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TRACKING OF MICROORGANISMS ON THE SURFACE AND IN SERVERS A THE PUBLIC HOSPITAL IN PALMAS-TO

RASTREAMENTO DE MICRORGANISMOS DE SUPERFÍCIE E EM SERVIDORES DE UM HOSPITAL PÚBLICO EM PALMAS-TO

SEGUIMIENTO DE MICROORGANISMOS EN LA SUPERFICIE Y EN LOS SERVIDORES DEL HOSPITAL PÚBLICO EN PALMAS-TO

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RESUMO

A infecção hospitalar (IH) é um problema de saúde pública no Brasil. Bactérias resistentes aumentam o risco de superinfecções e elevam o número de mortes, fatores que podem estar associados a falhas nos processos de antissepsia e desinfecção do ambiente, favorecendo as contaminações cruzadas. Este estudo investigou a presença de microrganismos em superfícies hospitalares, de mãos e narinas de funcionários e analisou infecções retrospectivas suspeitas de infecção hospitalar de um Hospital Público de Palmas-TO. Os resultados revelaram a presença predominante de microrganismos do gênero *Staphylococcus*. A análise apontou falhas nos procedimentos de antissepsia e desinfecção, indicando a necessidade urgente de medidas de biossegurança mais rigorosas. A pesquisa enfatiza a importância de protocolos antimicrobianos adequados para prevenir e tratar Infecções Relacionadas à Assistência à Saúde (IRAS) e destaca a necessidade de conscientização e treinamento dos profissionais de saúde. O estudo também aponta para a crescente resistência antimicrobiana e a identificação frequente de cepas multirresistentes. Esses achados têm implicações significativas para melhorar a segurança do paciente em ambientes hospitalares e fornecem uma base sólida para o desenvolvimento de estratégias eficazes de prevenção e controle de infecções nosocomiais, visando reduzir a incidência de IH e melhorar a qualidade da assistência à saúde.

Palavras-chave: Infecção hospitalar. Contaminação. Resistência bacteriana.

ABSTRACT

Hospital infection (HI) is a public health problem in Brazil. Resistant bacteria increase the risk of superinfections and raise the number of deaths, factors that may be associated with failures in antiseptic and environmental disinfection processes, favoring cross-contamination. This study investigated the presence of microorganisms on hospital surfaces, on employees' hands and nostrils, and analyzed retrospective infections suspected of hospital infection at a Public Hospital in Palmas, TO. The results revealed the predominant presence of microorganisms of the genus *Staphylococcus*. The analysis

indicated shortcomings in antiseptic and disinfection procedures, highlighting the urgent need for more rigorous biosafety measures. The research emphasizes the importance of appropriate antimicrobial protocols to prevent and treat Healthcare-Associated Infections (HAIs) and underscores the need for awareness and training of healthcare professionals. The study also points to the growing antimicrobial resistance and frequent identification of multidrug-resistant strains. These findings have significant implications for improving patient safety in hospital settings and provide a solid foundation for the development of effective strategies for the prevention and control of nosocomial infections, aiming to reduce the incidence of HI and enhance the quality of healthcare.
Keywords: Hospital infection. Contamination. Bacterial resistance.

RESUMEN

La infección hospitalaria (HI) es un problema de salud pública en Brasil. Las bacterias resistentes aumentan el riesgo de sobreinfecciones y aumentan el número de muertes, factores que pueden estar asociados a fallas en los procesos de antisepsia y desinfección ambiental, favoreciendo la contaminación cruzada. Este estudio investigó la presencia de microorganismos en superficies hospitalarias, en manos y fosas nasales de los empleados, y analizó retrospectivamente infecciones sospechosas de ser nosocomiales en un Hospital Público de Palmas-TO. Los resultados revelaron la presencia predominante de microorganismos del género Staphylococcus. El análisis destacó fallas en los procedimientos de antisepsia y desinfección, lo que indica la necesidad urgente de medidas de bioseguridad más rigurosas. La investigación enfatiza la importancia de protocolos antimicrobianos adecuados para prevenir y tratar las Infecciones Asociadas a la Atención de la Salud (IAAS) y destaca la necesidad de concienciar y capacitar a los profesionales de la salud. El estudio también señala una creciente resistencia a los antimicrobianos y la frecuente identificación de cepas multirresistentes. Estos hallazgos tienen implicaciones significativas para mejorar la seguridad del paciente en entornos hospitalarios y proporcionan una base sólida para desarrollar estrategias efectivas para la prevención y el control de infecciones nosocomiales, con el objetivo de reducir la incidencia de HI y mejorar la calidad de la atención a la salud.
Descriptores: Infección hospitalaria. Contaminación. Resistencia bacteriana.

INTRODUCTION

The hospital environment exposes healthcare professionals and other workers to a variety of risks, especially biological ones, making it a conducive setting for various infections and a significant increase in antimicrobial-resistant bacteria, necessitating the development of prevention strategies (Baur et al., 2017).

Hospital infection (HI) has emerged as an inherent challenge within hospitals and constitutes a serious global public health problem with negative consequences for both patients and healthcare institutions. It is a leading cause of nosocomial mortality and may be associated with severe diseases, medical and surgical interventions, and related complications (Ferraz et al., 2016; Khan et al., 2017). The high frequency of infections caused by resistant bacteria poses

a serious public health issue, increasing the risk of superinfections and elevating the number of deaths, factors that may be linked to failures in antiseptic and environmental disinfection processes (Puzi et al., 2022).

To prevent or mitigate the risks of contamination, it is essential to implement and adhere to biosafety measures, including adopting safe and appropriate norms and methods to maintain the health of patients, professionals, and visitors. This helps prevent the spread of infectious agents, thereby reducing the risks of contracting nosocomial infections, especially bacterial infections (Andrade & Castro, 2016). Hospital units and their surroundings facilitate the spread of microorganisms, exposing employees, patients, and visitors to various antibiotic-resistant microorganisms and increasing the potential for cross-contamination (Baptista et al., 2022).

Several bacterial species are capable of spreading in the hospital environment, and according to Oliveira (2008), among enterobacteria, the most frequently isolated genera in biological samples include *Escherichia coli*, *Klebsiella* ssp, *Serratia* ssp, *Proteus* ssp, *Enterobacter* ssp, *Providencia* ssp, *Morganella* ssp, *Salmonella* sp, and *Shigella* sp. In the intensive care unit, the most frequent bacteria are *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* (Jacoby, 2008). Strains such as *Stenotrophomonas maltophilia*, *Klebsiella pneumoniae*, *Escherichia coli*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Acinetobacter baumannii*, *Staphylococcus aureus*, among others, cause various infections, exhibit resistance to multiple antimicrobials, and are associated with hospital infections (Andrade et al., 2021).

Bacterial resistance mechanisms are highly complex, and as reported by Carvalho et al. (2010), bacterial resistance to antimicrobials arises naturally due to the extensive use of these drugs, becoming increasingly common, particularly in common population infections, which poses a significant problem concerning the available treatments on the market. The development of antibiotic-resistant strains primarily occurs through two forms: natural and induced genetic mutation, with the natural selection process being fundamental in creating new strains (Alves et al., 2012).

Due to the high costs of hospitalization, the rise of bacterial resistance, inadequate practices by professionals, resistance to understanding the importance of biosafety among those working in the environment, and consequent deaths from nosocomial infections, there is a need for an epidemiological study of circulating strains in the hospital environment and their relationship with infections of patients who are or were hospitalized. This study proposes a

retrospective analysis of hospital infections related to potential nosocomial contamination processes through the collection of swabs from environmental surfaces, as well as the hands and noses of staff.

METHODOLOGY

Characterization

This is a cross-sectional, retrospective, and prospective study with a qualitative analysis of strain types and a quantitative analysis of retrospective infections. The data collection took place at a Public Hospital in Palmas, Tocantins state, from August 15, 2022, to August 15, 2023.

Retrospective Collection

As inclusion criteria, only strains from nosocomial infections with a multidrug-resistant profile were used. The current stock strains from the Hospital Laboratory, originating from clinical samples identified through microbiological culture and antibiogram, were included. Only the results of cultures and antibiograms recorded in the laboratory and/or the hospital database were collected. These strains were used for comparative tests with environmental strains. Patient names, general, epidemiological, and sample origin data were not used for any record, only the hospitalization location was reported for environmental comparative purposes.

Surface Tracking

Surfaces such as furniture, countertops, equipment, mattresses, and instruments were included. Inclusion criteria for this environmental research included all hospital environments with patients suspected of nosocomial infection, on surfaces that could facilitate cross-contamination and would be evaluated during collection. Excluded were hand-antiseptic surfaces, floors, and locations with no risk of cross-contamination. Sterile swabs in transport medium were used for collecting samples from furniture, countertops, and equipment, and immediately placed in liquid Brain Heart Infusion (BHI) agar. An exclusively environmental epidemiological assay, outlining a qualitative profile of strains and antimicrobial resistance.

Hand and Nasal Collection

Hands and nostrils of hospital staff. Staff were randomly chosen at various times and days, in environments where surface swabs were also collected or where patients with suspected

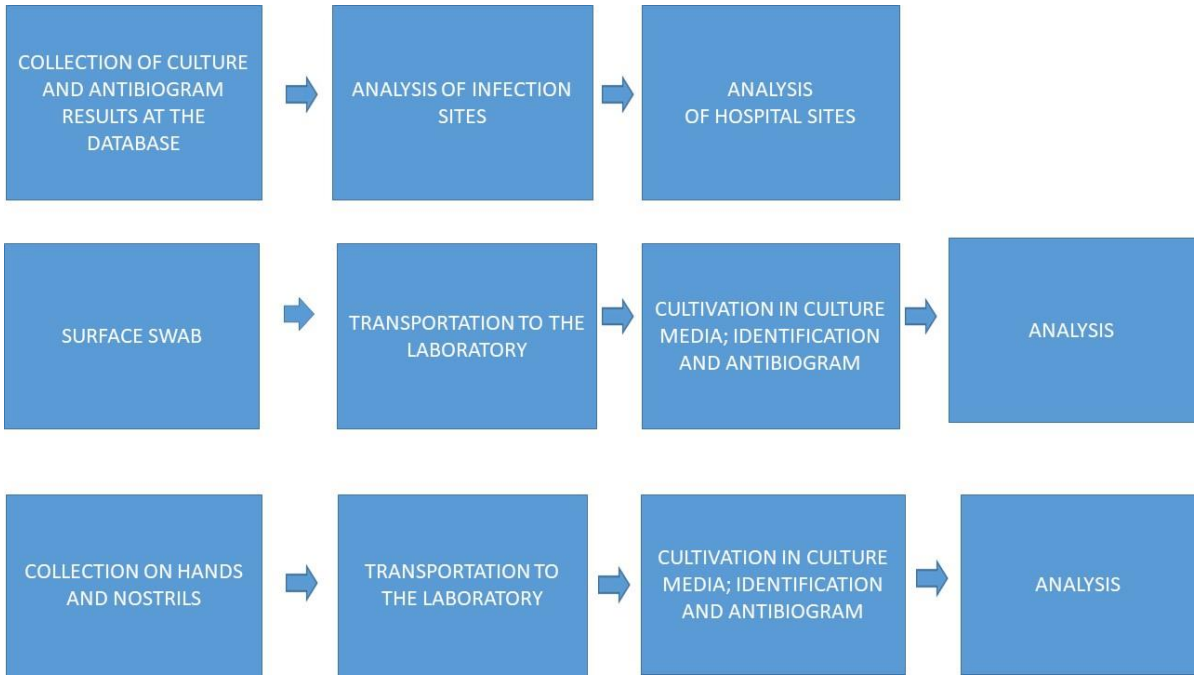
hospital infections were present. Inclusion criteria were staff members performing procedures on patients in the same locations as environmental collections. All cultures and antibiograms were analyzed to relate them to surface and staff collections.

Analytical Procedure

In the laboratory, swabs in BHI liquid medium tubes from all collections were incubated at 37°C for 24 to 48 hours. After this period, an aliquot from each tube was collected and seeded on specific culture media MacConkey Agar, CLED Agar, Blood Agar, and Chocolate Agar—using the streak plate technique and placed in an incubator at 37°C for 24 to 48 hours. Subsequently, bacteria were identified through specific biochemical series for gram-positive and gram-negative bacteria using tube culture media (Triplice Sugar Iron Agar, Simons Citrate, Lysine, Ornithine, Urea, and Phenylalanine) and Bactray 1 and 2. For fungi, they were seeded on Sabouraud Agar with chloramphenicol and placed at 35°C for growth.

For antimicrobial resistance tests, the disc diffusion method on Mueller-Hinton Agar was employed, distributed on 150 mm diameter Petri dishes, following the recommendations of Clinical and Laboratory Standards Institute (CLSI, 2024).

Figure 1 – Brief flowchart of the methodology.



Source: Author's elaboration.

Data Analysis

Data collection instruments will be used for records.

Ethic Aspects:

The Ethics Committee on Research Involving Human Subjects authorized the project, number CAAE: 59840422.3.0000.5519.

RESULTS AND DISCUSSION

With these significant results, we hope to contribute to the development of strategies that promote the prophylactic process, outbreak prevention, and reporting of notifiable diseases, as strains were identified coincidentally in the environment, among professionals, and in patient infections, suggesting possible cross-infections.

The results in Table 1 pertain to retrospective collections of infections in patients admitted to the hospital with suspected nosocomial infections. Data stored in the system were accessed and tabulated. It was observed that various sites were infected, showing a diversity of species, primarily from the gram-positive group, specifically the genus *Staphylococcus*. Infectious processes caused by *Escherichia coli*, mainly in the urinary tract, and by coagulase-negative *Staphylococcus* in blood cultures were identified. Similar results from Elias and Ribeiro (2017).

Table 1 – Frequency of bacteria found in blood cultures, urine cultures, and general cultures from September 2021 to November 2022 at a Public Hospital in Palmas-TO.

Strain	Blood culture	Urine culture	Others	Total	%
Acinetobacter baumannii complex	3	1	5	8	1,75%
Citrobacter spp.	-	18	5	23	5,07%
Enterobacter spp.	1	6	3	10	2,20%
Enterococcus spp.	11	42	12	65	14,34%
Escherichia coli	1	76	12	89	19,64%
Klebsiella pneumoniae	5	30	12	47	10,37%
Proteus mirabilis	1	2	3	6	1,32%
Pseudomonas aeruginosa	2	3	2	7	1,54%
Serratia spp.	3	3	7	13	2,86%
Staphylococcus aureus	2	1	3	6	1,32%

Staphylococcus coagulase negativa	114	-	29	143	31,56%
Staphylococcus capitis	12	-	7	19	4,19%
Staphylococcus haemolyticus	16	-	1	17	3,75%

Source: Author's elaboration.

It was possible to isolate a variety of microorganisms on the surfaces of the hospital, with coagulase-negative Staphylococcus being the most common, accounting for 44.64% (Table 2).

Table 2 – Isolation of microorganisms from surfaces at a Public Hospital in Palmas-TO.

STRAIN	**COLLECTED LOCATION**	**HOSPITAL ENVIRONMENT**
1. *Staphylococcus* coagulase neg.	Table	Infirmary GO
2. *Staphylococcus* coagulase neg.	Mattress	Infirmary GO
3. *Staphylococcus* coagulase neg.	IV Stand	Infirmary GO
4. *Shigella flexneri*	Syringe Infusion Pump	Infirmary GO
5. *Staphylococcus aureus*	Acrylic crib	Infirmary GO
6. *Staphylococcus* coagulase neg.	Corner table	Infirmary GO
7. *Streptococcus* sp.	Chair	Infirmary GO
8. There was no bacterial growth	Alcohol gel dispenser	Infirmary GO
9. *Acinetobacter baumannii*	Bed	Infirmary GO
10. *Staphylococcus* coagulase neg.	Bench	Corridor (high-risk) GO
11. *Staphylococcus* coagulase neg.	Drinking fountain	Corridor (high-risk) GO
12. There was no bacterial growth	Drinking water	Corridor (high-risk) GO
13. *Candida* sp	Bible stand	Corridor (high-risk) GO
14. *Citrobacter diversus*	Baby bathtub	Corridor (high-risk) GO
15. *Klebsiella* sp	Sink	Corridor (high-risk) GO
16. *Staphylococcus* sp	Bar	Bed F
17. There was no bacterial growth	Ball	Bed F
18. *Klebsiella ozaenae*	Pelvic balance (seat)	Bed F
19. *Bacillus* sp	Chair	Bed F
20. *Staphylococcus* coagulase neg.	Mayo Stand	Bed F
21. *Staphylococcus* coagulase neg.	Bed	Bed F
22. *Staphylococcus* coagulase neg.	Wall clock	Bed F
23. *Staphylococcus* coagulase neg.	Pelvic balance (stand)	Bed F
24. *Acinetobacter baumannii*	Bed controller	Bed F

25. *Streptococcus* sp	Curtain	Bed F
26. *Staphylococcus* coagulase neg.	MDF Closet	Bed D
27. *Staphylococcus* coagulase neg.	Ball	Bed B
28. *Bacillus* sp	Stool	Bed A
29. *Staphylococcus* sp	Heated crib D	Pre-delivery reception
30. *Staphylococcus* sp	Heated crib E	Pre-delivery reception
31. *Staphylococcus* coagulase neg.	Hive cabinet	IU
32. *Staphylococcus* coagulase neg.	Computer	IU
33. *Staphylococcus aureus*	Phone	IU
34. *Staphylococcus* coagulase neg.	Bench	IU
35. *Staphylococcus* coagulase neg.	Mayo Stand	IU
36. There was no bacterial growth	Water (Drinking fountain)	IU
37. There was no bacterial growth	Drinking fountain	IU
38. *Staphylococcus* coagulase neg.	Monitor (bed 5)	IU
39. There was no bacterial growth	Infusion Pump (bed 5)	IU
40. *Staphylococcus* coagulase neg.	Door handle	IU
41. There was no bacterial growth	Medicine pump	IU
42. *Pseudomona luteola*	Faucet	IU
43. There was no bacterial growth	Surgical table	SC
44. *Staphylococcus* coagulase neg.	Clamp	SC
45. There was no bacterial growth	Cradle	SC
46. There was no bacterial growth	Pediatric scale	SC
47. There was no bacterial growth	Surgical table	SC
48. There was no bacterial growth	Medicine preparation place	SC
49. *Staphylococcus* coagulase neg.	Incubator	SC
50. *Staphylococcus* coagulase neg.	Respirator	SC
51. *Staphylococcus* coagulase neg.	Chair	SC
52. There was no bacterial growth	Bench	SC
53. *Staphylococcus* coagulase neg.	Bed	SC
54. *Staphylococcus* coagulase neg.	Monitor	SC
55. There was no bacterial growth	Anesthesia cart	SC
56. *Staphylococcus* coagulase neg.	Sink	SC

*GO – Gynecology and Obstetrics; IU – Intensive Unit; SC – Surgical Center.
Source: written by the author himself.

Table 3 – Antimicrobial resistance of strains isolated from surfaces at a Public Hospital in Palmas-TO.

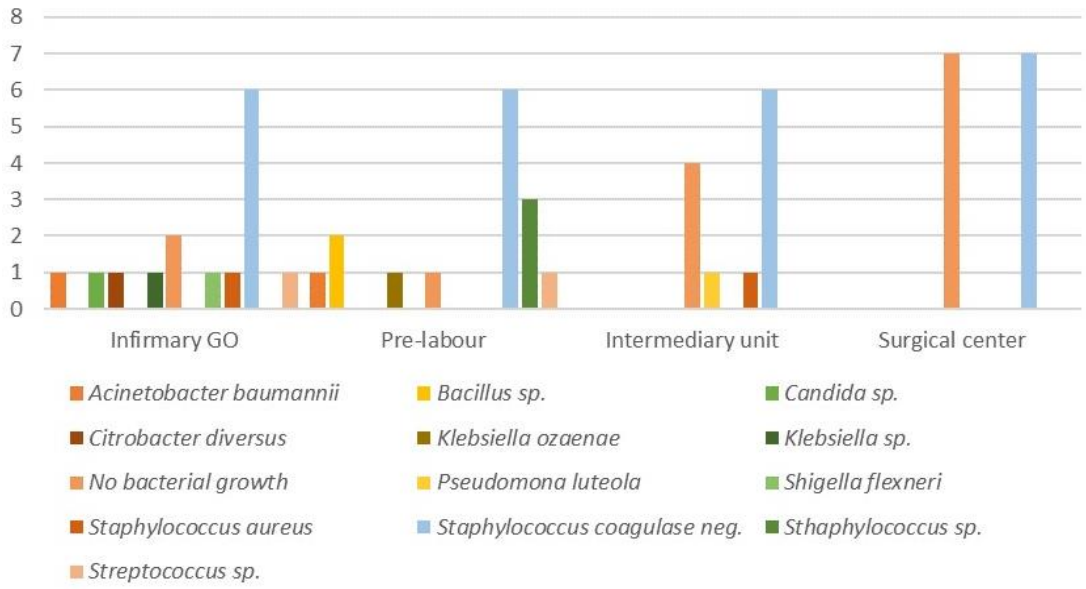
STRAIN	***RESISTANCE**
Staphylococcus coagulase negative (2)	OXA; AMP; PEN
Staphylococcus coagulase negative	OXA. AMP; PEN; RIF; ERI; SUT VAN.
Staphylococcus aureus	AMP; OXA.
Staphylococcus sp	AMP
Acinetobacter baumannii	VAN; CFO
Shigella flexneri	AMC
Klebsiella ozaenae	CRX; AMP; NIT; CFE; CPM; CAZ; AMC; SUT; CRX; AMP; FOS
Citrobacter diversus	AMC
Pseudomonas luteola	AMI; CIP

*OXA= oxacillin; AMP = ampicillin; PEN= penicillin; RIF= rifampicin; ERI=erythromycin; SUT= sulfamethaxazole/trimethopim; VAN= vancomycin; OXA=oxacillin; CFO= cefoxitin; NIT= nitrofurantoin; CRX=cefuroxime; FOS=fosfomycin; CFE= cephalexime.
Source: Author's elaboration.

We highlight the importance of this study for patient safety maintenance. Care in prevention to avoid cross-contamination is crucial. As shown in Table 2, samples collected from surfaces predominantly exhibited isolation of coagulase-negative *Staphylococcus* or species, also found in infections across various sites identified in retrospective infections, indicating potential cross-contamination of human microbiota due to lapses in antiseptic and disinfection processes. Additionally, strains with potential pathogenic action, such as *Klebsiella* and *Acinetobacter*, were identified on surfaces and in infections, raising suspicions of cross-infections.

Over the investigation months, 56 swabs were collected from 4 sectors. The chosen areas for collection contained materials and equipment frequently handled by both healthcare professionals and patients and their companions (Figure 2). In 30 samples collected in the Gynecology and Obstetrics Ward and the Pre-Labour unit, areas with high daily foot traffic, 40% (12) of CoNS were isolated. Only in 10% of the samples, there was no bacterial growth; in the others, nine different species of microorganisms were identified, including potentially pathogenic ones like *Acinetobacter baumannii*, a significant opportunistic pathogen responsible for a large percentage of Healthcare-Associated Infections (HAI) and hospital outbreaks (Wong et al., 2017). *A. baumannii* has several mechanisms of resistance to several antibiotic families, can form biofilms and therefore persist in the hospital environment (Rosales-Reyes et al., 2017).

Figure 2 – Distribution of microorganisms found on surfaces at a Public Hospital in Palmas-TO. 2022 – 2023.



Source: Author's elaboration.

The knowledge of the types of microorganisms found in maternal-infant hospital units is of great importance. Active, continuous, and systematic analysis of these microorganisms is necessary for the detection and control of pathogen spread due to their negative impact on neonatal survival (Barbosa, 2016), such as neonatal sepsis, a significant cause of infant morbidity and mortality, where early diagnosis is promising when combined with prophylactic measures and judicious antibiotic use (Silva, 2021a).

It's crucial to note that bacterial species' identification should be accompanied by resistance profiles to assess the circulation of resistant strains and infer potential consequences for patients. In Table 3, the strains' data and resistance profiles are presented, showing variability and multidrug resistance, likely due to the indiscriminate use of antimicrobials and/or ineffective antiseptic practices, with the consequent possibility of vertical transmission. Considering it is a hospital for pregnant women, this situation could compromise pregnancy, leading to abortion, prematurity, chorioamnionitis, puerperal endometritis, and in neonates, colonization can cause sepsis, meningitis, pneumonia, cellulitis, septic arthritis, and osteomyelitis (Palácio et al., 2018).

Of the 12 samples collected in the Intermediate Unit (IU), 58.3% showed growth of the genus *Staphylococcus*, of which 25% exhibited antimicrobial resistance characteristics. These resistant strains were present on devices routinely used by healthcare professionals, such as computers and phones in the Intermediate Unit. This is concerning, as the surfaces where these pathogens were found, despite being equipment not directly involved in patient care, constitute potential sources capable of colonizing and infecting patients through the hands of professionals. A study by Cordeiro et al. (2015) in the

intensive care unit of a medium-sized hospital in Bahia supports our results regarding equipment contamination.

It is essential to emphasize that this set of bacteria constitutes the human microbial repertoire, residing naturally on individuals' skin and mucous membranes, living in symbiosis with the host. In situations involving lesions in the skin barrier, introduction through needles, or insertion of medical devices (such as catheters and prosthetics, among others), these microorganisms acquire pathogenic potential and can trigger severe infections (Silva, 2021b). While these microorganisms, when obtained from the environment by people with a healthy immune system, maintain a balance and rarely cause diseases, in newborns, they are responsible for infections in various sites that compromise patients' clinical conditions (Moraes, 2013).

Staphylococcus aureus, Klebsiella pneumoniae, and Enterobacter spp., are present in most neonatal intensive care units, affecting newborns who are immunologically more susceptible to infections by multidrug-resistant bacteria. Pseudomonas aeruginosa has been highlighted as a major pathogen related to ventilator-associated pneumonia (VAP) in patients admitted to the ICU (Lima et al., 2017). It is noteworthy that bacteria develop and utilize survival tools to resist administered drugs, complicating treatment and increasing morbidity and mortality (Blair et al., 2015).

Samples collected from the hands and nostrils of healthcare professionals working in surgical centers, pre-partum rooms, neonatal ICU, administrative areas, and the hospital's milk bank mostly resulted in strains of coagulase-negative *Staphylococcus* and *Staphylococcus* sp, as shown in Table 4.

Table 4 – Collection of swabs from the hands and nostrils of 16 employees at the Public Hospital in Palmas.

INDIVIDUAL	ISOLATED HANDS STRAINS	ISOLATED NOSTRILS STRAINS
1	*Acinetobacter baumannii*	*Klebsiella* sp
2	*Bacillus* spp	*Klebsiella* sp
3	*Staphylococcus* coagulase negativa	*Klebsiella* sp
4	*Staphylococcus* coagulase negativa	*Klebsiella* sp
5	*Staphylococcus* coagulase negativa	*Klebsiella* sp
6	*Staphylococcus* coagulase negativa	*Klebsiella* sp
7	*Staphylococcus* coagulase negativa	*Klebsiella* sp
8	*Staphylococcus* coagulase negativa	*Staphylococcus* coagulase negativa
9	*Staphylococcus* coagulase negativa	*Staphylococcus* coagulase negativa
10	*Bacillus* spp	*Staphylococcus* coagulase negativa
11	*Staphylococcus* coagulase negativa	*Staphylococcus* coagulase negativa
12	*Staphylococcus* coagulase negativa	*Staphylococcus* coagulase negativa
13	*Bacillus* spp	*Staphylococcus* coagulase negativa
14	*Staphylococcus* coagulase negativa	*Staphylococcus* coagulase negativa

15	*Staphylococcus aureus*	*Staphylococcus* coagulase negativa
16	*Bacillus* spp	*Bacillus* spp

Source: Author's elaboration.

Regarding antimicrobial resistance, four coagulase-negative *Staphylococcus* strains exhibited resistance to oxacillin, erythromycin, ampicillin, and cefoxitin, with one of them also resistant to sulfamethoxazole with trimethoprim and clindamycin. These species were long considered contaminants because they are part of the microbiota; however, their pathogenic potential is now known, especially in hospitals and in immunosuppressed patients (Diaz-Tello et al., 2017).

For two Klebsiella strains, resistance was observed against amoxicillin with clavulanate, ciprofloxacin, ampicillin, gentamicin, and cefepime. Palos et al. (2017), in a study in Goiânia, found similar results, as they isolated strains of Staphylococcus aureus, coagulase-negative *Staphylococcus, Escherichia coli, Klebsiella pneumoniae, Citrobacter freundii, Enterobacter* sp*, Hafnia alvei, Serratia* sp and *Arizona* sp from the hands of a maternity hospital staff and visitors.

Among the microorganisms found in environmental samples, coagulase-negative *Staphylococcus* (CoNS) stood out, present in 44.6% of the collected samples (Chart 2), also abundant in infections with 114 isolations and on the hands and nostrils of employees, with 18 isolated strains. These results suggest failures in the cleaning and disinfection process of materials widely used in healthcare units, frequently touched by both professionals and patients' caregivers, such as support tables, monitors, water coolers, doorknobs, chairs, incubators, among others. These species are one of the most common causes of infection in neonatal and pediatric intensive care units (Okasaki, 2018).

Strains of *A. baumannii* were isolated, a strain that has a higher risk of mortality in patients with ventilator-dependent pneumonia and blood infections, as it has the ability to form biofilms, promoting persistent contamination and favoring selective pressure, and, consequently, resistance to antimicrobials. (Antunes et al., 2014).

Many urinary tract infections were verified, and by the presence of microorganisms on surfaces, hands, and nostrils, possible cross-contamination to the urinary tract can be inferred. Urinary tract infections (UTI) are associated with potential preventive HAIs, as the vast majority is related to bladder catheterization. Complications may arise from indwelling urinary catheters, lack of antimicrobial resistance protocols in infection, or inadequate hygiene by the team responsible for the procedure (Genário et al., 2022). In Cardoso et al. (2020) study, UTIs were the second leading cause of HAIs. UTIs can also be caused by yeast of the genus *Candida*, with *Candida albicans* being the most relevant opportunistic pathogenic fungus causing nosocomial fungal infections, where catheter presence can enable infection (Bonato et al., 2022).

The knowledge of the unit's microbiological profile enables the creation of suitable antimicrobial protocols for the prevention and treatment of Healthcare-Associated Infections (HAI), aiming to improve the quality of care provided (Baptista, 2022). Additionally, according to Freire et al. (2012), understanding the mechanisms of transmission of these infections, combined with the expansion of laboratory diagnostic resources, defines objective measures for their control. Among the main prevention methods are handwashing, identification of multidrug-resistant bacteria, appropriate antibiotic therapy, epidemiological surveillance, isolation measures, suitable materials and equipment, environmental hygiene, training of the multi-professional team, and the implementation of control measures. The prevention of HAIs should be the goal of all healthcare professionals.

With the obtained results, it was possible to develop a surface collection protocol based on retrospective infections, using low-cost materials, following the guidelines of the National Health Surveillance Agency, according to the methodological diagram in Figure 1. Determining the strain circulation based on patient infections identifies possible environments that need to be investigated, thus constructing an adequate flow for collection and identification reflecting the issue of cross-contamination.

CONCLUSION

Surface tracking in healthcare environments sheds light on various issues related to cross-infections. By isolating strains in these environments, combined with the antimicrobial resistance profile, it becomes possible to address potential failures leading to the contamination and infection process. Based on the obtained results, the need for educational actions aimed at various healthcare professionals was evident, focusing on raising awareness about both cross-contamination due to improper care practices and the consequences of the indiscriminate use of antimicrobials. In the case of multidrug-resistant strains, additional studies involving gene tracking become necessary. As this contributes to the development of specific proposals to control the spread of microorganisms, complemented by a thorough analysis of healthcare professionals' practices.

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