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Blood Culture Findings as Tools for Clinical Management and Patient Safety

Indicadores a partir de exames de hemocultura: ferramenta para gestão clínica e segurança do paciente

Hallazgos de hemocultivos como herramientas para la gestión clínica y la seguridad del paciente

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ABSTRACT

Introduction: Healthcare-associated Infections (HAI) have a significant impact on public health, and the use of indicators is a common practice for assessing and improving healthcare services. **Aim:** This study aimed to describe the utilization of blood culture results to develop indicators for hospital management and evaluate antimicrobial resistance. **Outlining:** This cross-sectional study was conducted at a teaching hospital. Blood cultures were performed during two periods: pre-implementation of antimicrobial sales restrictions in Brazil (05/2010-10/2010 - first period) and post-implementation (02/2011-07/2011 - second period). Computerized system reports were used to develop indicators, including infection incidence rates and antimicrobial resistance. **Results:** A higher infection rate (1.97/100 person-days) and a lower resistance rate (0.62/100 person-days) were observed in the second period, with the microorganism Staphylococcus sp. being more frequently identified in both periods. **Implications:** This study demonstrates the use of indicators to evaluate governmental actions related to HAIs, which can contribute to patient safety and healthcare management.

DESCRIPTORS

Blood Culture; Microbiology; Health Status Indicators; Patient Safety; Antimicrobials.

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INTRODUCTION

Healthcare-Associated Infections (HAIs) encompass the clinical manifestation of infections occurring 72 hours after admission to healthcare services or, if invasive procedures have been performed, before this timeframe. These infections have raised significant concerns in public health due to their high incidence and fatality rates.[1]

According to the Centers for Disease Control and Prevention (CDC), approximately 5% to 15% of hospitalized patients worldwide acquire HAIs.[2] In Brazil, the Ministry of Health estimates a global infection rate of 14%, with 9% of cases resulting in death.[3-4]

HAIs contribute to increased hospitalization time and costs, as well as the dissemination of microorganisms resistant to available antimicrobials, which is exacerbated by the abusive and unnecessary use of these agents.[5] Optimizing antimicrobial use is among the five objectives of the World Health Organization's (WHO) Global Action Plan for Antimicrobial Resistance Control.[2] Rapid release of laboratory results is a crucial factor in achieving this control as it facilitates the precise identification of microorganisms and subsequent use of ideal antimicrobials for each context.[6]

In recent decades, clinical microbiology has made significant advancements, particularly in the automation of clinical microbiology. This enables accurate identification of numerous microorganisms and earlier release of microbiological results, often within 24 hours. This milestone marks the beginning of precise pharmacotherapy and contributes to patient safety in the identification and treatment of HAIs.[7] Notably, blood culture plays a vital role in diagnosing sepsis, one of the leading causes of death in hospitals.[8]

An effective approach to identify and control the profile of HAIs in a healthcare service is the construction of indicators, which are tools that facilitate notification, monitoring, and the implementation of actions by the Hospital Infection Control Committee (HICC).[6] Examples of such indicators include infection incidence rates and antimicrobial resistance profiles, which can be valuable in clinical decision-making.[5]

Therefore, this study aims to describe an experience of utilizing blood culture results to develop indicators for hospital management and evaluate antimicrobial resistance in a teaching hospital.

METHOD

This is a cross-sectional study that utilized results from automated culture using the blood culture method with BACT/ALERT® VIRTUO® (https://www.biomerieux.com.br/produto/bactalertr-virtuor) to develop indicators for hospital management. The study was conducted in a general teaching hospital with approximately 330 beds located in Minas Gerais, Brazil. The hospital serves approximately ten thousand patients per month, with the majority being treated in the Emergency Department (ED), and around 13% of patients are admitted to the same institution. During the study period, the hospital had an outsourced clinical laboratory responsible for conducting biochemical, immunological, microbiological, and parasitological examinations. The hospital utilizes an electronic medical record system and an automated management system through which laboratory results are released. In case of necessity, direct communication is also established between the laboratory and other healthcare professionals to inform them about examination results or clarify doubts regarding procedures and patient-specific clinical aspects.

For the development of the indicators, results from blood culture examinations of adult patients admitted to the study hospital (time ≥ 72 hours) were considered. The study encompassed two periods: May to October 2010 and February to July 2011, which correspond to the semesters before and after the implementation of a restrictive measure (RDC nº 44, October 26, 2010) for the commercialization of antimicrobials in Brazil, a topic addressed in another study by the authors.

Results from cultures of patients diagnosed with bacterial infection at the time of admission, admissions for childbirth and postpartum care, and patients transferred from another hospital or with a hospital stay of less than 72 hours were excluded.

Data collection regarding automated culture examinations performed on blood samples (automated blood culture), antimicrobial resistance, and sociodemographic variables was conducted using secondary data recorded in electronic medical records of patients, supplemented with information from the HICC records.

In the study hospital, blood samples for blood culture are collected through a single puncture or at three different sites in anaerobic and aerobic bottles without needle exchange. In the case of collection at three sites, one sample is collected from a peripheral vein, one from a central venous access catheter (CVC), and the third from catheter reflux. Five to ten milliliters of blood are collected from adult patients, and 1-3 milliliters of blood are collected from children.

The primary outcome of interest was a positive culture result, demonstrated by positive in vitro blood culture results of microorganisms. In vitro susceptibility test results to antimicrobials (antibiogram) indicating "resistance" were also identified.

For the development of the indicators, the incidence rates (per 100 person-days) of infection and antimicrobial resistance were considered. The numerator was defined as the total number of isolated microorganisms (infection rate) and the total number of resistant microorganisms (resistance rate). The denominator for both indicators was calculated by summing the length of hospital stay (number of days). The proportion of examinations with positive culture results and the proportion of examinations with culture results indicating resistance were also determined relative to the total number of culture examinations requested. Examinations with duplicate results for the same patient were excluded.

This study has received approval from the Human Research Ethics Committee of UFV (Letter of Approval 176/2012).

RESULTS

A total of 413 patients were identified, for whom blood culture examinations were requested in the first period, and 410 patients in the second period. The mean age of patients in the first study period was 61.0 years, with a standard deviation (SD) of ±18.6, and an average length of hospital stay of 29.4 days (SD = ±22.8). The male gender had a higher frequency, represented by 63.2% (n=261).

Table 1 – Number of patients included in the study and total number of blood cultures performed.

Period	Total number of patients who underwent blood culture	Total number of examinations conducted	Average number of blood cultures requested per patient	Total number of positive resultsN (%)
Period 1	413	2 046	4.95	324 (15.8)
Period 2	410	1 928	4.70	408 (21.2)

Source: Prepared by the authors.

In the second analyzed period, the mean age was 62.1 years (SD = ±18.4), with 30.0 days (SD = ±23.9) of hospital stay, and 53.9% (n=221) of male patients. An increase in the incidence rate of infection and a decrease in the incidence rate of resistance were observed in the second period of the study (Table 2).

Table 2 – Incidence rate indicators of infection and resistance in the analyzed periods.

Period	Infection incidence rate (microorganisms per 100 person-days)	Resistance incidence rate (microorganisms per 100 person-days)
Period 1	1,54	0,75
Period 2	1,97	0,62

Note: Infection incidence rate = number of microorganisms / total length of hospital stay (days) x 100; Resistance incidence rate = number of resistant microorganisms / total length of hospital stay (days) x 100.
Source: Prepared by the authors.

The microorganisms *Staphylococcus sp.* (228; 70.37%), *Acinetobacter sp.* (15; 4.63%), *Klebsiella sp.* (13; 4.01%), *Streptococcus sp.* (15; 4.63%), and *Pseudomonas sp.* (10; 3.09%) were the most frequent in the blood cultures performed in the first period. In the second period, a higher frequency of blood culture results with growth of the microorganisms *Staphylococcus sp.* (225; 62.50%), *Acinetobacter sp.* (36; 8.82%), *Enterococcus sp.* (28; 6.86%), and *Proteus sp.* (18; 4.41%) was identified. Table 3 represents the frequency and description of the isolated microorganisms in the two periods.

Table 3 – Microorganisms isolated by the blood culture method in the study periods.

Microorganism	Period			
	Phase 1		Phase 12	
	Frequency n (%)	Cumulative n (%)	Frequency n (%)	Cumulative n (%)
Staphylococcus sp. [a,b]	228 (70.37)	228 (70.37)	225 (62.50)	225 (62.50)
Acinetobacter sp. [a,b]	15 (4.63)	243 (75.00)	36 (8.82)	261 (71.32)
Enterococcus sp. [b]	5 (1.54)	248 (76.54)	28 (6.86)	289 (78.18)
Streptococcus sp. [a]	15 (4.63)	263 (81.17)	3 (0.74)	292 (78.92)
Proteus sp. [b]	8 (2.47)	271 (83.64)	18 (4.41)	310 (83.33)
Klebsiella sp. [a]	13 (4.01)	284 (87.65)	9 (2.21)	319 (85.54)
Pseudomonas sp. [a]	10 (3.09)	294 (90.74)	9 (2.21)	328 (87.75)
Enterobacter sp.	8 (2.47)	302 (93.21)	12 (2.94)	340 (90.69)
Escherichia sp.	5 (1.54)	307 (94.75)	12 (2.94)	352 (93.63)
Morganella sp.	1 (0.31)	308 (95.06)	5 (1.23)	357 (94.86)
Serratia sp.	NHC	NHC	5 (1.23)	362 (96.09)
Candida sp.	3 (0.93)	311 (95.99)	4 (0.97)	366 (97.07)
Micrococcus sp.	2 (0.62)	313 (96.61)	4 (0.97)	370 (98.05)
Stenotrophomonas sp.	NHC	NHC	4 (0.97)	374 (99.03)
Sphingomonas sp.	3 (0.93)	316 (97.54)	NHC	NHC
Alcaligenes sp.	2 (0.62)	318 (98.16)	NHC	NHC
Burkholderia sp.	2 (0.62)	320 (98.78)	NHC	NHC
Citrobacter sp.	2 (0.62)	322 (99.40)	1 (0.25)	375 (99.28)
Achromobacter sp.	1 (0.30)	323 (99.70)	NHC	NHC
Salmonella sp.	1 (0.30)	324 (100.00)	NHC	NHC
Aeromonas sp.	NHC	NHC	1 (0.25)	376 (99.53)
Moraxella sp.	NHC	NHC	1 (0.25)	377 (99.78)
Providencia sp.	NHC	NHC	1 (0.25)	378 (100.00)

Note: [a] Microorganisms identified most frequently in Phase 1. [b] Microorganisms identified most frequently in Phase 2. NGC - No growth observed in the period.
Source: Prepared by the authors.

Regarding the occurrence of antimicrobial resistance, a higher frequency was identified in the genera Staphylococcus sp. (65; 61.90%), Acinetobacter sp. (10; 9.52%), Pseudomonas sp. (5; 4.76%), Klebsiella sp. (4; 3.81%), and Streptococcus sp. (4; 3.81%) in the first period. In the second period, a higher frequency of resistance was identified in the microorganisms Staphylococcus sp. (43; 48.86%), Acinetobacter sp. (19; 21.59%), Proteus sp. (8; 9.09%), and Enterococcus sp. (5; 5.68%). Table 4 presents the resistant microorganisms isolated by the blood culture examination.

Table 4 Isolated microorganisms exhibiting resistance in blood culture examinations.

Microorganism	Period		
	Phase 1	Phase 2	
	Resistance n (%)	Resistance (n)	Frequency (%)
Staphylococcus sp. [c,d]	65 (61.90)	43 (48.86)	48.86
Acinetobacter sp. [c,d]	10 (9.52)	19 (21.59)	21.59
Pseudomonas sp. [c,d]	5 (4.76)	3 (3.41)	3.41
Klebsiella sp. [c]	4 (3.81)	2 (2.27)	2.27
Streptococcus sp. [c]	4 (3.81)	0 (0.00)	0.00
Enterobacter sp. [d]	3 (2.86)	3 (3.41)	3.41
Enterococcus sp. [d]	3 (2.86)	5	5.68
Alcaligenes sp.	2 (1.91)	0	0.00
Escherichia sp.	2 (1.91)	2	2.27
Sphingomonas sp.	2 (1.91)	0	0.00
Achromobacter sp.	1 (0.95)	0	0.00
Candida sp.	1 (0.95)	1	1.14
Morganella sp.	1 (0.95)	1	1.14
Proteus sp. [d]	1 (0.95)	8	9.09
Salmonella sp.	1 (0.95)	0	0.00
Citrobacter sp.	0 (0.00)	1	1.14
Total	105 (100.00)	88	100.00

Note: [c] Microorganisms with the highest resistance frequency in Phase 1. [d] Microorganisms with the highest resistance frequency in Phase 2
Source: Prepared by the authors.

Table 5 presents the overall resistance profile of the microorganisms identified in culture examinations in the institution versus the antimicrobials used.

Table 5 – Multinomial regression of the leprosy reaction with gender. Teresina-PI, 2019 (n=206).

Microorganism	Antimicrobial Class	Phase 1 Resistance (n)	Phase 2 Resistance (n)
Acinetobacter sp.	Cephalosporins	4	4
	Aminoglycosides	3	1
	Imidazoles	3	2
	Beta-Lactams/Penicillins	6	3
	Polymyxins	2	5
	Glycopeptides	5	2
	Quinolones	1	0
	Macrolides	1	0
	Antifungal	1	0
	Sulfonamides	1	0
	TOTAL	27	17
Burkholderia sp.	Cephalosporins	1	0
	TOTAL	1	0
Enterobacter sp	Cephalosporins	3	0
	Polymyxins	1	1
	Aminoglycosides	1	0
	Lincosamides	1	0
	Beta-Lactams/Penicillins	3	1
	Carbapenems	1	1
	TOTAL	10	7
Escherichia sp.	Cephalosporins	0	3
	Carbapenems	0	0
	Imidazoles	0	0

	Beta-Lactams/Penicillins	0	2
	Sulfonamides and Trimethoprim	0	1
	Glycopeptides	1	0
	Quinolones	0	1
	Polymyxins	0	0
	TOTAL	1	7
Haemophilus sp	Beta-Lactams/Penicillins	1	0
	TOTAL	1	0
Klebsiella sp	Beta-Lactams/Penicillins	3	1
	Carbapenems	1	1
	Polymyxins	2	1
	Aminoglycosides	1	0
	Imidazoles	1	0
	Sulfonamides and Trimethoprim	1	0
	TOTAL	9	6
Morganella sp.	Quinolones	1	0
	TOTAL	1	1
Proteus sp.	Beta-Lactams/Penicillins	1	2
	Cephalosporins	1	3
	Polymyxins	1	0
	Sulfonamides and Trimethoprim	1	0
	Glycopeptides	1	1
	TOTAL	5	9
Pseudomonas sp.	Cephalosporins	10	3
	Quinolones	2	1
	Imidazoles	6	0
	Polymyxins	1	2
	Aminoglycosides	1	0
	Lincosamides	1	0
	Carbapenems	1	0
	Beta-Lactams/Penicillins	5	0
	Glycopeptides	1	0
	TOTAL	28	6
Salmonella sp.	Beta-Lactams/Penicillins	1	0
	Polymyxins	1	0
	TOTAL	2	0
Serratia sp.	Cephalosporins	1	0
	TOTAL	1	0
Sphingomonas sp.	Carbapenems	1	0
	Lincosamides	1	0
	Cephalosporins	1	0
	TOTAL	3	0
Staphylococcus sp	Cephalosporins	6	3
	Beta-Lactams/Penicillins	12	4
	Glycopeptides	5	2
	Polymyxins	4	3
	Lincosamides	1	1
	Imidazoles	1	0
	Aminoglycosides	3	1
	Carbapenems	4	5
	Quinolones	6	0
	TOTAL	42	19
Streptococcus	Glycopeptides	1	0
	TOTAL	1	0
	TOTAL	**132**	**27**

Source: Prepared by the authors

DISCUSSION

The main findings of the study indicate an increase in the occurrence of positive blood culture results during the second analyzed period compared to the first period. Performing blood cultures has a significant impact on the survival of hospitalized patients, particularly in terms of ensuring the appropriate use of antimicrobials. Delayed reporting of positive blood cultures in patients receiving inadequate empirical antimicrobial treatment can lead to delays in administering the ideal antimicrobial agent, which has been associated with increased mortality rates.[6,11] In Brazil, studies on antimicrobial resistance often have limited data, but they consistently demonstrate a significant rise in resistance among these organisms, resulting in increased morbidity, mortality, and infection-related costs.[12]

Although there was an increase in blood cultures yielding positive microbial growth, there was a decrease in the occurrence of antimicrobial resistance during the second evaluation period compared to the first. This difference may be attributed to the implementation of strategies aimed at controlling healthcare-associated infections within the institution or the implementation of restrictive measures concerning antimicrobial use in Brazil.[9] Although the primary focus of these measures is on antimicrobial use in community settings, studies indicate that the use of antimicrobials in these environments may have influenced resistance rates in healthcare settings and vice versa. [6,13-14] It is important to note that, during the study period, there were no significant changes in staffing within the institution, including those responsible for Infection Control and the medical staff. Additionally, there were no medication shortages or variations in the standardization of procedures for conducting tests in the institution, thus ensuring comparability between the two periods (data not shown).

While this study does not specifically focus on statistical analysis associating the restrictive measures with the occurrence of antimicrobial resistance, it observed an increase in culture results and a decrease in resistance during the final period compared to the initial period. The development of this indicator contributes to the clinical management processes within the institution under study, as well as the implementation of practices that enhance the safety of hospitalized patients. Timely and accurate performance of blood cultures by the institution's clinical laboratory is of utmost importance. Despite the decrease in resistance occurrence during the second analyzed period, there was an increase in the number of infections. This indicates the necessity for increased monitoring and the implementation of preventive actions.

The findings not only present the results of resistance rate indicators based on blood culture results but also suggest the use of this examination in healthcare management processes, such as evaluating laws and measures related to patient safety in the context of HAIs. In the studied hospital, these indicators are presented to senior management and department coordinators on a semi-annual basis. The intention is for the results to stimulate discussions and guide strategies aimed at preventing HAIs within the institution.

The microorganisms most frequently identified in blood cultures are similar to those found in other parts of the world [(15-17)]. Notably, *Staphylococcus sp.* represents over 60% of the isolates obtained from cultures in both periods. Microorganisms such as *Staphylococcus sp.*, *Klebsiella sp.*, *Streptococcus sp.*, *Escherichia sp.*, and *Salmonella sp.* are considered of international concern due to their global impact on HAIs and community infections [(5)]. The identification of Acinetobacter sp. growth also deserves attention, as the prevalence of this microorganism has been increasing in Brazilian hospitals in recent years [(18)]. In addition to the highlighted microorganisms, it is worth noting that other relevant global microorganisms were also identified in the blood cultures of this study in the context of human health.

The findings indicate that the most frequently identified microorganisms in blood cultures are also the ones displaying higher resistance. This finding reinforces the contribution of HAIs to the rise of antimicrobial-resistant microorganisms. It should be emphasized that resistance occurrence can be influenced by various factors such as the use of antimicrobials inducing cross-resistance, transmission of resistance genes by healthcare professionals working in different institutions, invasive procedures, among others [(5)]. The prompt and efficient release of blood culture results is crucial in this process, as it enables faster adjustment of antimicrobial therapies that can promote lower resistance. However, investments in strategies and technologies that improve and expedite the release of blood culture results are still necessary. [12,19]

Specifically, regarding blood cultures, greater attention should be given to infections in other surgical sites, as these can lead to sepsis considering the clinical vulnerabilities of patients.[12,20] Identifying the most frequent microorganisms in sepsis contributes to the detection of previous infections in other surgical sites and the establishment of preventive measures.[8] This underscores the recommendations that efforts related to preventing antimicrobial resistance should be part of routine healthcare services, and control and epidemiological surveillance should be incorporated into daily practice.[12]

The Brazilian National Health Surveillance Agency (ANVISA) launched the National Program to Combat HAIs, which proposed the establishment of specific strategies so that by 2020, 90% of states would have implemented State Programs for Prevention and Control of HAIs. This document reinforces that preventing HAIs is a strategic action for patient safety and underscores the importance of knowledge and notification of bloodstream infections. The document also proposed that by 2020, 80% of all hospitals with ICU beds (adult, pediatric, or neonatal) would report their primary bloodstream infection data.[4]

It is important to note that the activities of the clinical laboratory are strongly influenced by the pace of technological advancements, necessitating continuous investment in procedures that result in a more comprehensive mapping of antimicrobial resistance in Brazil.[12] The implementation of local strategies in healthcare services aimed at monitoring and identifying microorganisms through culture tests is considered highly important in ensuring patient safety.

As for the limitations of this study, it is noteworthy that the study did not identify other sociodemographic characteristics of the patients and did not measure the time taken to release blood culture results between the periods. Additionally, it is acknowledged as a limitation that it was not possible to determine whether the results indicating no growth were due to the absence of infections or the empirical use of antimicrobials, which may have masked the results. Moreover, it should be mentioned that Table 5, which presents the overall resistance profile of microorganisms identified in culture tests in the institution versus the antimicrobials used, includes all culture results regardless of whether they were blood cultures or not. Consequently, while it was feasible to associate antimicrobial use with bacteria, specifically selecting blood cultures was not possible due to several patients simultaneously having multiple types of infections, and the database was unable to provide more refined information beyond what was presented.

It is anticipated that these findings will contribute to the implementation of monitoring and evaluation indicators for HAIs in various healthcare services across Brazil.

CONCLUSION

The results obtained in this study through automated blood culture examinations demonstrated an increase in the incidence rate of infections and a decrease in the incidence rate of antimicrobial resistance in the period following the implementation of the national restrictive measure on antimicrobial use compared to the previous phase. These findings encompass significant aspects related to patient safety and hold the potential to contribute to the development of indicators concerning HAIs and the reduction of antimicrobial resistance through the rational utilization of antimicrobials within hospital settings.

RESUMO

Introdução: As Infecções Relacionadas à Assistência à Saúde (IRAS) geram impacto na saúde pública, sendo o uso de indicadores uma ação frequente para avaliação e melhorias de serviços. **Objetivo:** descrever a utilização de resultados de hemocultura para elaborar indicadores de gestão hospitalar e avaliar resistência antimicrobiana. **Delineamento:** trata-se de um estudo transversal realizado em um hospital de ensino. Utilizou-se hemocultura nos períodos anteriores (05/2010-10/2010 - primeiro período) e posteriores (02/2011-07/2011 - segundo período) à implantação de restrição para comercialização de antimicrobianos no Brasil. Utilizou-se relatórios de sistema informatizado para elaboração dos indicadores, taxa de incidência de infecção e resistência antimicrobiana. **Resultados:** observou-se maior taxa de infecção (1,97/100 pessoas-dia) e menor taxa de resistência (0,62/100 pessoas-dia) no segundo período, e maior frequência do microrganismo *Staphylococcus* sp. em ambos os períodos. **Implicações:** o estudo demonstra o uso de indicadores para avaliação de ações governamentais relacionadas às IRAS, o que pode contribuir para a segurança dos pacientes e gestão em saúde.

DESCRITORES
Hemocultura; Microbiologia; Indicadores Básicos de Saúde; Segurança do Paciente; Antimicrobianos.

RESUMEN
Introducción: Las Infecciones Asociadas a la Atención de la Salud (IAAS) tienen un impacto significativo en la salud pública, y el uso de indicadores es una práctica común para evaluar y mejorar los servicios de atención médica. **Objetivo:** Este estudio tuvo como objetivo describir la utilización de los resultados de hemocultivos para desarrollar indicadores para la gestión hospitalaria y evaluar la resistencia antimicrobiana. **Delineación:** Este estudio transversal se realizó en un hospital universitario. Se realizaron hemocultivos durante dos períodos: antes de la implementación de restricciones en la venta de antimicrobianos en Brasil (05/2010-10/2010 - primer período) y después de la implementación (02/2011-07/2011 - segundo período). Se utilizaron informes del sistema computarizado para desarrollar indicadores, incluyendo tasas de incidencia de infección y resistencia antimicrobiana. **Resultados:** Se observó una mayor tasa de infección (1.97/100 días-persona) y una menor tasa de resistencia (0.62/100 días-persona) en el segundo período, siendo el microorganismo Staphylococcus sp. identificado con mayor frecuencia en ambos períodos. **Implicaciones:** Este estudio demuestra el uso de indicadores para evaluar acciones gubernamentales relacionadas con las IAAS, lo cual puede contribuir a la seguridad del paciente y la gestión de la atención médica.

DESCRIPTORES
Cultivo de Sangre; Microbiología; Indicadores de Salud; Seguridad del Paciente; Antimicrobianos.

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All authors actively participated in the conception or design of the study; in data collection, analysis, and interpretation; in the writing of the article or its critical revision; and in the final approval of the version to be published. **All authors agree and are responsible for the content of this version of the manuscript to be published.**

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AVAILABILITY OF DATA

The data are held by the teaching hospital where the research was conducted and can be accessed by any author of the article.

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CONFLICTS OF INTEREST

There are no conflicts of interest to declare.