STRATEGIES FOR THE CONTROL OF HOSPITAL INFECTIONS CAUSED BY VANCOMYCIN-RESISTANT ENTEROCOCCUS: AN INTEGRATIVE REVIEW

ESTRATÉGIAS PARA CONTROLE DE INFECCÇÃO HOSPITALAR CAUSADA POR ENTEROCOCCUS VANCOMICINA-RESISTENTES: UMA REVISÃO INTEGRATIVA

ESTRATEGIAS PARA CONTROLAR LA INFECCIÓN DEL HOSPITAL CAUSADA POR ENTEROCOCCUS RESISTENTE A LA VANCOMICINA: UNA REVISIÓN INTEGRATIVA

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ABSTRACT

Objective: to evaluate the importance of Vancomycin-resistant Enterococcus (VREs) as agents of Health care-associated infections (HAIs) and to identify national and international strategies used in the control of HAIs by VREs. Method: this is an integrative literature review. We selected 18 articles that dealt with the importance of HAIs by VREs and the control strategies. Results: we noted an agreement among the articles regarding ways to minimize the rates of HAIs by VREs. The occurrence of HAIs is permissive when hygiene measures are inadequate. Furthermore, training on the use of antimicrobials, surveillance cultures, and the structuring of a specialized committee are strategies to reduce cases and should be followed for the contingency of VREs as agents of HAIs. Conclusion: preventive actions are the most efficient way to reduce cases of HAIs by VREs. It is essential to standardize and control the use of antimicrobials, in order to prevent the selection of resistant strains. Furthermore, it is necessary to keep active administrative strategies for the control of HAIs and to update the technical and cleaning professionals who work in health services, enabling continuing education on all topics involving case control.

Descriptors: Infection Control; Cross Infection; Delivery of Health Care; Drug Resistance, Bacterial; Vancomycin-Resistant Enterococci.

RESUMO

Objetivo: avaliar a importância dos Enterococcus resistentes à Vancomicina (VRE) como agentes de infecções relacionadas à assistência à saúde (IRAS) e identificar as estratégias nacionais e internacionais usadas no controle de IRAS por VREs. Método: revisão integrativa da literatura. Seleção de 18 artigos que tratavam da importância de IRAS por VREs e das estratégias de controle. Resultados: observou-se concordância entre os artigos em relação às maneiras de minimizar os
índices de IRAS por VREs. A ocorrência de IRAS é permissiva quando medidas para higiene são inadequadas. Ademais, treinamentos acerca do uso de antimicrobianos, culturas de vigilância e estruturação de una comisión especializada son estratégias para redución de casos e que devem ser seguidas para contingencia de VREs como agentes de IRAS. **Conclusión**: ações preventivas son a maneira más eficiente de reduzir os casos de IRAS por VREs. É imprescindible padronizar e controlar o uso de antimicrobianos visando á prevención da selección de linhagens resistentes. Ainda, faz-se necesario manter ativas estratégias administrativas para controle de IRAS e actualización dos profesionais técnicos e da limpeza que atuam nos servicios de saúde, possibilitando educación continuada acerca de todos os tópicos que envolvan o controle dos casos.

**Descritores**: Controle de Infecção; Infecção Hospitalar; Assistência à Saúde; Resistência Bacteriana a Medicamentos; Enterococos Resistentes à Vancomicina.

**RESUMEN**

**Objetivo**: evaluar la importancia de los *Enterococcus* resistentes a la Vancomicina (VREs) como agentes de infecciones asociadas a la atención sanitaria (IAAS) e identificar las estratégias nacionales e internacionales utilizadas para controlar las IAAS causadas por los VREs. **Método**: revisión integradora de la literatura. Se seleccionaron 18 artículos que trataban sobre la importancia de las IAAS por los VREs y las estratégias de control. **Resultados**: se observó una concordancia entre los artículos sobre las formas de minimizar las tasas de IAAS por VREs. La aparición de IAAS es permissible cuando las medidas de higiene son inadecuadas. Ademáis, los tratamientos sobre el uso de antimicrobianos, las culturas de vigilancia y la estructuração de una comisión especializada son estratégias para reducir los casos y que deben seguirse para la contingencia de los VREs como agentes de IAAS. **Conclusión**: las acciones preventivas son la forma máis eficiente de reducir los casos de IAAS por VREs. Es imprescindible programar y controlar el uso de antimicrobianos para prevenín la aparición de líneas resistentes. Asimismo, es necesario mantener activas las estratégias administrativas para el control de las IAAS y la actualización de los profesionais técnicos y de limpieza que trabalen en los servicios sanitarios, permitindo la formación continua en todos los temas que involucren o control de casos.

**Descripores**: Control de infecciones; Infecció Hospitalaria; Prestación de Atención de Salud; Farmacorresistencia Bacteriana; Enterococos Resistentes a la Vancomicina.
The prevention and the control of infections caused by microorganisms have been a concern of scholars and health professionals since ancient times. During the XIX century, the Hungarian physician Ignaz Semmelweis (1818-1865) already advocated the need for antisepsis procedures for contact with patients. In addition, Joseph Lister (1827-1912), inspired by studies developed by Louis Pasteur, is also recognized for his achievements in pre-surgical antisepsis. Nevertheless, the prevention of microbial transmission among people only became more relevant after the elucidation of the relationship between microorganism and disease by the German physician Robert Koch (1843-1910).

Infection is defined as a condition in which there is a tissue and/or pathophysiological reaction resulting from the presence of an infectious microorganism in a host. Hospital or nosocomial infections are today referred to as Health care-associated infections (HAIs). HAIs are those that manifest themselves as a result of a patient’s hospitalization, of which there was no clinical evidence at the time of admission, acquired in the hospital by a patient who was admitted for a reason other than this infection.

Examples of HAIs are surgical site infections, ventilator-associated pneumonia, urinary tract infections and bloodstream infections due to the use of catheters, urinary and intravenous, respectively. According to Fernando et al, inadequate or insufficient sanitation techniques and excessive use of antimicrobials are among the main causes of HAIs. The incorrect or excessive use of antimicrobials increases the selective pressure on microbial communities, allowing the emergence of sub-populations of resistant bacteria.

Microbial resistance is a topic of great relevance in the context of surveillance and monitoring of HAIs, since infections caused by bacteria resistant to multiple classes of antimicrobials have become increasingly common and difficult to treat, thus reducing therapeutic
options. Therefore, this type of HAIs is often associated with longer hospitalization, higher risk of complications, increased mortality, and hospitalization costs.\textsuperscript{5,6}

Studies on the prevalence of microorganisms related to HAIs highlight the Gram-negative bacteria \textit{Pseudomonas aeruginosa}, \textit{Acinetobacter}, \textit{Klebsiella} and \textit{Escherichia coli}. Gram-positive bacteria include mainly \textit{Staphylococcus aureus}, \textit{Coagulase-negative Staphylococcus}, \textit{Streptococcus pneumoniae} and \textit{Enterococcus spp}.\textsuperscript{3,4,7,8} Special attention has been given to Oxacillin/Methicillin-resistant \textit{Staphylococcus aureus} (MRSA) and Vancomycin-resistant \textit{Enterococcus} (VREs). Nevertheless, the emergence of resistant strains is more worrisome than the diversity of etiologic agents, making this an important public health problem.\textsuperscript{9}

The genus \textit{Enterococcus} is composed of coccus-shaped, Gram-positive, facultative anaerobic bacteria that are able to survive in unfavorable environmental conditions.\textsuperscript{10} They are present in a wide range of environments, including the gastrointestinal tract of humans and other animals, in addition to being found in soil, water, food and surfaces.\textsuperscript{7,11} Nevertheless, some representatives of the genus \textit{Enterococcus} can cause serious infections in immunocompromised\textsuperscript{8} patients or those undergoing prolonged broad-spectrum antibiotic therapy.\textsuperscript{7} There are species that are intrinsically resistant to vancomycin, such as \textit{Enterococcus gallinarum} and \textit{Enterococcus casseliflavus}. However, the concern is around species that have acquired resistance to this antimicrobial, such as \textit{Enterococcus faecalis} and \textit{Enterococcus faecium}.\textsuperscript{10,12}

In order to control the spread of VREs, in 1995, the Centers for Disease Control and Prevention (CDC), through the Infection Control Practices Advisory Committee, published a guide on the subject. This guide recommended continuing education of staff, hand and instrument sanitation, monitoring, surveillance cultures and restriction of vancomycin use as means to decrease the number of infections and colonizations.\textsuperscript{13} Since then, the basic instructions provided by CDC have been reinforced as tools to contain the spread of VREs and other infections caused by resistant bacteria.\textsuperscript{7,14}

Considering the significant consequences of HAIs caused by VREs to patients, health care professionals and the hospital service, this integrative review was conducted in the sense of obtaining answers to the following questions: “What is the importance of VRES as agents of HAIs and what are the main actions proposed in the face of HAIs caused by VREs?”.

\textbf{OBJECTIVES}

To depict the importance of Vancomycin-resistant \textit{Enterococcus} (VRES) as agents of Health care-associated infections (HAIs) and to identify the national and international strategies used in the control and prevention of HAIs by VRES.
This is a bibliographical study, typified as integrative literature review, which followed steps of preparation of the guiding question, establishment of inclusion and exclusion criteria, literature search, critical analysis of the information, and discussion of the results.

With the purpose of analyzing the HAI caused by VREs, we performed a search for scientific articles in the NCBI/PubMed and SciELO databases. The scientific articles were searched using keywords related to the theme, namely: “Vancomycin-resistant Enterococcus”; “hospital infection”; “hospital infection control program”; “strategies to prevent HAI”.

Inclusion criteria were applied for articles published between 2015 and 2020, available in full, in Portuguese, English or Spanish languages, with title and abstract consistent with the intention of the research. Exclusion criteria covered characteristics that ran away from the intention of this research or the inclusion criteria.

The instrument, designed to extract and analyze data from the selected articles, was composed of the following items: (1) Does the text correlate the incidence of HAI with the presence of microorganisms multiresistant to antimicrobials? (2) What is the importance of infections caused by Vancomycin-resistant Enterococcus in the hospital environment?; (3) What are the main strategies suggested for the control and monitoring of HAI? (itemize elements); (4) How should HAI control committees act?; (5) How do strategic policies and surveillance take place in Brazil?; (6) What is the importance of controlling the use of antimicrobials in the prevention of HAI?; (7) How do patient contact restriction and continuing professional education strategies affect the occurrence of HAI by VREs?

Complying with the flowchart shown below (Figure 1), we selected 18 articles for the final evaluation (Table 1), in addition to documents from official bodies, such as ANVISA (Brazilian Health Surveillance Agency) and CDC, which are important for the analysis and description of the proposed subject.
Records identified through searches in databases (n=124) → Records identified through searches in other data sources (n=2) → Records after elimination of duplicate studies (n=98) → Selected for review (n=53) → Excluded Records (n=45) → Works excluded for not meeting the objective (n=28) → Articles selected after full reading (n=25) → Studies included for analysis and development of this article (n=18)

**Figure 1.** Flowchart of study selection; adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2009). Uberaba, Brazil, 2020.
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
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<td>Economic burden of nosocomial infections caused by vancomycin-resistant enterococci</td>
<td>Puchter L, Chaberny IF, Schwab F, Vonberg RP, Bange FC, Ebadi E</td>
<td>Antimicrob Resist Infect Control 2018 Jan;7(1)</td>
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<tr>
<td>Continuous increase of vancomycin resistance in enterococci causing nosocomial infections in Germany - 10 years of surveillance.</td>
<td>Remschmidt C, Schröder C, Behnke M, Gastmeier P, Geffers C, Kramer TS</td>
<td>Antimicrob Resist Infect Control 2018 Apr;7(1)</td>
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<td>O uso de antibióticos e as resistências bacterianas: breves notas sobre a sua evolução</td>
<td>Loureiro RJ, Roque F, Teixeira Rodrigues A, Herdeiro MT, Ramalheira</td>
<td>Rev Port Saude Publica 2016 Jan;34(1)</td>
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<td>Hospital-Associated Infections</td>
<td>Babady NE</td>
<td>Microbiol Spectr 2016 Jun;4(3)</td>
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<tr>
<td>Vancomycin resistant Enterococci: A brief review</td>
<td>Raza T, Ullah SR, Mehmood K, Andleeb S</td>
<td>J Pak Med Assoc 2018 Mai;68(5)</td>
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<tr>
<td>Perfil clínico e microbiológico dos casos de infecção hospitalar ocorridos em um hospital de médio porte do noroeste do Rio Grande do Sul</td>
<td>Pozzato GS, Parisi MM</td>
<td>Rev Bras Anal Clin 2018 Dez 16; 50(3)</td>
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**SciELO**
1. HAIs and antimicrobial resistance

The development of HAIs by a patient is related to the length of hospital stay, nutritional status, use of antibiotics, nature of the procedures and treatments performed, degree of immunosuppression, performance of invasive procedures and use of catheters and probes.\(^7\,^{12}\,^{15}\) The length of stay in intensive care units (ICUs), probably due to the greater need of handling and care by the medical and nursing staff, together with the immunocompromised status of the patient, is associated with higher rates of HAIs.\(^7\) Besides the ICU, hemodialysis and oncology are other sectors that usually present a higher number of cases of HAIs.\(^7\)

Transmission of HAI-causing bacteria occurs (a) through health care workers, including residents, physicians, nurses and nursing technicians; (b) among patients; (c) by visitors; (d) by the environment and fomites.\(^7\,^{11}\,^{15}\)

The hospital environment is a place of extensive use of antimicrobials, making it conducive to the development of bacterial resistance. Excessive use of antimicrobials is described as one of the main factors favoring the emergence of resistant strains due to selective pressure.\(^4\,^{15}\)

The selective pressure exerted by the use of antimicrobials selects those bacteria that have somehow modified their genetic material, enabling them to survive in the presence of a previously efficient drug. This occurs by random mutations in DNA or by acquisition of new sequences, from the horizontal transfer of mobile genetic elements, for example.\(^11\) These modifications can result in mechanisms of drug inactivation, changes in enzymatic pathways, changes in the site of action of drugs, efflux pumps\(^10\), enabling microbial growth even in the presence of the drug.
2. HAIs caused by Vancomycin-resistant Enterococcus (VREs)

VREs began to emerge in the 1980s in the United States (USA) and Europe, where the first case was reported in 1986. In the USA, the genus *Enterococcus* is the second leading cause of HAIs, accounting for 14% of cases, with Vancomycin-resistant *E. faecium* being the agent responsible for most bloodstream infections. In Europe, the rates of HAIs caused by VREs range from 2 to 20%.12

In Brazil, the first record of VRE infection occurred in 1996. Currently, VRE has been considered endemic in Brazilian hospitals3,12, being responsible for hospital outbreaks of great importance.12

Puchter et al5, in a retrospective case-control study conducted in Germany, demonstrated that VRE-related HAIs increase hospital costs, mainly regarding medications and expenses with nursing staff and medical products. According to the authors’ analysis, the costs for the treatment of patients with infections caused by VREs are on average 13,000 euros higher when compared to the costs for patients with infections caused by sensitive *Enterococcus*.

HAIs due to VREs usually affect the urinary tract and sterile sites, such as blood, whose culture also shows a positive catheter tip12,16,17, suggesting the origin of the infection through catheter insertion. Bloodstream infection caused by Vancomycin-resistant *E. faecium* has been associated with increased total cost of hospitalization and prolonged hospital stay.18 The number of cases and bloodstream infections caused by VRE has been increasing in recent years, characterizing a threat to patient safety.19

We should also underline the high number of individuals colonized by VRE, but without any sign indicating the presence of the bacteria. Asymptomatic colonization has an incidence 10 times higher when compared to the pathological process, being a condition described as more permissive to sanitation failures and consequent transmission of the bacteria.

3. Strategies for the control and monitoring of HAIs

The rates of infections caused by bacteria of the genus *Enterococcus* have been increasing over the years. According to Remschmidt et al19, in Germany, HAIs due to *Enterococcus* have increased from 1.4% in 2007 to more than 10% in 2016.

The priority in managing cases of colonization or infection is source control.7 Because of the ability of bacteria of the genus *Enterococcus* to spread and their endemicity profile, if source control is not held at the beginning and is not applied consistently, later attempts to eradicate the problem become almost impossible.12
National and international studies show that practices of adequate sanitation applied to hands, bedding, surfaces and equipment, associated with contact precautions among patients, visitors and nursing staff, along with rotation and restriction in the use of antimicrobials, are recommended actions to prevent or reduce the occurrence of HAIs by VREs. Furthermore, the control of HAIs can be optimized with continuing education of professionals and with the maintenance of hospital control committees and policies.

In addition to the aforementioned actions, the monitoring of colonization or infection cases can be held by surveillance cultures, performed periodically and in asymptomatic patients, being a way to screen colonization by VRE.

### 3.1 Hand sanitation

Hands are considered to be important routes of transmission of VRE among patients and, for this reason, the practice of hand sanitation is considered the best way to demonstrate quality in health care services and to prevent HAIs. Good hand sanitation is a fundamental principle related to the prevention of HAIs caused by VREs, in addition to the fact of being an indication of safety in hospitals.

The monitoring of hand sanitation in health services, through a scheme that ensures feedback to the professionals, should be conducted as a way to demonstrate their performance in the control and prevention of HAIs, allowing behavioral changes about the preventive practices.

When efficient, hand sanitation can reduce cases of VRE infection by 47%. Proper hand sanitation involves using soap and water and maintaining hand rubbing for at least 30 seconds, which allows for the elimination of any VREs present. Hands that have been sanitized for 5 seconds show no impact on microbial content, and may continue to transmit VREs.

Access to washbasins should be readily available in health care settings and in a quantity and distribution that allows their frequent use. Health services should adapt to the recommendations of the World Health Organization regarding the number and the most appropriate position for hand sanitation equipment, ensuring that this practice does not cease due to difficulty in accessing water, soap and alcohol.

### 3.2 Sanitation of surfaces and equipment

Like hands, fomites can be disseminators of VREs. Therefore, sanitizing them should be considered a key component of HAI control programs, since VREs can survive on dry surfaces and equipment for months.

Reyes et al recommend that health care facilities follow some cleaning protocols and that these be performed with uninterrupted frequency. Nevertheless, the monitoring of the
efficiency of the protocols can be periodic and should include the accomplishment of cultures with samples from surfaces and equipment, since VREs can survive in the environment for up to a year.

Among the ways to decontaminate these sites, the most common is the use of sodium hypochlorite. Nevertheless, there are other ways, which, despite their higher cost, do not require direct action of cleaning professionals, such as ultraviolet lighting (UV) and vaporized hydrogen peroxide (VHP).

According to a study by Eckstein et al., traditional cleaning shows 29% efficiency in preventing transmission of VREs, since, after sanitizing rooms where there were patients colonized by VRE, 71% of environmental samples were still positive. Nevertheless, another study showed that patients admitted to rooms that had undergone VPH have 80% less chance of acquiring VRE; and, when disinfection is conducted by UV, the chances are 31% lower.

At the University Hospital of Münster, Germany, Correa-Martínez and collaborators phylogenetically compared VRE strains identified in cultures from the hospital environment, periodically performed as part of the hospital’s HAI control, and VRE strains from surveillance cultures based on rectal swabs, performed as routine screening on hospitalized patients. According to the authors, there was genetic similarity among the strains, confirming that the hospital environment acts as a reservoir, facilitating the expansion of cases of HAIs by VREs. In this same study, it was observed that cases of HAIs related to the same strain of VREs could be delayed due to the survival of VREs in the hospital environment, i.e., a strain that was causing infection in a given period may remain in the environment for a long time, on surfaces and equipment, causing future infections in new patients.

### 3.3 Surveillance cultures

The use of surveillance cultures is considered useful for early detection and intervention and has been shown to be beneficial in reducing the number of *Enterococcus* infections and also in reducing bacterial transmission among high-risk patients.

Surveillance cultures are performed on samples collected with a rectal or perianal swab or also by means of stool test. The samples are cultured on solid media, which can be of different types, especially VRE-selective and chromogenic. In outbreak situations, the collection of wound and skin samples should also be considered.

After positive results in a culture, it is important to perform antimicrobial susceptibility testing (AST), in order to evaluate the sensitivity profile of the isolated strain. *Enterococcus* are considered resistant when the Minimum Inhibitory Concentration (MIC) of Vancomycin is greater than or equal to 32 µg/mL.
The implementation of surveillance systems using screening with perianal swabs becomes more reliable when there are systems that allow early identification of patients at risk. According to Reyes et al., surveillance cultures are of great importance, especially in specific populations, such as dialysis patients, patients hospitalized for long periods, ICU patients, as well as oncological and transplanted patients.

On the other hand, Linfield and collaborators, in a study conducted in the ICU at Ronald Reagan UCLA Medical Center, in California, observed that sampling using a perianal swab was more sensitive (S=96%) when compared to stool test (S=84%) in identifying VRE. According to the same authors, 63% of the surveyed patients were not colonized with VRE at the time of admission, as well as 39.1% of those who had been admitted before the study. These patients, considered negative cases, were evaluated weekly, and 25% of them were contaminated in some way with VREs strains. This evaluation once again demonstrates the importance of surveillance cultures in hospitalized patients.

4. Committees for the control of HAIs

The formation and support of specialized groups, composed of trained professionals, is an advantageous practice in the process of HAI case containment. Control programs guided by these groups facilitate the implementation of strategic actions in health services.

According to Storr and collaborators, among the key components for prevention and control of HAIs, the programs managed by specialized committees stand out in first place. These committees should be composed of trained professionals from different areas of training, and in sufficient number, being 1 for every 100 or 250 beds, depending on the situation of the health service.

In Brazil, during the 1960s, the first Hospital Infection Control Committee (CCIH, as per its Portuguese acronym) was established; and, about 20 years later, the Brazilian Association of Hospital Infection Control Professionals (ABIH, as per its Portuguese acronym) was founded. With the consolidation of ABIH, norms and regulations were proposed, thus reducing the cases of HAIs across the country.

5. Strategic policies and inspection in Brazil

In November 2016, ANVISA published the National Program for Prevention and Control of Health care-associated infections (PNPCIRAS, as per its Portuguese acronym). It is a document that brings together policies and programs aimed at reducing cases of HAIs in Brazil, containing objectives and goals to be achieved by health services between the years 2016 and 2020. Specific objectives were established to consolidate the national system of epidemiological surveillance of HAIs; to reduce the incidence of priority HAIs at the national level; to
prevent and to control the spread of microbial resistance in health services; and to consolidate the PNPCIRAS program.\textsuperscript{21}

For each of the objectives to be achieved, there is a table with the description of activities that should be followed by health services. In general, the activities are aimed at strengthening CCIHs and state and national programs for prevention of HAI, developing evaluation methods for the efficiency of actions, qualifying professionals who directly work with patients and giving support to microbiological diagnostic laboratories.\textsuperscript{21,25}

The importance of maintaining national level programs, such as PNPCIRAS, is defended by Gomes and Moraes\textsuperscript{27}, who also emphasize the relevance of maintaining surveillance. According to the authors, ANVISA is responsible for the interdiction of establishments that violate biosafety rules, in addition to the investigation of compliance with health standards that involve patient safety and HAI prevention. There should also be supervision of the CCIHs’ actions, as well as technical cooperation when required.\textsuperscript{27}

Nevertheless, failures in surveillance and in assisting health care facilities to implement tools to combat the advance and decrease the incidence of HAI have been reported.\textsuperscript{25,27}

\section*{6. Restrictions and control of antimicrobial use}

In the hospital environment, there is intense and frequent use of various types of antimicrobials. This fact is understood as a mechanism that promotes the selection of resistant bacterial strains.\textsuperscript{7,27} Several studies relate the use of antimicrobials with cases of HAI by multidrug-resistant microorganisms.\textsuperscript{4,9,11,12,17,26}

Optimizing the use of antimicrobials, including dose, timing and route of administration is a key strategy in preventing HAI.\textsuperscript{4} In this context, PNPCIRAS is aimed at publishing a national guideline to address the controlled use of antimicrobials as part of strategies focused on training professionals.\textsuperscript{21}

Restriction strategies, combined with education about the prescription, are considered fundamental in preventing the selection of resistant microorganisms.\textsuperscript{4,22} The development of protocols on the use of antimicrobials is also understood as a strategy to adapt their use in the hospital environment,\textsuperscript{21,26} in order to standardize the choice of the correct classes, since up to 50\% of prescriptions are somehow inadequate.\textsuperscript{4}

\section*{7. Contact precautions}

Contact, whether direct, person-to-person, with fluids or fomites, is understood to be one of the main causes of microorganism transmission, leading to a possible increase in the incidence of HAI. Contact precautions are recommended for infections transmitted through di-
rect contact with infected or colonized patients or fomites\cite{6}, and when caring for hospitalized patients or handling body fluids.\cite{21,27}

There are no intervention studies that have compared the rates of acquisition of HAIs with contact precautions \textit{versus} standard precautions routinely performed.\cite{4} Nevertheless, patient contact precautions actions and policies should be held when dealing with cases of HAI outbreaks.\cite{7} In addition to the use of personal protective equipment such as gloves, gowns, masks and goggles, when necessary, patients can be housed in individual rooms, in such a way as to restrict contact.\cite{4}

The non-occupancy of the hospital beyond the preestablished limits, such as the maximum number of beds per room, is a basic action\cite{22} to be followed, in order to hinder the occurrence of cases of HAIs by VREs, as well as by other microorganisms.

8. Continuing education

Educational actions are understood as primary strategies for the solution of the problem of HAIs\cite{25} and are among the recommendations of the control programs of HAIs in Brazil, such as PNPCIRAS.\cite{21} Education about VRE colonization should be conducted from the first day of hospitalization\cite{20}, since it is understood as a preventive activity. In addition to educational activities, periodic evaluations of the effectiveness of training must also be performed.\cite{22}

Educational activities should cover all other strategies for the control of HAIs. Hand, equipment and environment sanitation, interpretation of protocols, control of the use of antimicrobials and contact precautions must be part of continuing education, since the training of professionals is what supports the adoption of appropriate practices.\cite{25}

**DISCUSSION**

Vancomycin-resistant \textit{Enterococcus} was listed in 10 of the analyzed articles\cite{3,5,7,11,12,15,16,17,18,19} as a major cause of HAIs in recent years. The morbidity and the mortality associated with cases of HAIs caused by VREs, along with the increase in hospital expenses for the treatment of patients, reinforce the concern with colonizations and infections caused by VREs.

Regarding the thematic organization, we noted that 06 articles\cite{4,7,12,17,20,22} pointed hand sanitation as one of the most important strategies to control HAIs, regardless of the etiologic agent, while 05 articles advocated monitoring through surveillance cultures as a fundamental strategy in controlling the incidence of HAIs in different hospitals. In 03 articles, concrete links were established between contaminated surfaces and the colonization of patients by VREs.\cite{4,7,15} Thus, this confirms that hands are still the main pathogen transmission routes, in-
cluding VREs, but also highlights the role of inert surfaces in the dissemination dynamics of these pathogens, especially considering the ability of Enterococcus to survive adverse environmental conditions.

We found that three articles emphasize the importance of the performance of the Hospital Infection Control Committees in the sense of reducing cases of HAIs. The formation of teams with trained professionals is able to facilitate the implementation of strategic actions in health services, which is in line with the recommendation of PNPCIRAS, belonging to ANVISA.

We identified that only one article discusses the inspection function of the Brazilian Health Surveillance Agency in cases of hospital infection. The authors point out the supervision and the correct application of PNPCIRAS as fundamental actions.

We observed that the restriction and the control of the use of antimicrobials in the hospital environment are considered in nine articles as essential strategies for the prevention of HAIs. Optimizing the use of antimicrobials would include the adequacy of the prescription (correct choice of drug), adjustment of dose, time and route of administration, with the development of protocols to be followed in the hospital environment.

In four of the selected articles, it was shown that the act of restricting patient contact can reduce the spread of pathogens in the hospital environment. Continuing professional education strategies were also associated with a reduction in the occurrence of HAIs by VREs.

We should emphasize that actions to control and prevent HAIs should be based on the specificity of the health system, i.e., they should be directed to the microorganisms that cause HAIs in the respective sites. In those places where the number of cases of HAIs caused by VREs is high, the monitoring of patient colonization by VREs should be maintained as a routine activity of the service. Continuing professional education should be seen as a preventive and essential activity, and should be encouraged among the different hospital sectors.

As a limitation, we identified the scarce robust scientific evidence on the specific strategies and particularities to be adopted for the control of HAIs by VREs. This condition is believed to be due, in part, to the fact that Gram-negative bacteria have long been the main agents of HAIs and, consequently, the focus of control strategies. However, Gram-positive bacteria have emerged in recent years as important causes of HAIs, not only in Brazilian hospitals, but also internationally, making it essential to control these pathogens, in order to obtain positive and effective results for infection control in the hospital environment.
The concern with the control of HAIs is as old as its discovery, but, in spite of this, it seems that the implementation of microbial control strategies adopted in hospital environments is still insufficient to eradicate this problem that is so common and, at the same time, so serious, which, besides health losses, brings economic losses.

With all the knowledge about the emergence of bacterial resistance and the incidence of HAIs, such as those caused by VREs, it is clear the need to maintain efficient sanitation practices in hospitals and health services, internationally understood as a key action to reduce the cases of HAIs. The preparation for such actions should include from health professionals to cleaning workers.

Surveillance cultures allow early detection and intervention, and this monitoring of cases must be performed with appropriate frequency and periodicity. In addition, it is necessary to develop strategies that adjust the use of antimicrobials, enabling continuing education for professionals who prescribe and administer them.

The continuing education about the interventions performed to reduce HAIs is another fact that is in line with national and international studies; and, therefore, it must be performed in a comprehensive way with all the professionals included in the hospital care, addressing the various topics that involve the minimization of HAIs. All the processes must be followed by a committee or a technical team focused on the control of HAIs, in order to ensure the safety of the hospitalized patients.

Thus, we argue that this study is relevant to teaching, research and clinical practice, since it seeks to understand the importance of Vancomycin-resistant Enterococcus as agents of HAIs and the strategies to be adopted to minimize their occurrence in the hospital environment. The discussions on the theme are relevant and may contribute to help the multidisciplinary team in the control of these pathogens, thus contributing to improve the quality of treatment offered to hospitalized patients, prioritizing the effectiveness of the care provided.
CONTRIBUTIONS

Nathália Grosbelli Vicari. Preparation of the manuscript.
Yago Marcos Pessoa Gonçalves. Preparation of the manuscript.
Adriana Gonçalves de Oliveira. Correction and analysis of the manuscript.
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CONFLICTING INTERESTS

The authors declare that there are conflicting interests.

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