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REVIEW ARTICLE

Prevalence of methicillin-resistant *Staphylococcus* in nursing professionals: an integrative review

Prevalência de Staphylococcus resistente à meticilina em profissionais de enfermagem: revisão integrativa

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ABSTRACT

Objective: to estimate the prevalence of colonization by methicillin-resistant Staphylococcus aureus among nursing professionals according to scientific evidence. **Method:** integrative literature review conducted in September 2020 through access to the LILACS, MEDLINE, CINAHL and Web of Science databases. **Results:** the prevalence of methicillin-resistant *Staphylococcus aureus* ranged from 0 to 30.4%, mean of 8.4%. In addition, surveys conducted more recently (2015: 15.7%; 2016: 9.2%; 2017: 15.9%) and in Asia (14.57%) estimated higher mean prevalence rates. **Conclusion:** the prevalence of colonization by methicillin-resistant Staphylococcus among nursing professionals found in the various national and international studies is still significant, which reinforces the need to adopt active surveillance programs as a strategy to detect asymptomatic cases and contribute to break the chain of transmission of infections.

Descriptors: Nurse Practitioners; Methicillin-Resistant *Staphylococcus aureus*; Prevalence.

RESUMO

Objetivo: estimar a prevalência de colonização por *Staphylococcus* resistente à meticilina entre profissionais de enfermagem conforme evidências científicas. **Método:** revisão integrativa da literatura, realizada em setembro de 2020, mediante acesso nas bases de dados LILACS, MEDLINE, CINAHL e *Web of Science*. **Resultados:** A prevalência de *Staphylococcus aureus* Resistente à Meticilina variou de 0 a 30,4%, com média de 8,4%; além disso, as pesquisas conduzidas mais recentemente (2015: 15,7%; 2016: 9,2%; 2017: 15,9%) e no continente asiático (14,57%) estimaram maiores prevalências médias. **Conclusão:** ainda são expressivas as prevalências de colonização por *Staphylococcus* resistente à meticilina entre profissionais de enfermagem verificadas nos diversos estudos realizados em âmbito nacional e internacional, o que reforça a necessidade de adoção de programas de vigilância ativa, como estratégia para detecção de casos assintomáticos e contribuição no rompimento da cadeia de transmissão das infecções.

Descritores: Profissionais de Enfermagem; *Staphylococcus aureus* Resistente à Meticilina; Prevalência.

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INTRODUCTION

Staphylococcus aureus, found on the skin and nasal cavities of healthy people, has been shown to be one of the most prevalent pathogens in hospital-acquired infections. As this pathogen can develop resistance, it is considered one of the most important microorganisms in the context of Healthcare Associated Infections[1].

In this context, methicillin is an antimicrobial used routinely in hospitals to treat infections caused by S. aureus. For the past 50 years, clinical microbiologists around the world have faced the serious challenge of the emergence and spread of Methicillin-Resistant Staphylococcus Aureus (MRSA), a nosocomial pathogen that causes severe morbidity and mortality[2,3].

In addition, MRSA can be seen not only in the hospital setting, but also in the community or in asymptomatic carriers. Fatal infections are more common in patients with known risk factors, such as advanced age, use of antibiotics, prolonged hospitalization and immunocompromised state[4,5].

Two main factors have contributed to the marked increase in this resistance: the misuse of antibiotics and the spread of resistant microorganisms with a high adaptive capacity. On the other hand, the main control measures are the early identification of colonized or infected patients, education and training of professionals, audit of cleaning and hygiene practices, identification of the isolation of patients with illustrative signs, and adherence to contact precautions as recommended by Hospital Infection Control Services[6,7].

Nursing professionals are the interface between the hospital and the community, especially by their direct contact with users, objects and environmental surfaces, serving as agents of cross contamination; in addition to the damage caused to the host's body[8]. Thus, knowledge about the prevalence of MRSA in the public in question is necessary to select strategies aimed at its eradication as an important part of a comprehensive infection control policy and consequently, improvement of public health.

In view of these aspects, the aim of the present study was to estimate the prevalence of colonization by methicillin-resistant Staphylococcus among nursing professionals according to scientific evidence.

METHOD

An integrative literature review was conducted, which allows the combination of several methodological approaches and has the potential to play a crucial role in evidence-based practice for nursing[9].

The study design was structured in six distinct steps: development of the research question; definition of databases and criteria for inclusion and exclusion of studies; definition of the information to be extracted from the selected studies; evaluation of studies included in the review; interpretation of results; presentation of the review/synthesis of knowledge[9].

The research question was developed according to the PVO strategy (P – population; V – variable of interest; O – outcome). According to the objective of the study, the following structure was considered: P – nursing professional; V – Methicillin-resistant Staphylococcus aureus; O – prevalence[10]. Therefore, the following question was asked: What is the prevalence of colonization by methicillin-resistant Staphylococcus aureus among nursing professionals according to scientific evidence?

In September 2020, a bibliographic survey was performed through virtual access to the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS); Medical Literature Analysis and Retrieval System Online (MEDLINE); Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Web of Science.

Controlled descriptors from Medical Subject Headings (MeSH), CINAHL titles and Health Sciences Descriptors (DeCS) were selected to search the databases. To systematize the sample collection, the advanced search form was used and the peculiarities and distinct characteristics of each database were respected. The descriptors were combined with the Boolean connector OR within each set of terms in the PVO strategy, and then crossed with the Boolean connector AND, as shown in Figure 1.

The search was performed by two researchers independently. They standardized the sequence of use of descriptors and crossings in each database and compared the results obtained. To guarantee a broad search, articles were accessed in their entirety through the portal of journals of the Coordination for the Improvement of Higher Education Personnel (Portuguese acronym: CAPES) in an area with a recognized Internet Protocol (IP) at the Universidade Federal do Piauí.

For the selection of publications, the following inclusion criteria were adopted: original studies showing a prevalence of methicillin-resistant Staphylococcus among nursing professionals, published until September 2020. All species of the Staphylococcus genus were considered and there were no restrictions of language and time of publication.

The exclusion criteria were: book chapters, news, editorials, doctoral theses, master's dissertations, technical reports, narrative, integrative or systematic review studies, those already selected in the search in another database and studies that did not answer the study question.

The studies found were imported into the Endnote Web software, made available on the Web of Science database, with the aim to organize the studies and identify duplicates.

The total of 1,458 publications were identified, of which 182 were duplicates and considered only once, which totaled 1,276 articles for reading. Subsequently, after reading titles and abstracts, was performed the selection of potentially

eligible articles that showed the prevalence of methicillin-resistant Staphylococcus, and 178 articles were chosen for reading in full. At the end, after applying the other inclusion and exclusion criteria, 21 articles comprised the sample of this review (Figure 2).

A data collection form prepared for the present study was used in the extraction and synthesis of information from the selected studies. It included information of authors, journal, year of publication, year of study, country, place of data collection, prevalence of MRSA, region of sample.

The extracted data were entered into Microsoft Excel version 16.0 for the calculation of mean prevalence and cross-reference with the other variables of interest. The results found

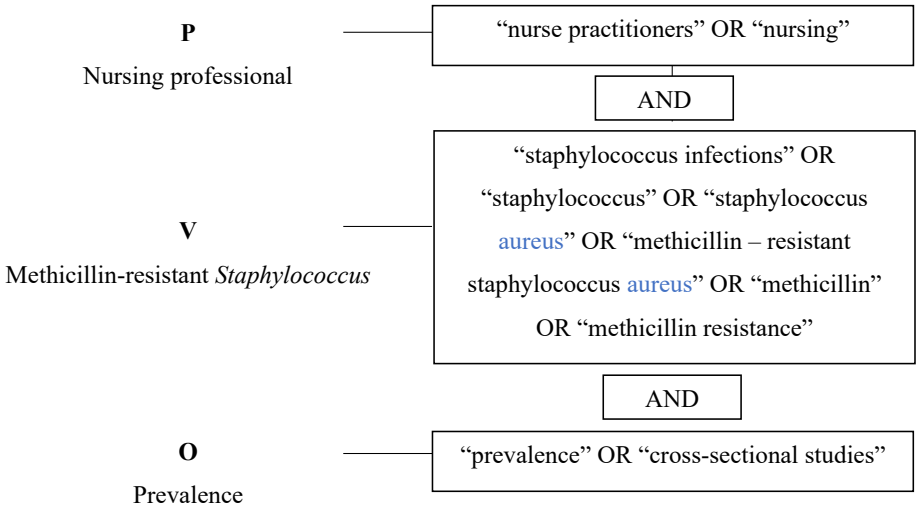


Figure 1. Controlled descriptors used in the search strategy for population, intervention and outcomes.

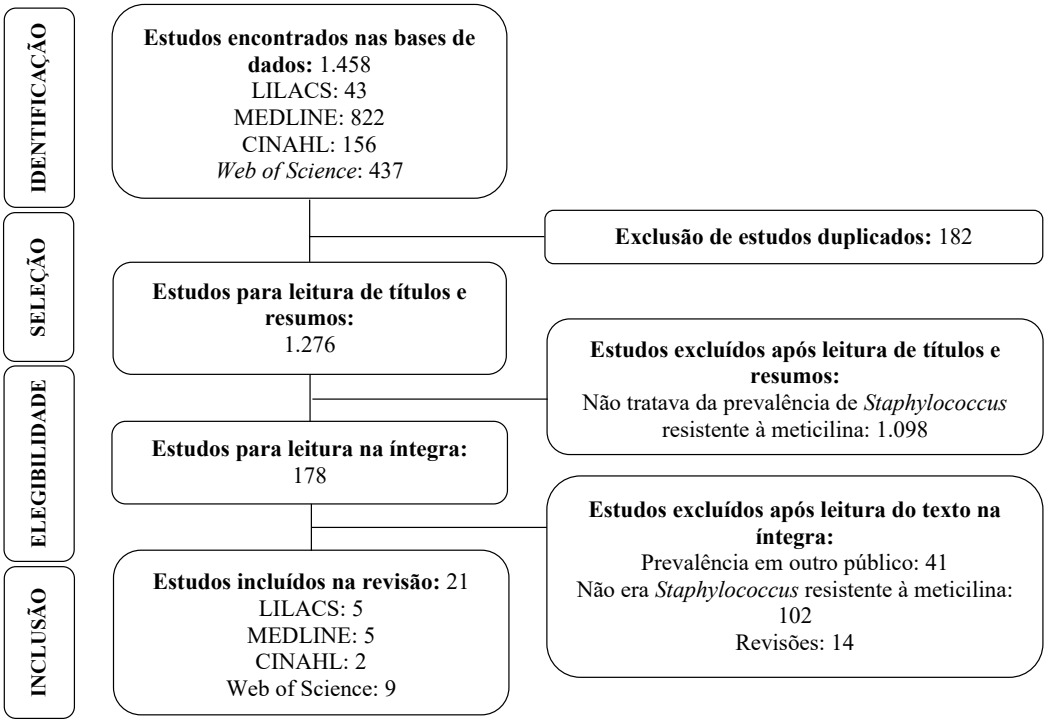


Figure 2. Flowchart of the search and selection of articles included in the review.

were presented in the form of a table and graphs, followed by a critical analysis and qualitative synthesis of the results found.

RESULTS

In the present review, 21 articles published in different journals were selected, and no scientific journal had record of more than one work on this specific theme.

Regarding the year of publication, 2011, 2015 and 2018 were the years with more records of articles in the area of interest (three papers in each year). However, in the previous two years, there has been no published scientific study. In addition, articles were published more frequently (six studies) in Brazil.

The location of studies were two environments, hospitals and nursing homes, with 90.5% and 9.5% of publications in each, respectively. As the aim of most studies conducted in nursing homes was to establish the prevalence of bacteria in older adults, they were not included in this review.

The prevalence of MRSA ranged from 0 to 30.4%, mean of 8.4%, and in data collection for its evaluation, the nasal region was the most frequently evaluated area (90.5%). Chart 1 displays the categorization of studies included in the review after the full reading of information extracted from works.

Graph 1 shows the mean prevalence of MRSA in nursing professionals by year of the study. Studies conducted between 2015 and 2017 estimated higher mean prevalence rates (2015: 15.7%; 2016: 9.2%; 2017: 15.9%), whether through more modern assessment mechanisms or by the real increase in MRSA prevalence.

Graph 2 shows the prevalence of MRSA in nursing professionals worldwide; the Asian continent has the highest mean prevalence (14.57%), followed by North America (11.67%).

DISCUSSION

This work provides data regarding colonization by methicillin-resistant Staphylococcus among nursing professionals according to scientific evidence. The prevalence of MRSA varied from 0 to 30.4%, mean of 8.4%.

Differences in the prevalence of MRSA between countries and hospitals can be explained in part by variations in the quality and size of samples, the use of various microbiological methods (sampling technique to culture media) and different guidelines for interpreting the results. In addition, adherence to infection control in each sector is closely related to the microbiological colonization observed[3].

In a pioneering study conducted in Canada, no samples with the presence of MRSA were found, suggesting that other factors may play a role in colonization, thereby requiring further investigation on the subject[25]. On the other hand, in a study carried out in the Gaza Strip, a prevalence of 30.4% was found, higher than the mean observed, and the rate of MRSA carriers was significantly higher among nurses (p=0.001)[3].

In an investigation conducted in Brazil, when evaluating the nasal and palmar region of 50 nursing professionals working in different hospital sectors, 8% were colonized with MRSA, of which half worked in the ICU (Intensive Care Unit) and none in the operating room[1]. Another Brazilian study also identified a higher prevalence of MRSA among professionals working in the ICU sector, followed by those of the medical clinic and surgical clinic[11].

In this perspective, the literature clarifies that the ICU is the sector with the most severe clinical cases, prolonged hospital stay, use of invasive procedures and indiscriminate antibiotic therapy, which represent important risk factors for the acquisition of multi-resistant microorganisms[1,27]. Therefore, active surveillance for MRSA colonization can identify foci of transmission and individuals at risk for adverse outcomes, leading to improved prevention programs[11].

Staphylococcus aureus is a widely distributed bacterium, found in several parts of the human body, such as nasal passages, throat, intestines and skin. Of these anatomical sites, the nostrils have the highest colonization index[28]. This factor corroborates with data found in this review, where the nasal region was the most frequently evaluated area (90.5%).

In relation to the year of studies, in those conducted more recently, was estimated a higher mean prevalence of MRSA. In this sense, the following stand out: in a study conducted in a university hospital in the United States, 124 professionals were evaluated and was found a prevalence of 10.5%[22], and in the study conducted at the University Hospital Fayoum, Egypt, after analyzing material collected from the nasal region of 95 professionals, MRSA was found in 10.5% of the sample[4].

The current methods of evaluating bacterial strains may influence the increase in the colonization found, and the Polymerase Chain Reaction (PCR) mecA is currently considered the gold standard for screening MRSA[4].

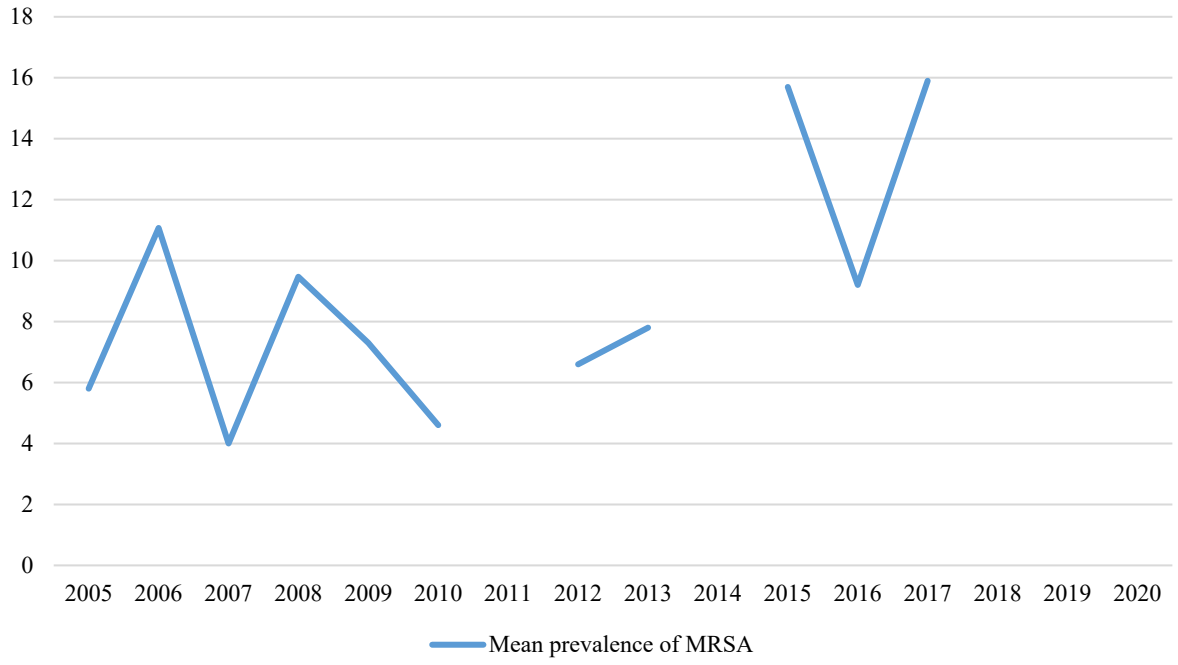
In addition, in the distribution of prevalence rates of studies by continent where data collection was performed, Asia had the highest mean prevalence, followed by North America, revealing global spread of the infection. In the study conducted at the Nishtar Medical Unit and Multan Hospital, Pakistan, the presence of positive strains for MRSA was found in 15.9% of nursing professionals[8]. In the study conducted in the United States with 80 professionals, 17.5% of the sample was colonized with the resistant bacteria[21].

As nursing professionals have greater contact with patients, they represent a higher risk for the acquisition and transport of bacteria compared to other health workers[17]. Therefore, actions of surveillance and control of infections focused on that professional class must be developed efficiently. The

Chart 1. Categorization of studies included in the review.

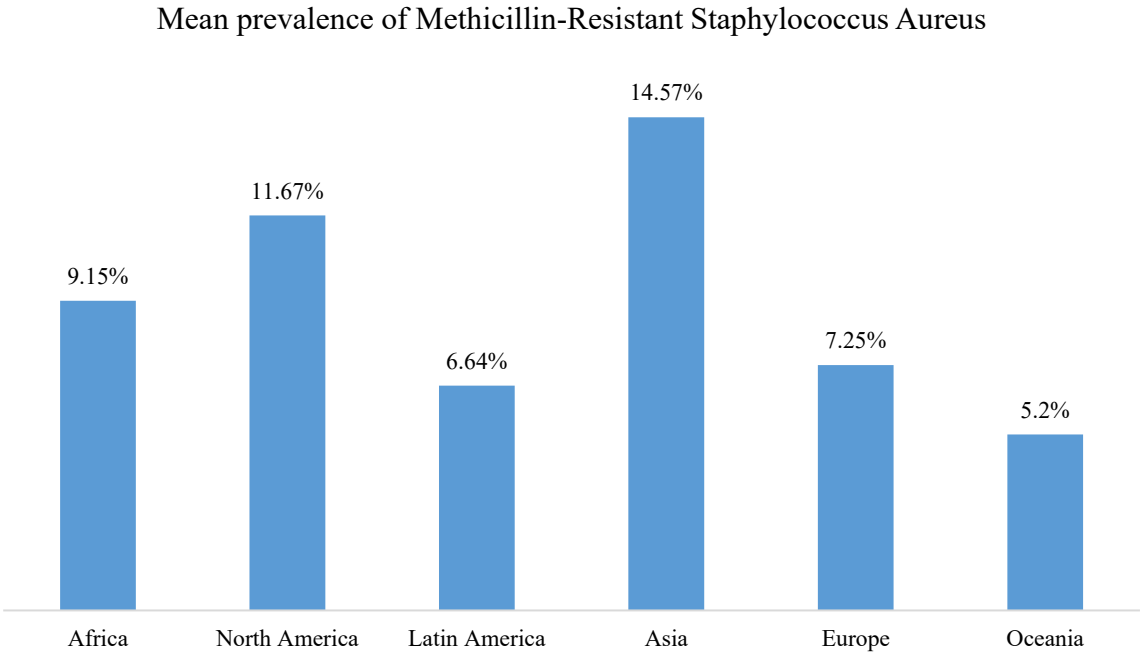
	Authors	Year of publication	Country	Study location	MRSA prevalence (f/n)*	Sample region
A1	Moura JP et al.[11]	2011	Brazil	Large teaching hospital in the interior of São Paulo	7.1% (25/351)	Oral
A2	Montalvo R et al.[12]	2011	Peru	National Hospital Dos de Mayo	7.3% (3/41)	Nasal
A3	Camilo CJ, Peder LD, Silva CM[1]	2016	Brazil	Hospital of the city of Cascavel, Paraná	8% (4/50)	Nasal and Palmar
A4	Cruz, EDA et al.[13]	2011	Brazil	University Hospital in Curitiba, Paraná	12.7% (62/486)	Oral
A5	Reinato LAF et al.[6]	2015	Brazil	Specialized care units for HIV/ AIDS in a teaching hospital	6.6% (4/61)	Nasal
A6	Silva ECBF et al.[14]	2010	Brazil	Referral hospital in Recife, Pernambuco	1.5% (3/202)	Nasal and Palmar
A7	Silva ECBF et al.[15]	2012	Brazil	Hospital das Clínicas of Pernambuco	3.3% (5/151)	Nasal and Palmar
A8	Baldwin NS et al.[16]	2009	United Kingdom	Northern Ireland Nursing Home	8.7% (11/126)	Nasal
A9	Jannati E et al[17]	2013	Iran	Teaching Hospital	4.6% (8/173)	Nasal
A10	Legese H et al.[18]	2018	Ethiopia	Two hospitals of Adis Abeba	7.8% (10/128)	Nasal
A11	Monaco M et a.l[19]	2009	Italy	Nursing Home in Bergamo	5.8% (3/51)	Nasal
A12	Suffoletto BP et al.[20]	2008	United States	Five teaching hospitals in Pittsburgh	7.0% (11/158)	Nasal
A13	Bisaga A et al.[21]	2008	United States	Hospital	17.5% (14/80)	Nasal
A14	Aila NAE, Laham NAA, Ayesh BM[3]	2017	Gaza Strip	Hospital Al Shifa	30.4% (38/125)	Nasal
A15	EliëTurenne M C et al.[22]	2015	United States	University Hospital	10.5% (13/124)	Nasal
A16	Hefzey EM, Hassan GM, Reheem FAE[4]	2016	Egypt	Fayoum University Hospital	10.5% (10/95)	Nasal
A17	Hematian A et al.[23]	2018	Iran	Imam Khomeini Hospital	8.7% (7/80)	Nasal and Palmar
A18	Khanal R et al.[24]	2015	Nepal	Teaching Hospital of the Faculty of Medical Sciences, Bhairahawa	7.8% (4/51)	Nasal
A19	Saito G et al.[25]	2013	Canada	Teaching Hospital in Toronto, Ontario	0% (0/55)	Nasal, axillary and any open wound (if present)
A20	Salman MK et al.[8]	2018	Pakistan	Nishtar Medical Unit, Multan Hospital	15.9% (22/138)	Nasal
A21	Verwer PEB et al.[26]	2012	Australia	Royal Hospital, Perth	5.2% (30/581)	Nasal

*f/n: absolute frequency of nursing professionals with MRSA presence versus study sample.
MRSA: Methicillin-Resistant *Staphylococcus Aureus*.
Source: research data.



Source: research data.
MRSA: Methicillin-Resistant *Staphylococcus Aureus*.

Graph 1. Mean prevalence of Methicillin-Resistant *Staphylococcus Aureus* in nursing professionals by year of the study according to data from the reviewed literature.



Source: research data.

Graph 2. Mean prevalence of Methicillin-Resistant *Staphylococcus Aureus* in nursing professionals worldwide according to data from the reviewed literature.

implementation of protocols based on universal precautions and permanent health education activities on the subject can have significant results for infection control.

In the meantime, considering the clinical and epidemiological characteristics of multidrug-resistant infections, it is essential that the work in public health is aimed at their eradication, since this problem involves a portion of the population exposed to risk, although with intrinsic endemic potential.

As limitations of the study, we can mention the use of a small number of databases that can lead to loss of information, and the exclusion of some types of publications that may bring some subjectivity to the analyzes.

CONCLUSION

The results of this review show the still significant prevalence of colonization with methicillin-resistant Staphylococcus among nursing professionals in the various national and international studies. Such data contribute to reflect the health reality of health institutions, which should be used primarily in strategic planning to solve this problem.

In this perspective, hospital infection control actions must be improved, focusing on the reality observed in each location and the practice of evidence-based medicine, for which the results presented here are of singular relevance.

In the context of management of health institutions, active surveillance programs are an important strategy for detecting asymptomatic cases and contribute to break the transmission chain of Healthcare-Associated infections.

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