) | 1 (4,8) | 0 (0,0) | 1 (4,8) |
| Subtotal | 2 (9,5) | 2 (9,5) | 0 (0,0) | 4 (19,0) |
| Total | 13 (61,9) | 7 (33,3) | 1 (4,8) | 21 (100,0) |

Source: authors, 2023.

*A*s demonstrated (Table 3), 81.0% of infections were caused by organisms attributed to the ESKAPE group *(Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa and Enterobacter spp. K. pneumoniae stands out with 33.3%, followed by A. baumannii and P. aeruginosa with 19.0%.*

## DISCUSSION

The context of this study is marked by a number of ICU beds below the population need. In 2016, while the recommendation was 1 to 3 ICU beds for every 10,000 inhabitants, Roraima had 0.94 SUS beds for this population, with no ICU beds for coronary or burns[9–11]. With the COVID-19 pandemic, the number of ICU beds in public institutions tripled, which required a demand for professionals qualified in adult intensive care, as well as an update of the profile

of patients admitted to these sectors to support the adaptation of measures that provide patient safety and quality of care[12].

The data collected from patients admitted to intensive care sectors showed a higher frequency of male patients, both in the total number of patients participating in the study and in the total number of patients with infection. This characteristic is also found in other studies that address the topic, such as a study conducted in a hospital in Minas Gerais, which showed a greater number of men than women[13] and in a study conducted in Rio de Janeiro, which demonstrated that HAIs were more frequent in male patients[14].

The high rates of men hospitalized and affected by hospital infections can be explained by the fact that they have difficulty seeking disease prevention services, either due to cultural issues or the characteristics of preventive services. It is observed that basic health units, when promoting prevention actions, have as their target audience, in most cases, the maternal and child population. Furthermore, the opening hours of these units do not favor those who work during business hours and, consequently, in general, men choose to seek health care in hospital emergency care units when cases are already advanced[15].

Regarding the age of patients admitted to the ICU during the study period, an average of 50.6 years was observed, and the distribution by age group showed an excess of elderly patients. Regarding patients with infection, the highest percentage was in those belonging to the younger age groups. The number of elderly people under intensive care has been increasing as the population ages, as observed in other studies that demonstrate the greater vulnerability of this population group. This is due to the increase in life expectancy, the increase in the prevalence of chronic non-communicable diseases that contribute to higher hospitalization rates, increased hospitalization time and the vulnerability of this population to acquiring HAIs[16,17].

As for the younger group that had higher infection rates, this may be related to the severity of the case, considering that, in general, young patients are hospitalized in ICUs due to multiple traumas, which increases the vulnerability of this group to infectious diseases[18].

It is already well established in the literature that prolonged hospital stays, especially in ICUs, are a risk factor for acquiring HAIs, since they increase the chances of invasive procedures and the use of antibiotics, in addition to the particularities of the environment to which the individual is exposed, promoting the natural selection of resistant bacteria. As observed in this study, in which 66.7% of patients were hospitalized in ICUs for a period longer than 15 days, other studies reinforce that patients with long hospital stays are vulnerable to other risk factors, prolonging their hospital stay. It is also noteworthy that patients diagnosed with infections have an increase of almost 15 days in

their hospital stay. Consequently, there is withdrawal from family, work, and social life, directly impacting the quality of life of the individual and family[19,20].

Regarding HAIs, it is a consensus that they can occur in any location where there is health care; however, in the hospital environment, such infections are more prevalent, with ICUs being the sectors where they occur most frequently. This is related to the profile of patients admitted to the sector, whether due to extremes of age, comorbidities, prolonged hospital stay, infection by drug-resistant bacteria and/or the use of different invasive devices. Considering the latter, it is worth noting that the most frequent hospital infections are those related to some of these devices, such as urinary tract infection (UTI) related to bladder catheters, bloodstream infection (BSI) associated with vascular catheters, surgical site infection (SSI) and ventilator-associated pneumonia (VAP)[21].

It is important to highlight that invasive devices and procedures are necessary for the treatment of patients under intensive care; however, they require the health team, especially nursing staff, to establish and comply with protocols to prevent these infections. These protocols, also known as packages or bundles, consist of standardizing care, seeking to reduce risks and help prevent HAIs, through scientific evidence[22].

For each procedure, there are prevention packages that, when implemented correctly, together with training and monitoring of the team responsible for carrying out the procedures, present results in preventing and reducing different types of infection. However, the practice must be carried out following the protocols by the professionals who are working in that environment, from its insertion, maintenance, hygiene, handling and removal to avoid possible HAIs[23]. Another proven effective way to reduce the risk of infection is through proper hand hygiene by health professionals[24].

Among the main invasive devices used by the patients participating in this study were the indwelling urinary catheter, mechanical ventilation (orotracheal tube and tracheostomy) and feeding devices (nasogastric, nasoenteral and gastrostomy tubes). These devices are important risk factors for HAIs, as they are gateways for microorganisms to enter and spread into different organic systems, such as the respiratory, urinary and intestinal tracts, among others[25].

Regarding the agents causing infections in the participants of this study, there was a predominance of pathogens attributed to the ESKAPE group (Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa and Enterobacter species), with emphasis in this study on K. pneumoniae (14.3%), A. baumannii (14.3%) and P. aeruginosa (14.3%) [26]. This group of pathogens is frequently identified in hospital infections, as in a study conducted in 2019 in an ICU in the state of Pará, which showed that the most

common colonization by microorganisms was also attributed to bacteria from the ESKAPE group, S. aureus (61.4%), followed by K. pneumoniae (40.4%) and P. aeruginosa (26.3%) [13].

In the local context, these pathogens have been identified since 2016, when infections caused by A. baumannii were identified in the ICUs participating in this study. Furthermore, a study at the time identified the presence of international clones of this microorganism with an extensively drug-resistant profile responsible for outbreaks during the period between 2016 and 2018[26].

Given its relevance, the ESKAPE group was included on the World Health Organization list in 2017 as "priority pathogens" due to their resistance to antibiotics, they were highlighted as a threat to human health and required priority to promote research and development of new antibiotics that could deal with these multiresistant bacteria[28].

These are bacteria, mostly belonging to the human microbiota, which, due to imbalance, begin to cause infection. For example, E. faecium is part of the human microbiota, but can cause urinary tract infections, meningitis and bloodstream infections. P. aeruginosa, K. pneumoniae and Enterobacter spp are considered the main causes of hospital pneumonia, especially in patients with a long hospital stay, but are also part of the human bacterial flora. S. aureus, part of the human skin microbiota, however, can cause serious diseases such as pneumonia and sepsis. A. baumannii, one of the pathogens that is most resistant to antibiotics, mainly affects patients admitted to the ICU and can cause VAP, UTI, BSI, burn and wound infections[25].

The analysis of antibiotic use by the patients participating in this study showed that a high number of patients were under antibiotic therapy. The indiscriminate use of antimicrobials is a public health problem, since they favor bacterial resistance to drugs. Consequently, treatment options for patients with HAIs become scarce and treatment more difficult[29].

Cephalosporins, glycopeptides and carbapenems stand out among the most prescribed antibiotics. Antibiotics are the most prescribed class of drugs in hospitals. Estimates indicate that 20-50% of prescriptions for these drugs in hospitals are inappropriate, contributing to the emergence and spread of drug-resistant bacteria[30].

Furthermore, studies indicate that prior use of these drugs is a risk factor for acquiring infection. Also noteworthy are studies that showed high percentages (82.9%) of prior use of carbapenems and demonstrated that prior exposure to cephalosporins led to a six-fold increased risk of acquiring infection by A. baumannii producing OXA-23. That said, it is reinforced that strategies promoting the rational use of antimicrobials are strongly recommended to reduce the high prescription rate of these drugs and promote the appropriate use of antibiotics in a hospital environment[31,32].

## CONCLUSION

The research showed the profile of patients and healthcare-related infections over a three-month period, described the characteristics of individuals admitted to ICUs and affected by infections in a hospital environment, among the findings of which the prolonged length of hospital stay, use of invasive devices and use of antibiotics stand out. Among the etiological agents of infections, it follows the global, national and local pattern, with a prevalence of microorganisms attributed to the ESKAPE group, with emphasis on Gram-negative bacilli, which are characterized in the literature as extensively resistant to drugs.

These data reinforce the need for measures to prevent and control infections in the hospital environment, with emphasis on hand hygiene, application of precautionary and isolation measures, management of antimicrobial use, use of infection prevention protocols, such as those aimed at the use of invasive devices and cleaning and disinfection of surfaces.

This study has limitations such as the use of secondary databases, which resulted in the exclusion of patients due to lack of information or incomplete data in medical records and infection notification forms.

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**Authorship Criteria (authors' contributions)**

Substantially contributed to the conception and/or planning of the study: Morais DN, Caldart RV.

Obtained, analyzed and/or interpreted the data: Morais DN, Caldart RV.

Written and/or critically reviewed and approved the final version of the published work: Morais DN, Bezerra NKS, Nunes LR, Machado HMB, Barreto F, Silva PS, Caldart RV.

**Conflict of Interest**

"Nothing to declare".

**Scientific Editor:** Ítalo Arão Pereira Ribeiro. Orcid: https://orcid.org/0000-0003-0778-1447