

# Compliance with surgical site infection prevention measures in hospitals

Adesão às medidas de prevenção de infecção do sítio cirúrgico em hospitais  
Adhesión a las medidas de prevención de infección del sitio quirúrgico en hospitales

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## Abstract

**Objective:** To assess compliance with actions for surgical site infection prevention and control, adopted in clinical practice in accordance with the recommendations proposed by the World Health Organization: auditing the moment of antibiotic administration, trichotomy with an electric clipper/disposable blade, material sterility confirmation, and surveillance and dissemination of surgical site infection rates.

**Methods:** This is a cross-sectional observational study, carried out in 30 hospitals in the state of Minas Gerais, from February 2018 to April 2019, based on an audit of a surgical procedure, situational diagnosis and interview with Hospital Infection Control Services.

**Results:** In 93.3% of Hospital Infection Control Services, protocols for prophylactic antibiotic use and compliance audits were reported, 69% reported trichotomy with an electric clipper. All carried out surgical site infection surveillance, however, only 63.3% carried out rate disclosure. In the situational diagnosis, trichotomy was performed in 76.7% inside the operating room with an electric clipper (56.7%). In the audit of the moment of antimicrobial administration between 30-60 minutes before surgical incision, compliance was identified in 63.3%; 93.3% of services confirmed material sterility through process indicators.

**Conclusion:** Differences were found between recommendations from the Hospital Infection Control Service and compliance with good practices during situational diagnosis and auditing of surgical procedures, reinforcing the need for training and audits aimed at effectively complying with professionals' practices regarding such measures.

## Resumo

**Objetivo:** Avaliar a adesão às ações de prevenção e controle da infecção de sítio cirúrgico, adotadas na prática clínica de acordo com as recomendações propostas pela Organização Mundial de Saúde: realização da auditoria de momento da administração de antibiótico, tricotomia com tricotomizador elétrico/lâmina descartável, confirmação da esterilidade dos materiais e, vigilância e divulgação das taxas de infecção de sítio cirúrgico.

**Métodos:** Estudo observacional transversal, realizado em 30 hospitais de grande porte do estado de Minas Gerais, de fevereiro de 2018 a abril de 2019, a partir de uma auditoria de um procedimento cirúrgico, diagnóstico situacional e entrevista com os Serviços de Controle de Infecção Hospitalar.

**Resultados:** Em 93,3% dos Serviços de Controle de Infecção Hospitalar foram referidos protocolos para uso de antibiótico profilático e auditorias de adesão, 69% informaram tricotomia com tricotomizador elétrico; todos realizavam a vigilância da infecção de sítio cirúrgico, no entanto, apenas 63,3% realizavam a divulgação das taxas. No diagnóstico situacional, a tricotomia foi realizada em 76,7% dentro da sala cirúrgica com

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tricotomizador elétrico (56,7%). Na auditoria do momento de administração do antimicrobiano profilático entre 30-60 minutos antes da incisão cirúrgica identificou-se conformidade em 63,3%; 93,3% dos serviços confirmavam a esterilidade dos materiais por meio de indicadores de processo.

**Conclusão:** Verificou-se divergências entre recomendações do Serviço de Controle de Infecção Hospitalar e adesão às boas práticas durante diagnóstico situacional e auditoria de procedimentos cirúrgicos, reforçando a necessidade de treinamentos e auditorias visando adesão efetiva às práticas dos profissionais a tais medidas.

## Resumen

**Objetivo:** Evaluar la adhesión a las acciones de prevención y control de infecciones del sitio quirúrgico adoptadas en la práctica clínica, de acuerdo con las recomendaciones propuestas por la Organización Mundial de la Salud: realización de auditoría del momento de administración del antibiótico, tricotomía con tricotomizador eléctrico/lámina descartable, confirmación de esterilidad del material y control y difusión de índices de infección del sitio quirúrgico.

**Métodos:** Estudio observacional transversal, realizado en 30 hospitales de gran tamaño del estado de Minas Gerais, de febrero de 2018 a abril de 2019, a partir de una auditoría de un procedimiento quirúrgico, diagnóstico situacional y entrevista con los Servicios de Control de Infecciones Hospitalarias.

**Resultados:** En el 93,3 % de los Servicios de Control de Infecciones Hospitalarias se citaron protocolos para el uso de antibiótico profilático y auditorías de adhesión, el 69 % informó tricotomía con tricotomizador eléctrico, todos realizaban el control de infecciones del sitio quirúrgico, pero solo el 63,3 % realizaba la difusión de los índices. En el diagnóstico situacional, la tricotomía fue realizada en el 76,7 % dentro del quirófano con tricotomizador eléctrico (56,7 %). En la auditoría del momento de administración del antimicrobiano profilático de 30 a 60 minutos antes de la incisión quirúrgica, se identificó conformidad en el 63,3 %, el 93,3 % de los servicios confirmó la esterilidad del material por medio de indicadores de proceso.

**Conclusión:** Se verificaron divergencias entre las recomendaciones del Servicio de Control de Infecciones Hospitalarias y la adhesión a las buenas prácticas durante el diagnóstico situacional y auditoría de procedimientos quirúrgicos, lo que refuerza la necesidad de capacitaciones y auditorías para una efectiva adhesión de las prácticas de los profesionales a tales medidas.

## Introduction

Healthcare-associated infections (HAIs) are infections acquired by patients receiving health care and represent one of the most frequent preventable adverse events worldwide.<sup>(1)</sup> The Centers for Disease Control and Prevention (CDC) define HAI as systemic or localized conditions resulting from the action of infectious agents or their toxins, which manifest within 72 hours of patient admission or after hospital discharge.<sup>(2,3)</sup>

Surgical site infection (SSI) stands out among the HAI as one of the most important. SSI is directly related to surgical care and is considered a global public health concern, due to the high rates of morbidity and mortality, in addition to the impact on length of stay and the increase in hospital costs due to its treatment.<sup>(2,3)</sup>

This infection affects 160,000 to 300,000 patients in the United States of America (USA) every year, being responsible for an extra expenditure of about ten billion dollars annually for its treatment and ranks second among all HAIs.<sup>(4,5)</sup> In Europe, the situation is no different, as it is identified as the second most recurrent infection, accounting for about 500,000 cases per year and increasing length of stay by up to three times<sup>(4)</sup> compared to surgical patients without infection. In Brazil, it ranks third among all HAIs.<sup>(6)</sup>

SSI is considered multifactorial and its occurrence is related to intrinsic factors, of patients themselves, such as the underlying disease, preoperative hospitalization time, nutritional imbalance, immunosuppression, preexisting or coexisting infection, age extremes, and smoking; and extrinsic factors, i.e., not dependent on patients, being attributed to the surgical technique, skin preparation, team rigor in adopting preventive measures during the surgical act, among others.<sup>(4,7-9)</sup>

Thus, national and international associations and societies, in line with the World Health Organization (WHO), in order to improve care for surgical patients, prevent SSI and ensure safer operative care, in 2008, proposed the second global challenge “Safe Surgery Saves Lives”. This challenge established guidelines and measures to prevent SSI, with the goal of reducing by 25%, by 2020, infectious complications resulting from surgical procedures.<sup>(2,4-7,9)</sup>

With regard to SSI prevention, it is reported that approximately 50% of SSIs can be preventable<sup>(4,6,7)</sup> when SSI prophylaxis and control measures are effectively adopted, on the other hand, there is also evidence that non-compliance with these measures increases SSI rates and may favor the occurrence of adverse events in patients, which in most cases are preventable.<sup>(10,11)</sup>

Although the recommendations for preventing SSI are well described and grounded in the literature, it is not well established how large hospitals have been leading to compliance with SSI prevention behaviors, in order to meet this WHO challenge.

Given the above, the following research question was defined: how have large hospitals in Minas Gerais adopted SSI prevention measures related to the WHO safe surgery program global challenge?

The objective was to assess compliance with SSI prevention actions adopted in the clinical practice of large hospitals based on the following variables: performing an audit at antibiotic administration, shaving with an electric clipper/disposable blade, confirming material sterility and, surveillance and disclosure of SSI rates.

## Methods

This is a cross-sectional observational study. A total of 30 large hospitals in the state of Minas Gerais participated in the study, voluntarily, from February 2018 to April 2019.

Large health establishments in Minas Gerais were selected after surveying them in the Brazilian National Register of Health Establishments (CNES - *Cadastro Nacional de Estabelecimentos de Saúde*). As a large hospital, those with an operating capacity of 150 to 500 beds were considered, in accordance with the Ministry of Health guidelines.<sup>(12)</sup>

A total of 542 hospital institutions were identified, of which 32 were classified as large hospitals. Due to refusals and/or conflicts of interest, the final sample consisted of 30 hospitals. Conflicts of interest in this study were considered to be the fact that research participants were employees of hospitals who would be eligible to compose the sample.

The institutions eligible to participate in the study were invited by the researchers in partnership with the State and Municipal Department of Health, a partner in this project, as it is a topic of national interest. During invitation, the objectives of the research, its relevance and contributions were presented, through an invitation letter and/or tele-

phone contact, highlighting the voluntary, non-rewarded, confidential, secret character, in addition to risks and benefits.

Data were collected by the researchers themselves, followed by two health professionals, nurses, working at the Minas Gerais Department of Health, working in the Coordination of Patient Safety and Infection Control, previously trained in techniques for applying questionnaires and observations through interviews and audits. After obtaining consent from the institution's legal guardian, an interview was carried out with the Hospital Infection Control Service (HICS) coordinator, operating room situational diagnosis and surgical procedure observation in each of the institutions.

The interview with the HICS coordinator was intended to outline the profile of hospitals and learn about the institution's policies for adopting SSI prevention measures proposed by the WHO, and learn about the measures and protocols adopted by institutions for SSI prevention and surveillance.

For the situational diagnosis, the focus was to identify the coherence of infrastructure and processes developed in the operating room with the recommendations and good practices defined by national and international manuals and guidelines, through observation of the variables of interest using a data collection instrument, ensuring that the minimum conditions necessary for adopting SSI prevention measures were implemented. Finally, the observation of a surgical procedure in each of the institutions that made up the study sample aimed to verify whether the SSI prevention measures proposed by the institutions were, in fact, implemented in hospitals' clinical practice.

After carrying out several pre-tests to validate the questionnaires, a descriptive data analysis was carried out and its readjustment, which were adapted for the research. Moreover, instrument consistency was assessed using Cronbach's alpha, which showed adequate internal consistency (0.80).

For compliance with SSI prevention practices, the institution's performance was considered regarding the audit of antibiotics and the moment in which they were administered, preoperative trichotomy with an electric clipper and use of disposable

blades, material sterility confirmation and, SSI surveillance for SSI diagnosis as well as disclosure of SSI rates to surgeons, as shown in Chart 1. It should be clarified that the moment of antimicrobial drug administration during the audit conducted did not include a dose increase, as this was not justified by the duration of the observed procedure.

**Chart 1.** Presentation of study variables according to the way of obtaining and expected response guided by WHO recommendations

Markers	Measurements	Expected	Instrument
01) Antibiotic audit	1.1) Audit of antibiotics is carried out; 1.2) Time when antimicrobial is administered.	- An antimicrobial audit is carried out; - Prophylactic antibiotic is administered between 30 and 60 minutes before the surgical incision.	1.1) Interview with the HICS coordinator; 1.2) Surgical procedure observation.
02) Preoperative trichotomy	2.1) Method adopted to perform trichotomy of surgical patients; 2.2) Place where trichotomy is performed.	- Trichotomy is performed with an electric clipper; - Trichotomy is performed outside the operating room.	Situational diagnosis.
03) Material sterility	3.1) Professionals check the sterilized materials through process indicators in the operating room, before surgery.	- Sterilized materials are checked before the procedure using process indicators.	Surgical procedure observation.
04) SSI surveillance	4.1) Existence of a HICS in the hospital; 4.2) The institution monitors patients to diagnose the occurrence of SSI.	- There is a HICS in the institution; - The institution monitors patients to diagnose the occurrence of SSI.	Interview with the HICS coordinator.
05) Disclosure of ISC rates	5.1) The institution discloses SSI rates to surgeons.	- SSI rates are disclosed to surgeons.	Interview with the HICS coordinator.

Data were tabulated and analyzed in the statistical program Statistical Package for the Social Sciences (SPSS) version 22.0, with descriptive statistics and calculation of measures of central tendency (mean and median).

This research is part of a study entitled “*Panorama dos Desafios Globais da OMS para Segurança do Paciente em Hospitais de Grande Porte em Minas Gerais*”, approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais, under CAAE (Certificado de Apresentação para Apreciação Ética - Certificate of Presentation for Ethical Consideration) 30782614.3.0000.5149, meeting the principles of Resolution 466/2012. Furthermore, the Minas Gerais Department of Health was a co-participant, giving consent to the project.

## Results

### Characterization of the institutions participating in the study

A total of 30 large institutions from Minas Gerais participated in this study. Of these, 43.3% (13) are located in the Central region, 20% (06), in the Southeast, 10% (03), in the North, 10% (03), in the South, 6.7% (02), in the Center-South region, and 3.3% (01) in each of the following districts: South East, Southern Triangle and Northern Triangle. As for institution characterization, 60% (18) of hospitals were characterized as of high/medium complexity, financed by a philanthropic entity (43.3%; 13), considered teaching and research (43.3%; 13), and only 36.7% (11) of institutions had some type of accreditation. Regarding the total number of beds available, an average of 288 (153-1,080) was identified. Regarding the number of operating rooms, the average observed was 09 (04-19). The monthly average of surgeries performed by the institutions visited was 721 (250-1,300), and the annual average was 8,872 (1,400-16,280) surgical procedures. Most (96.7%) hospitals performed general surgeries, followed by orthopedic (93.3%), gynecological (83.3%) and plastic (80%). In contrast, only 26.7% underwent transplants, 36.7%, head/neck surgeries, and 43.3%, pediatric surgeries. Of the 30 hospitals participating in the study, 56.7% (17) claimed to fully adopt the WHO global challenges and 13.3% (04) partially.

### Patient safety practices recommended by Hospital Infection Control Services

It was identified that in 93.3% (28) of hospitals, HICS self-reported record for the existence of surgical antibiotic prophylaxis protocols and audits to verify compliance with such protocols. As for performing preoperative trichotomy, 69% (20) of institutions, according to HICS, performed this procedure with an electric clipper, with nursing technicians being the professional responsible in 83.3% (25) of situations. The presence of an instituted and active HICS was mentioned in all institutions. Nurses were mentioned in all services, while medical professionals were absent in only one HICS. The

frequency of employees with administrative functions was a reality in 66.6% (20) of hospitals. As for the criteria adopted for HAI diagnosis, according to the HICS coordinator, 83.3% (25) used those described by the Brazilian National Health Regulatory Agency (ANVISA - *Agência Nacional de Vigilância Sanitária*), and 16.7% (05) those described by the National Healthcare Safety Network (NHSN). One institution reported using both criteria. The disclosure of SSI rates was mentioned by the HICS coordinator as a reality in 63.3% (19) of hospitals, being carried out through reports in 73.7% (14) of cases and 26.3% (05) through meetings.

### Operating room's situational diagnosis

During the situational diagnosis in the operating room, the variables of interest for the study were carefully verified. Regarding trichotomy, 76.7% (23) were performed inside the operating room, 10% (03), in the waiting room, and 13.3% (04), in the inpatient unit. Electric clipper was used in 56.7% (17) of situations, and cutting blade in 43.3% (13) of cases. With regard to temperature in the operating room, it was evident that it was registered in 60% (18) of hospitals visited, with the wall thermometer being the most used method for such verification. It was noticed, however, that in 40% (12) of establishments, temperature was measured empirically, considering the temperature setting available on the air conditioning display. When checking the maximum and minimum temperature inside the operating room, it was found that this specific thermometer was absent in 70% (21) of operating rooms. In this regard, when checking temperature, it was observed that 46.7% (14) did not have any type of thermometer. It was noted that of the operating rooms in which thermometers were identified, the average temperatures were: minimum 22.4°C; maximum: 23.6°C; and at the time verified: 22.1°C. It was identified that only 30% (09) patients, of the 30 observed during the surgical procedure, were submitted to some type of heating inside the operating room, at the time of the visit. It was found that the proposal was not adopted by 20% (06) of institutions. However, the presence of shoes for private use inside the operating room was a reality in only 26.7% (08) of hospitals. Regarding

the estimated percentage of compliance with the safe surgery checklist, estimated by the operating room coordinator, this was reported to be adopted in about 81% of the hospitals participating in the study.

### Verification of safe surgery protocol implementation by observing the procedure

Prophylactic antimicrobial administration between 30 and 60 minutes before surgical incision occurred in only 63.3% (19) of observed procedures. Thus, using topical antibiotics to close the incision was identified in 26.7% (08) of situations. The performance of trichotomy inside the operating room was observed in 26.7% (08) of assisted procedures, with an electric clipper (16.7%; 05), cutting blade (6.7%; 02) and scissors (3.3%; 01), performed by a surgeon or resident. As for the preparation of patients' skin, in 96.7% (29) of procedures followed, this was recorded in a wide area around the incision and performed by the main surgeon in 76.7% (23) of situations. The most used antiseptic solution was chlorhexidine and alcohol. Patient heating during the surgical procedure was verified in only 50% (15) of 30 surgeries followed. Of these, only 6.7% (02) were heated with a disposable thermal blanket, and 43.3% (13), with blankets or sheets, and these inputs had not been mentioned by the HICS. Although 50% (15) of patients were heated during the procedure, temperature monitoring was identified in only 30% (09) of 30 observations, being performed equally in 10% (03) by each type of thermometer: axillary, transesophageal and by infrared sensor. Considering the moments in which patients' temperature was monitored, the following situations were found: only after anesthetic induction (13.3%; 04), during the entire procedure (13.3%; 04) and arrival at the operating room (3.3%; 01). It was noteworthy that this monitoring was not observed in 70% (21) of procedures monitored. It was identified that glycemic control was performed in patients known to be diabetic and those undergoing long-term surgeries. Sterilized materials were checked using process indicators in the operating room in 93.3% (28) of surgeries. Regarding safe surgery checklist application/coordination, in the perioperative period, it was observed that this function was assigned to a professional in 63.3% (19) of

institutions, with the circulating nurse being responsible for such attribution in 46.7% (14) of services.

### Compliance of hospitals to surgical site infection prevention measures

Based on the global challenge “Safe Surgery Saves Lives” recommendations and other guidelines and guidelines aimed at preventing SSI, as described in the method of this study, hospitals visited were arranged according to the percentage of compliance with measures considered the gold standard for SSI prevention analyzed in the present study. The results are shown below (Table 1). The data contained in this table were obtained through data collection instruments as described in table 1.

**Table 1.** Presentation of hospitals' compliance percentage in relation to each analyzed measure considered as the gold standard for SSI prevention according to WHO

Bookmarks	Measurements	Hospital compliance percentage
01) Antibiotic audit	1.1) Audit of antibiotics is carried out;	1.1) 86.6% (26)
	1.2) Time when the antimicrobial is administered.	1.2) 63.3% (19)
02) Preoperative trichotomy	2.1) Method adopted to perform the trichotomy of surgical patients;	2.1) 36.6% (11)
	2.2) Place where trichotomy is performed.	2.2) 23.3% (07)
03) Material sterility	3.1) Professionals check sterilized materials through process indicators in the operating room before surgery.	3.1) 93.3% (28)
04) SSI surveillance	4.1) Existence of a HICS in the hospital;	4.1) 100% (30)
	4.2) The institution monitors patients to diagnose the occurrence of SSI.	4.2) 100% (30)
05) Disclosure of ISC rates	5.1) The institution discloses SSI rates to surgeons.	5.1) 63.3% (19)

It should be noted that of the eight measures analyzed in the five extracts, it was found that four of them showed compliance among the hospitals above 80%, highlighted in bold in Table 1. Among all institutions, the presence of a HICS and surveillance of surgical patients were present in 100% of them. On the other hand, the lack of definition of site for carrying out the trichotomy procedure as well as the method for carrying out such a procedure drew attention as the most challenging measure.

## Discussion

Philanthropic institutions, which were the majority in this study, are considered the main service

providers for the Brazilian Health System (SUS – *Sistema Único de Saúde*) at the national level,<sup>(13)</sup> since they must offer this health system 60% or more of hospitalizations, obtaining, in exchange, a subsidy of 20% on gross revenue according to the care provided.<sup>(14)</sup>

It was identified that all hospitals participating in the study have an established and active HICS, in accordance with Ordinance 2616 of May 12, 1998, which determine the existence and execution of a nosocomial infection control program in hospitals in the country.<sup>(15)</sup>

Thus, the presence of surgical prophylactic antibiotic routines and protocols was reported by 93.3% of services. However, it is considered that such a measure should have been mentioned by all HICS, since this recommendation has been reinforced in manuals and national and international guidelines that deal with SSI prevention,<sup>(4-7,9)</sup> with the objective of ensuring the presence of antimicrobial drugs satisfactorily throughout the surgery, being one more action to prevent skin microorganisms from penetrating the surgical incision, especially in long-term procedures.<sup>(16,17)</sup>

The lack of compliance with the moment of administration is one of the main problems related to the antibiotic in the surgical patient, which often happens in completely incorrect periods, not allowing the antimicrobial to reach its adequate serum level at the time of incision, which can potentiate the occurrence of SSI.<sup>(18,19)</sup> The correct and rational use of surgical prophylactic antibiotics has been reported as an important measure to prevent SSI, especially in long-term surgeries.<sup>(16,17)</sup>

With regard to preoperative trichotomy, it was identified that both the HICS recommendations and what was observed during surgery are at odds with what the national (ANVISA) and international (AORN, CDC, WHO, APIC) manuals and guidelines recommend carrying out this practice to prevent SSI.<sup>(4-7,9)</sup>

This technique, performed with a blade, can cause lesions on patients' skin that increase the risk of SSI, due to accumulation of bacteria in these places, which can progress to the surgical site at the time of incision. Additionally, performing it in the operating

room can cause dispersion of hairs in the air, which, during the procedure, can be taken to the surgical site in a way that is not noticed by the team, and may, in the same way, potentiate the occurrence of SSI. For this reason, it is recommended to use an electric trichotomizer to perform trichotomy.<sup>(4-7,9)</sup>

Although the electric clipper is widely recommended for performing preoperative clipping due to its ability to prevent injuries to patients' skin,<sup>(4-7,9)</sup> several services still use a cutting blade to perform this procedure,<sup>(8,18)</sup> corroborating the findings of this study.

The disclosure of SSI rates is another measure that should have been followed by 100% of hospitals,<sup>(6,7)</sup> being recommended since the SSI prevention guideline, in 1999, by the CDC, as the disclosure of care indicators is a strategy which enables improvements in clinical practice,<sup>(20)</sup> making it possible to analyze, together with the surgeon, possible failures that may increase the risk of SSI, in addition to proposing structuring processes and establishing partnerships that lead to quality care and safety for surgical patients.<sup>(20,21)</sup>

With regard to warming patients, it was observed that only 50% (15) of patients were warmed during the surgical procedure. This finding is worrying, considering that perioperative hypothermia can contribute to several serious complications such as blood loss, coagulopathy, need for transfusion, thermal discomfort, prolonged anesthetic recovery, increased length of hospital stay, in addition to SSI, since peripheral vasoconstriction as a result of hypothermia prevents the arrival of oxygen to the surgical wound, delaying healing, and prevents the arrival of prophylactic antimicrobials at the operated site, increasing the risk of causing infection.<sup>(22-24)</sup>

It is considered that about 20 to 84% of people undergoing surgical procedures suffer from hypothermia during the perioperative period, which is defined as a core body temperature of less than 36°C, also known as unintentional hypothermia.<sup>(24,25)</sup>

In this regard, active forced air, dispensed in disposable thermal blankets, is considered the best and most effective method of warming patients,<sup>(5)</sup> as it allows heat to be transmitted through the skin, raises its core temperature and maintains normothermia during the perioperative period.<sup>(26)</sup> In Brazil, this issue is reinforced by the Federal Council of Medicine

(FCM), which recommends warming patients undergoing surgeries longer than one hour and under high-risk conditions, regardless of the surgical time.<sup>(6,9,27-29)</sup>

Although active forced air is considered the most effective method to warm patients and prevent perioperative hypothermia,<sup>(5,23,25)</sup> national and international recommendations are not unanimous in relation to this practice, leading this measure not to appear as a gold standard for SSI prevention. However, this theme has been explored by scientific studies and has motivated a deeper discussion.

In this context, it was found that half of the analyzed SSI prevention measures were adopted by 80% of the hospitals participating in the study, and the other measures were adopted by 63.3%, 36.6% and 23.3%. With regard to trichotomy, there was a lack of compliance with this measure in 23 institutions, and checking sterilized materials before surgery was not carried out in 2 hospitals, which is a very serious issue, since material sterility is a parameter defining factor for the quality and reduction of risks related to surgical care. These findings become worrying considering that the WHO, when proposing the global challenge, outlined as one of its goals the reduction of SSI by 25% by 2020.<sup>(7)</sup>

According to the above, there is a need for investments in public policies, people development, a culture of safety in institutions and prioritizing the reduction of SSI rates, which are still at high levels, with devastating consequences. Finally, it is highlighted that, as an important strategy in this context, the discussion in a multidisciplinary way about the safe surgery program in health undergraduate and graduate courses, in addition to encouraging teaching institutions to promote research on this topic.<sup>(30,31)</sup>

The present study presented as a limitation the observation of only one surgical procedure in each health institution. However, it was found that the findings corroborate the national and international literature that addresses the theme.

## Conclusion

It was evident that large hospitals in Minas Gerais partially adopt the SSI prevention measures pro-

posed by the WHO, in the second global challenge “Safe Surgery Saves Lives”. Preoperative trichotomy, in terms of method and location, was the investigated measure that showed the lowest compliance, demonstrating that in the vast majority of institutions this procedure is still done inappropriately with an inadequate method. Differences were observed between the HICS recommendations and compliance with good practices by professionals during situational diagnosis and auditing of surgical procedures, demonstrating weaknesses in the implementation of SSI prevention measures in clinical practice. Based on the results obtained, it was found that SSI prevention measures and conducts adopted in clinical practice still deserve greater investments, monitoring and audits at services. Thus, it was verified the importance of the measures being aligned with the HICS recommendations, which were not effectively found in the present study. In this sense, carrying out process audits regarding the team’s knowledge and compliance with SSI prevention measures is important, in order to investigate and intervene, if necessary, in an interdisciplinary manner, in local and specific training with the objective of ensure that professionals are up-to-date, reinforcing the importance of multidisciplinary work for SSI prevention.

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## Collaborations

Araújo BS and Oliveira AC declare that they contributed to the project design, data analysis and interpretation, article writing, relevant critical review

of intellectual content and approval of the final version to be published.

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