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# Prevalence and antimicrobial susceptibility profile of microorganisms in a university hospital from Vitória (ES), Brazil

## *Prevalência de microrganismos e perfil de suscetibilidade antimicrobiana em um hospital universitário de Vitória (ES), Brasil*

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## ABSTRACT

**Introduction:** Healthcare associated infections (HAIs) occur during the hospital stay as a result of underlying morbidity, invasive procedures, acute pathology or medical treatment. They lead prolonged stay and, consequently, to an increase in financial charges. The main tool to control these infections is the use of antimicrobials. However, the increase in resistance and the low frequency of discovery of new drugs justify the research that evaluates the resistance profile of microorganisms to antimicrobials. **Objective:** To evaluate the prevalence and antimicrobial susceptibility profile of HAIs at a philanthropic reference hospital in Espírito Santo, Brazil. **Methods:** Observational, retrospective and cross-sectional study, between July 2014 and June 2016. Data on blood, urine and corporal secretions culture were collected from the data base of the Hospital Infection Control Commission. **Results:** There was a high prevalence of HAIs in patients older than 60 years. Two hundred and forty three (47.55%) patients were female. The four most prevalent bacteria were: *Acinetobacter* spp., *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Polymyxin was the drug which presented the best antimicrobial effects. **Conclusion:** Polymyxin was active *in vitro* against all isolates of *Acinetobacter* spp. Regarding *K. pneumoniae*, both polymyxin and amikacin showed a significant effectiveness. Regarding *Pseudomonas aeruginosa*, polymyxin was effective in all samples. Regarding *S. aureus*, teicoplanin, daptomycin and vancomycin were effective in all samples. Polymyxin showed a good overall *in vitro* activity.

**Key words:** antimicrobial resistance; hospital-acquired infection; bacteria; antibacterials; microbial susceptibility testing.

## INTRODUCTION

Healthcare Associated Infections (HAIs) or hospital-acquired infection is an infection that is acquired within seventy-two hours from the admission of the patient at the hospital, and manifest during the hospitalization period. Furthermore, an infection occurring within seventy-two hours prior to the admission, when related to diagnostic and therapeutic procedures performed in a hospital setting during this period, may be also referred as HAIs[1, 2].

Many HAIs develop after the patient is immunologically compromised. Most infections originate from the patient's microbiota (endogenous), but may originate from the in-hospital microbiota (exogenous). It is known that colonization precedes infection in both cases, making it difficult to determine whether the agent came from the community or was acquired during hospitalization[3].

One of the wards where HAIs are most prevalent is the intensive care unit (ICU), where physicians treat serious diseases and debilitated patients[4]. As medical care becomes more complex and antibiotic resistance increases, cases of HAIs tend to grow[5]. Therefore, a major concern is the increase of microorganisms resistant to a greater number of antimicrobials. They are also associated with significant morbidity, mortality, and increased hospital costs, and are documented in literature[6-9]. Of most concern, however, is the slow

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rate of the antibiotic's development in recent years, which highlights the importance of understanding current levels of resistance and preserving the efficacy of existing antibiotics[10].

Mortality rates for HAIs depend on topography, underlying disease, etiology, among others factors. In Brazil, mortality varies from 9%-58%, of which 40% consists of infections that reach the bloodstream[11]. Gram-negative microorganisms are the main cause, reaching 58.5%, while Gram-positives microorganisms account for 35.4% of the deaths. The pathogens most commonly found were *Staphylococcus aureus* (14%), coagulase-negative *Staphylococci* (12.6%), *Klebsiella* spp. (12%), and *Acinetobacter* spp. (11.4%)[12].

Due to the increasing number of HAIs cases, also related to the indiscriminate consumption of antimicrobials in primary care in most countries, according to Cavanagh *et al*. (2016)[13], and their direct interference in hospital morbidity and mortality rates, it is crucial to evaluate the HAIs rates, considering the level of susceptibility of the microbial agents to the drugs in use. Furthermore, it is vital to seek knowledge about which of the major agents is responsible for infections in the different areas of the body, and which age group and gender are most affected. This knowledge may enable better management of cases and, consequently, reduce morbidity and mortality rates, improve patients' quality of life, as well as reduce and prevent surgical complications. In short, it may enable better control and understanding of the well-being of the patients in this university hospital.

## OBJECTIVE

The aim of this study was to evaluate the prevalence and antimicrobial susceptibility profile in vitro of Healthcare Associated Infections at a philanthropic reference hospital in Espírito Santo, Brazil.

## METHODS

This is a retrospective, descriptive study of a quantitative approach carried out in a teaching hospital. The information was collected in the database of the Hospital Infection Control Committee. The study population consisted of 511 patients with infectious disease, in antimicrobial treatment, of both sexes, in all age groups, hospitalized in the ward of infectious diseases, gastroenterology, hematology, pneumology, geriatrics and cardiology, and in the intensive care unit (ICU) and neonatal intensive care unit (NICU) from July 2014 to June 2016. The 2013 survey included the hospitalization of 3419 patients in the ward of infectious diseases, gastroenterology, hematology, pneumology, geriatrics and cardiology, 284 in neonatology and 44 in ICU.

In samples of urine, blood and secretions (subphrenic abscess, abdominal, bronchial, abscess, blister, left hand cellulite, eschar, surgical wound, knee, ulcer, luminal drainage, wound, intraumbilical surgical wound, intraperitoneal, lower limb, pleural, ocular, oropharyngeal, right hip, subcutaneous, soft tissue, tracheal, urethral). Patients with incomplete records were excluded.

For urine culture, 5% sheep blood agar (SBA) and MacConkey agar (MAC) were used. For blood culture, SBA, chocolate agar and MAC were used, after culture in an automated blood culture system. Secretion culture was performed in SBA, chocolate agar and MAC. Microbial identification and susceptibility profile evaluation were performed using the MicroScan auto SCAN-4 (Beckman Coulter®) automated system.

The data was inserted in a spreadsheet for construction of a database. The exploratory analysis of the database included calculation of mean, median, standard deviation and amplitude for continuous variables and absolute and relative frequency for categorical variables. Microsoft Excel® and Microsoft Word® programs were used.

The categorical variables were gender (male/female) and infected site of the body (blood/urine/ secretions), while the quantitative variables were age, bacterial prevalence and antimicrobial susceptibility profiles.

The project was submitted to Research Ethics Committee's and was approved under the number 45228115.8.0000.5065.

## RESULTS

A total of 511 patients diagnosed with Healthcare Associated Infections were the subjects of this study, where 243 (47.55%) of the participant patients were female and 268 (52.45%) were male. A higher prevalence of infections among patients older than 60 years of age is shown in **Table 1**.

In the urine samples, *Escherichia coli* were the most prevalent bacteria (24.5%), followed by *Klebsiella pneumoniae* (21%) and *Pseudomonas aeruginosa* (14.6%). In the blood samples, coagulase-negative *Staphylococci* were the most common (40.1%), followed by *Staphylococcus aureus* (19.6%) and *Acinetobacter* spp. (12%). Finally, samples the most prevalent microorganism in the secretions was the *S. aureus* (26.5%), followed by *P. aeruginosa* (19.4%) and *Acinetobacter* spp. (17.6%) (**Table 2**).

After analyzing the data, the four most common bacteria were selected for further evaluation regarding their antimicrobial susceptibility *in vitro* to the drugs used at the hospital: *Acinetobacter* spp. (**Table 3**), *K. pneumoniae* (**Table 4**), *P. aeruginosa* (**Table 5**) and *S. aureus* (**Table 6**).

**TABLE 1** – Epidemiological profile of patients

| Age (years) | *n* (%) | Urine (%) | Blood (%) | Secretions (%) |
|---|---|---|---|---|
| 0-20 | 33 (6.45) | 6 (4.65) | 14 (4.72) | 13 (15.11) |
| 20-40 | 62 (12.13) | 18 (13.95) | 34 (11.48) | 10 (11.62) |
| 40-60 | 118 (23.09) | 29 (22.48) | 70 (23.64) | 19 (22.09) |
| > 60 | 298 (58.31) | 76 (58.91) | 178 (60.13) | 44 (51.16) |
| Total | 511 (100) | 129 (25.2) | 296 (57.9) | 86 (16.8) |

**TABLE 2** – Prevalence of microorganisms per sample

| Microorganism | Urine *n* (%) | Blood *n* (%) | Secretions *n* (%) | Total |
|---|---|---|---|---|
| *Acinetobacter* spp. | 10 (5.85) | 38 (12) | 20 (17.7) | 68 |
| *Enterobacter* spp. | 11 (6.45) | 5 (1.6) | 1 (0.9) | 17 |
| *Enterococcus* spp. | 10 (5.85) | 10 (3.2) | 12 (10.6) | 32 |
| *Escherichia coli* | 42 (24.6) | 6 (1.9) | 2 (1.8) | 50 |
| *Klebsiella oxytoca* | 6 (3.5) | 3 (1) | - | 9 |
| *Klebsiella pneumoniae* | 36 (21) | 14 (4.4) | 12 (10.6) | 62 |
| *Proteus* spp. | 14 (8.2) | 2 (0.6) | 5 (4.4) | 21 |
| *Pseudomonas aeruginosa* | 25 (14.6) | 20 (6.3) | 22 (19.5) | 67 |
| *Staphylococcus aureus* | 4 (2.35) | 62 (19.6) | 30 (26.5) | 96 |
| *Staphylococcus* spp. | 2 (1.2) | 127 (40.2) | 1 (0.9) | 130 |
| *Streptococcus agalactiae* | 5 (2.9) | 8 (2.55) | - | 13 |
| Others | 6 (3.5) | 21 (6.65) | 8 (7.1) | 35 |
| Total | 171 | 316 | 113 | 600 (100) |

n: *total of microorganisms isolated from the sample; %: percentage of microorganisms present in the sample.*

**TABLE 3** – Susceptibility profile of *Acinetobacter* spp. isolated from different clinical specimens in antimicrobial testing

| Antimicrobial | Urine S/T (%) | Blood S/T (%) | Secretions S/T (%) |
|---|---|---|---|
| Amikacin | 6/10 (16.6) | 21/36 (58.3) | 16/20 (80) |
| Aztreonam | - | 0/1 (0) | - |
| Cefepime | 1/8 (12.5) | 5/29 (17.2) | 1/16 (6.25) |
| Ceftazidime | 1/6 (16.6) | 5/28 (17.85) | 0/14 (0) |
| Ciprofloxacin | 1/10 (10) | 5/37 (13.5) | 2/19 (10.5) |
| Ertapenem | - | 0/1 (0) | 0/2 (0) |
| Gentamicin | 1/8 (12.5) | 7/30 (23.3) | 3/15 (20) |
| Imipenem | 0/8 (0) | 0/27 (0) | 0/18 (0) |
| Meropenem | 1/9 (11.1) | 7/36 (19.4) | 1/20 (5) |
| Piperacillin/tazobactam | - | 0/2 (0) | 0/4 (0) |
| Polymyxin | 10/10 (100) | 31/31 (100) | 11/11 (100) |
| Ticarcillin/clavulanic acid | - | 52/3 (5.7) | - |

*S: number of samples susceptive to the antimicrobial; T: number of samples tested for the antimicrobial.*

**TABLE 4** – Susceptibility profile of *Klebsiella pneumoniae* isolated from different clinical specimens in antimicrobial testing

| Antimicrobial | Urine S/T (%) | Blood S/T (%) | Secretions S/T (%) |
|---|---|---|---|
| Nalidixic acid | 2/3 (66.6) | - | - |
| Amoxicillin/clavulanic acid | 15/35 (42.8) | 5/14 (35.7) | 7/12 (58.3) |
| Amikacin | 33/36 (91.6) | 14/14 (100) | 10/10 (100) |
| Ampicillin | 9/36 (25) | 0/14 (0) | 0/11 (0) |
| Aztreonam | 4/22 (18.1) | 1/5 (20) | 2/5 (40) |
| Ampicillin/sulbactam | 4/23 (17.3) | 0/8 (0) | 4/6 (66.6) |
| Cephalothin | 4/25 (16) | 1/2 (50) | - |
| Ceftriaxone | 3/12 (25) | 4/7 (57.1) | 1/3 (33.3) |
| Cefoxitin | - | 1/1 (100) | - |
| Cefotaxime | 7/33 (21.2) | 4/11 (36.3) | 5/11 (45.4) |
| Ceftazidime | 6/25 (24) | 2/6 (33.3) | 3/6 (50) |
| Cefuroxime | 4/21 (19) | 1/7 (14.2) | 2/5 (40) |
| Ciprofloxacin | 14/35 (40) | 8/14 (57.1) | 6/12 (50) |
| Ertapenem | 21/32 (65.6) | 12/14 (85.7) | 8/10 (80) |
| Gentamicin | 19/34 (55.8) | 11/14 (78.5) | 7/12 (58.3) |
| Imipenem | 27/36 (75) | 12/14 (85.7) | 11/12 (91.6) |
| Levofloxacin | 11/23 (47.8) | 4/8 (50) | 4/6 (66.6) |
| Norfloxacin | 12/34 (35.2) | - | - |
| Nitrofurantoin | 7/32 (21.8) | - | - |
| Meropenem | 28/36 (77.7) | 12/14 (85.7) | 11/12 (91.6) |
| Piperacillin/tazobactam | 12/34 (35.2) | - | 7/9 (77.7) |
| Sulfamethoxazole/ trimethoprim | 13/36 (36.1) | 7/14 (50) | 5/11 (45.4) |

*S: number of samples susceptive to the antimicrobial; T: number of samples tested for the antimicrobial.*

**TABLE 5** – Susceptibility profile of *Pseudomonas aeruginosa* isolated from different clinical specimens in antimicrobial testing

| Antimicrobial | Urine S/T (%) | Blood S/T (%) | Secretions S/T (%) |
|---|---|---|---|
| Amikacin | 19/25 (76) | 13/20 (65) | 17/20 (85) |
| Aztreonam | 6/17 (35.2) | 4/9 (44.4) | 8/16 (50) |
| Cefepime | 7/24 (29.1) | 5/19 (26.3) | 9/20 (45) |
| Ceftriaxone | 0/15 (0) | 0/6 (0) | 0/16 (0) |
| Cefotaxime | 0/15 (0) | 0/6 (0) | 0/16 (0) |
| Ceftazidime | 5/20 (25) | 4/10 (40) | 10/15 (66.6) |
| Ciprofloxacin | 8/24 (33.3) | 7/20 (35) | 10/22 (45.4) |
| Ertapenem | 0/8 (0) | 2/4 (50) | 1/11 (9) |
| Gentamicin | 7/24 (29.1) | 6/20 (30) | 7/20 (35) |
| Imipenem | 8/25 (32) | 6/20 (30) | 7/22 (31.8) |
| Levofloxacin | 5/22 (22.7) | 7/19 (36.8) | 10/22 (45.4) |
| Norfloxacin | 1/3 (33.3) | - | - |
| Meropenem | 5/25 (20) | 6/20 (30) | 8/22 (36.3) |
| Piperacillin/tazobactam | 9/24 (37.5) | 7/18 (38.8) | 12/22 (54.5) |
| Polymyxin | 20/20 (100) | 18/18 (100) | 21/21 (100) |

*S: number of samples susceptive to the antimicrobial; T: number of samples tested for the antimicrobial.*

**TABLE 6** – Susceptibility profile of *Staphylococcus aureus* isolated from different clinical specimens in antimicrobial testing

| Antimicrobial | Urine S/T (%) | Blood S/T (%) | Secretions S/T (%) |
|---|---|---|---|
| Ampicillin | 0/2 (0) | 0/33 (0) | 0/18 (0) |
| Ampicillin/sulbactam | - | 5/26 (19.2) | 0/1 (0) |
| Ciprofloxacin | 0/4 (0) | 16/59 (27.1) | 12/29 (41.4) |
| Clindamycin | 3/4 (75) | 25/60 (41.6) | 22/30 (73.3) |
| Daptomycin | - | 22/22 (100) | - |
| Erythromycin | - | 5/59 (8.4) | 7/30 (23.3) |
| Gentamicin | - | 30/56 (53.5) | 24/30 (80) |
| Imipenem | - | 0/1 (0) | - |
| Oxacillin | 0/4 (0) | 17/61 (27.8) | 12/29 (41.4) |
| Penicillin | 0/2 (0) | 0/40 (0) | 0/16 (0) |
| Rifampicin | 4/4 (100) | 48/60 (80) | 24/30 (80) |
| Sulfamethoxazole/ trimethoprim | 3/4 (75) | 41/59 (69.49) | 28/30 (93.3) |
| Teicoplanin | 2/2 (100) | 45/45 (100) | 19/19 (100) |
| Tetracycline | 4/4 (100) | 54/59 (91.5) | 28/29 (96.6) |
| Vancomycin | 3/3 (100) | 52/52 (100) | 26/28 (92.9) |

*S: number of samples susceptive to the antimicrobial; T: number of samples tested for the antimicrobial.*

*Acinetobacter* spp. was mainly susceptible to polymyxin (100%).

The bacteria *K. pneumoniae* (Table 4) isolated in urine samples proved to be more susceptible to amoxicillin/clavulanic acid (85%) and meropenem (77.7%).

In blood samples, *K. pneumoniae* was susceptible 100% of the time it was tested to amikacin and to cefoxitin. Its susceptibility was also high when tested to meropenem (85.7%) and imipenem (85,7%).

Finally, when *K. pneumoniae* susceptibility was tested in secretions samples, it proved to be 100% susceptible to amikacin, and also showed a high susceptibility to meropenem (91.6%), imipenem (91.6%), ertapenem (80%), piperacillin/tazobactam (77.7%) and tobramycin (75%).

The bacteria *P. aeruginosa* (Table 5) susceptibility to antimicrobials in urine samples was evaluated, and it was 100% susceptible to polymyxin. It also showed a moderate susceptibility to amikacin (76%).

In blood samples, the microorganism was susceptible every time it was tested to polymyxin. It also showed low susceptibility to amikacin (65%).

Once tested in secretions samples, *P. aeruginosa* was 100% susceptible to polymyxin, also showing high susceptibility to amikacin (85%) and low susceptibility to ceftazidime (66.6%).

The bacteria *S. aureus* (Table 6) presented 100% of susceptibility in the urine samples tested using rifampicin, teicoplanin, tetracycline and vancomycin, also showing high susceptibility (75%) to clindamycin, gentamicin and sulfamethoxazole/trimethoprim.

In blood samples, *S. aureus* was susceptible in 100% of the tests to daptomycin, teicoplanin and vancomycin. *In vitro* susceptibility was also high to tetracycline (91.5%) and rifampicin (80%).

Finally, in secretions samples, *S. aureus* was always susceptible to teicoplanin. Moreover, it showed high susceptibility to tetracycline (96.6%), sulfamethoxazole/trimethoprim (93.3%), vancomycin (92.9%), rifampicin (80%) and gentamicin (80%).

## DISCUSSION

Brazil has a large territory, besides having heterogeneous sociodemographic indicators[12]. As a result, different patterns of antimicrobial resistance and antimicrobial use may arise[14]. As shown by Loureiro *et al.* (2016)[15] *in vitro* antimicrobial susceptibility testing becomes increasingly necessary, and this information is essential prior to antimicrobial prescription.

In our study, urinalysis showed predominance of *E. coli* (24.6%), followed by *K. pneumoniae* (21%) and *P. aeruginosa* (14.6%). A study conducted in the Brazilian northeast exposes *Escherichia coli* as the most prevalent (68.4%), followed by *Klebsiella* spp. (7.9%), *P. aeruginosa* (6.1%) and *P. mirabilis* (5.2%)[16]. It should be noted that the same study evaluated patients in outpatient or inpatient setting, without checking statistical differences between them, except in two situations, which are irrelevant to the present study[16].

In a university hospital in Kathmandu, *E. coli* was isolated in 189 (79.1%) cases, followed by *Klebsiella* spp. (11.7%), *Citobacter* spp. (8%) and *Proteus* spp. (7%)[17]. Similar results were found in Bangladesh by Setu *et al.* (2016)[18]. The most common uropathogens were *E. coli* (63.93%) and *Klebsiella* spp. (17.09%). In most of the studies performed so far, the most common organism identified as responsible for UTI was *E. coli*[19].

In blood, the most prevalent pathogens were coagulase-negative *Staphylococci* (40.1%), followed by *S. aureus* (19.2%) and *Acinetobacter* spp. (12%). When compared to a study carried out in sixteen Brazilian hospitals, including the five Brazilian regions[12], the most common were *S. aureus* (14%), coagulase-negative *Staphylococci* (12.6%), *Klebsiella* spp. (12%), and *Acinetobacter* spp. (11.4%).

There were differences between the percentages of blood infections for the *P. aeruginosa* and *Acinetobacter* spp., which in this study corresponded to the sum of 18.3%, and in the Brazilian cohort[12] it was 21% while in the American study[20] it was 6%. These divergences can be explained by the population and climatic heterogeneity. The Gram-negative bacteria have been more prevalent in tropical regions, according to an American study from Baltimore, Maryland[21], as in Brazil, whose average temperature is higher than the country in the study in question, besides the time difference between the studies.

As for the susceptibility profile, still in blood samples, in the study of Ahmed *et al.* (2017)[22], *Acinetobacter* spp. was resistant to ceftriaxone, gentamicin, imipenem and ceftazidime. Furthermore, *K. pneumoniae* was resistant to ceftriaxone and gentamicina. *Pseudomonas* spp. was resistant to gentamicin and amikacin. Regarding *S. aureus,* it was resistant to ampicillin, erythromycin and ciprofloxacin. The results for *S. aureus* and *Acinetobacter* spp. differ from those in our study, which may be due to the differences between the communities where both studies took place.

Furthermore, in secretions samples, the most prevalent microorganism was *S. aureus* (26.5%), followed by *P. aeruginosa* (19.4%) and *Acinetobacter* spp. (17.6%). In a study conducted at a university hospital in Rio Grande do Sul, Brazil, the most isolated microorganism was *S. aureus*, followed by *P. aeruginosa* and *E. coli*, but the secretions analyzed were composed only by skin[23].

Regarding the susceptibility test in secretion samples, *K. pneumoniae* was 100% sensitive to amikacin. All samples with *P. aeruginosa* were sensitive to polymyxin, showing high sensitivity to amikacin (85%). In a study conducted in a Brazilian University Hospital from Pernambuco, the most effective antimicrobials against *P. aeruginosa* were: amikacin, imipenem, meropenem and aztreonam[24]. In Kempfer *et al.* (2010)[23] study, there was a sensitivity of 95.2% to tobramycin, with predominance in tracheal and nasal secretions. Regarding *S. aureus,* it was sensitive whenever tested against teicoplanin and daptomycin. Regarding antimicrobial susceptibility profiles, in Kempfer *et al.* (2010)[23], *S. aureus* showed 84.6% of sensitivity to sulfamethoxazole-trimethoprim.

Methicillin-resistant *S. aureus* (MRSA) has become an endemic hospital pathogen in several countries. The US Centers for Disease Control and Prevention (CDC) report that MRSA infections now account for 63% of *staphylococcal* infections in the USA, after rising from 2% in 1974[25].

Infections traditionally caused by MRSA were limited to hospitals. These infections are called healthcare-associated MRSA (HA-MRSA). However, in recent years community-associated or community-acquired infections (CA-MRSA) are been increasingly documented worldwide[26].

In our study, there was a high MRSA isolation rate in blood samples (27.8%) and secretion samples (41.4%) in hospitalized patients. These values are similar to those found in other regions of Brazil (29%)[27], but differ from those found in a university hospital in the same country (76.13%)[28], especially those found in the State of Santa Catarina, Brazil (less than 2%)[29].

This variation in rates may be related to the presence of CA-MRSA as a cause of Healthcare Associated Infections. The high number of MRSA in secretions in our study may be indicative of the presence of CA-MRSA lines causing infections in hospitalized patients, since part of the secretions samples comes from skin and soft tissues.

Other authors have reported the relationship between skin and soft tissue infections with the presence of asymptomatic CA-MRSA carriers[30-32]. According to Bonesso *et al.* (2014)[31] there is evidence that the use of ciprofloxacin and working in a healthcare environment are related to the acquisition and persistence of MRSA strains.

## CONCLUSION

Our study found that the most frequently isolated microorganisms in urine, blood and secretions were, respectively: *E. coli* (24.5%), coagulase-negative *Staphylococci* (40.1%) and *S. aureus* (26.5%).

The less active antimicrobials against *Acinetobacter* spp. were cephalosporins and carbapenems, while the most active antimicrobials against *Acinetobacter* spp. were polymyxin. The other antibiotics showed quite different results.

Regarding *K. pneumoniae,* ampicillin showed unsatisfactory results, while those of cephalosporins were varied. In all samples, carbapenems and amikacin showed good results.

The less active antimicrobials against *P. aeruginosa* in all samples were ceftriaxone and cefotaxime, while the most active were polymyxin in all samples. Amikacin also presented a good performance.

Futhermore, the *S. aureus* samples tested showed high sensitivity to glycopeptides, daptomycin, tetracycline, rifampicin and sulfamethoxazole/trimethoprim.

Knowledge about the pathogenic bacterial flora of the hospital in which the study was performed is fundamental, since it improves the clinical management of patients who, due to hospitalization, are considered a sample of the population most susceptible to infections.

## RESUMO

***Introdução:*** *As infecções relacionadas com a assistência à saúde (IRAS) ocorrem durante a internação como resultado de morbidade subjacente, procedimentos invasivos, patologia aguda ou tratamento médico. Elas levam à prolongada permanência e, consequentemente, à carga econômica. A principal ferramenta para conter essas infecções são os antimicrobianos. No entanto, o aumento da resistência e a baixa taxa de descoberta de novos medicamentos justificam a pesquisa que avalia o perfil de resistência de microrganismos aos antimicrobianos.* ***Objetivo:*** *Avaliar a prevalência e o perfil de suscetibilidade antimicrobiana das IRAS ocorridas em um hospital filantrópico de referência do Espírito Santo, Brasil.* ***Métodos:*** *Estudo observacional, retrospectivo e transversal, entre julho de 2014 e junho de 2016. Os dados sobre cultura de sangue, urina e secreções corporais foram coletados da base de dados do Centro de Controle de Infecção Hospitalar.* ***Resultados:*** *Houve alta prevalência de IRAS em pacientes com mais de 60 anos. Duzentos e quarenta e três (47.55%) pacientes eram do sexo feminino. As quatro bactérias mais prevalentes foram:* Acinetobacter *spp.,* Klebsiella pneumoniae*,* Pseudomonas aeruginosa *e* Staphylococcus aureus*. A polimixina foi a droga que apresentou os melhores efeitos antimicrobianos.* ***Conclusão:*** *A polimixina foi ativa* in vitro *contra todos os isolados de* Acinetobacter *spp. Quanto à* K. pneumoniae*, tanto a polimixina quanto a amicacina apresentaram eficácia significativa. Em relação à* Pseudomonas aeruginosa*, a polimixina foi efetiva em todas as amostras. Já em relação ao* S. aureus*, teicoplanina, daptomicina e vancomicina foram efetivas em todas as amostras. A polimixina demonstrou um bom desempenho geral* in vitro*.*


***Unitermos:*** *resistência microbiana a medicamentos; infecção hospitalar; bactérias; antibacterianos; testes de sensibilidade microbiana.*

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