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# Prevention of surgical site infection in a university hospital: evaluation by indicators

## Prevenção da infecção de sítio cirúrgico em hospital universitário: avaliação por indicadores

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## ABSTRACT

**Introduction:** Surgical Site Infections (ISC) have a major impact on patient safety, and their evaluation through indicators becomes a necessary practice in the search for the quality of health services. **Objective:** To evaluate indicators of prevention of STI in a university hospital, and to verify the association of compliance of indicators between general surgery and orthopedic specialties. **Method:** Evaluative, transversal, observational and quantitative research. 200 elective surgeries performed from April to August 2016 at the Paraná University Hospital Surgical Center were analyzed by direct observation and recording of variables extraction forms that compose three indicators according to the Handbook of Evaluation of Control Practices for Hospital Infections. After tabulation of the data, descriptive statistical analysis and inferential were used. **Results:** The general compliance of the indicators was better for preoperative conditions (85.5%) and structural conditions (90.0%) than for intraoperative asepsis practices (74.0%). There was statistical significance (p-value=0,003) only for the "Distance Infection" component, with a worse result for orthopedics. **Conclusions:** No indicator achieved optimal compliance even with several fully adequate components. There are spaces to search for improvements in STI prevention, focusing on the registry of investigation of previous infections and in asepsis conditions.

**KEYWORDS:** Surgical Wound Infection; Quality Indicators, Health Care; Patient Safety; Quality Management; Surgicenters

## RESUMO

**Introdução:** As Infecções de Sítio Cirúrgico (ISC) têm grande impacto na segurança do paciente e a sua avaliação, através de indicadores, torna-se prática necessária na busca pela qualidade dos serviços de saúde. **Objetivo:** Avaliar indicadores de prevenção de ISC em hospital universitário, bem como verificar a associação de conformidade dos indicadores entre as especialidades de cirurgia geral e ortopedia. **Método:** Pesquisa avaliativa, transversal, observacional e quantitativa. Foram analisadas 200 cirurgias eletivas realizadas de abril a agosto de 2016 no Centro Cirúrgico de hospital universitário do Paraná, por observação direta e registro em formulários para extração de variáveis que compõem três indicadores do Manual de Avaliação das Práticas de Controle de Infecção Hospitalar. Após tabulação dos dados, empregou-se análise estatística descritiva e inferencial. **Resultados:** As conformidades obtidas foram melhores para as condições do paciente no pré-operatório (85,5%) e condições estruturais (90,0%) em comparação às práticas de assepsia no intraoperatório (74,0%). Houve significância estatística (p-valor=0,003) apenas para o componente "Infecção a Distância", com pior resultado para ortopedia. **Conclusões:** Nenhum indicador alcançou a conformidade ideal, mesmo com diversos componentes plenamente adequados. Há espaços para busca de melhorias na prevenção de ISC, com enfoque no registro de investigação de infecções prévias e nas condições de assepsia.

**PALAVRAS-CHAVE:** Infecção da Ferida Operatória; Indicadores de Qualidade em Assistência à Saúde; Segurança do Paciente; Gestão da Qualidade; Centros Cirúrgicos

## INTRODUCTION

The pursuit of quality in healthcare is a pressing matter due to social demands and changes in the mode of production of care, where the risks inherent in care are increasingly recognized. Therefore, the pursuit of quality in healthcare is inseparable from the promotion of patient safety, which is understood as the reduction of care-related risks to the minimum acceptable levels[1].

Patient safety is a complex good that involves both the dissemination of the systemic organizational culture in favor of safer care and the elaboration, implementation and evaluation of rational strategies that can improve it[1,2]. In the context of these strategies, it is recommended that these consider the particular dynamics of the care production of each service. Moreover, they should reduce the most obvious risks and the adverse events produced by care or its absence through systematic actions, such as protocols, continuing education, monitoring of practices, risk management, among others[2].

Worldwide, Healthcare-Associated Infections (HCAI) are considered a set of adverse events of very high epidemiological importance. They mean negative results for health organizations due to their costly potential and, obviously, negative factors to the safety of the patients, since HCAI greatly increase morbidity and mortality rates[3,4]. Thus, HCAI are a direct product of healthcare and, despite their epidemiological and clinical severity, most of the identified events are preventable[1,3].

In Brazil, there were official publications of measures aimed at establishing the best practices for the prevention of HCAI, according to the epidemiological and clinical relevance of their topographies, namely: pneumonia associated with healthcare, urinary tract infection, bloodstream infection, and surgical site infection[4].

Surgical Site Infection (SSI) is defined as a postoperative infection that affects the surgical wound and/or the cavity and operated organs and is clinically an inflammatory and suppurative process. It can reach 3 to 20% of the patients submitted to operative procedures[4], in addition to representing up to 31% of the total prevalence of HCAI in hospital settings[5]. As a general criterion, SSI should be diagnosed no later than 30 days after the procedure if there has been no prosthetic material installed in the surgery[6].

Because of the impact on the safety of the surgical patient, SSI have been the target of studies all over the world. In the universe of scientific publications, alarming results appear, such as: a study conducted in Turkey[7] identified a general SSI rate of 4.3% (out of 41,563 surgical procedures) and the majority of surgical specialties (n = 22) presented rates higher than those recommended by the National Health Safety Network (NHSN); a study done in India[8] identified a similar overall rate of SSI (4.2%), reaching 8.3% infection in breast surgeries. In Colombia[9], 193 cases of SSI were observed in 5,063 surgical procedures. All the cited studies confirm that this scenario is worrisome and that health institutions need to enforce their current recommendations on SSI prevention.

A systematic review conducted by researchers from different European countries suggests that SSI require prolonged hospitalization, reoperation and readmission. They increase the burden on health systems, as well as the mortality rates among infected patients[10]. This scenario reaffirms the need to control and evaluate the practices that complicate surgical procedures, in order to improve decision-making in favor of SSI prevention[4,11].

Both in the SSI context and in the global context of health quality and safety, indicators have been used as objective measures that delineate a specific reality or health situation. Therefore, they are elementary to the evaluation of services and rational planning of health action improvement[11,12]. In this scope, there is the formulation of a manual of indicators validated by a group of researchers and professionals with expertise in the area of HCAI control. It includes monitoring the factors related to SSI through metrics of evaluation of the clinical conditions of the patient; the performance of procedures in the preoperative period; the preoperative preparation of the surgical team; the antisepsis related to the procedures; and the physical and human resources of the surgical center. This is fundamental to inform decision makers on what to do to support SSI prevention initiatives[12].

Reinforcing the justification for studies on this matter, it is worth mentioning that the “Safe Surgery Saves Lives” program, launched by the World Health Organization (WHO), focuses on prevention of SSI, safe anesthesia, safe surgical teams and the use of surgical assistance indicators[13]. Therefore, it is believed that the prevention of SSI versus evaluation by indicators is useful to increase the safety of surgical patients, since it has the potential to rationally base the (re)planning of services, which undoubtedly leverages social relevance of scientific research in this scope. Furthermore, research into the range of SSI prevention indicators can support the strengthening of best practices through benchmarking results compared between health organizations.

In view of the above, we questioned: what is the status of the actions that promote SSI prevention in a given university hospital? In order to answer this question, we evaluated SSI prevention indicators in a public university hospital, as well as verified the association of conformity of indicators between general and orthopedic specialties.

## METHOD

Evaluative, cross-sectional, observational and quantitative research done in the Surgical Center (SC) of a public university hospital in the state of Paraná, Brazil. The hospital has an operational capacity of 210 beds exclusively destined to the Unified Health System (SUS) and covers a population of approximately two million people. It is a reference center in trauma care, high-risk pregnancy and treatment of Human Immunodeficiency Virus (HIV). The SC has five operating rooms and another room reserved for post-anesthetic recovery.

The study sample comprised 200 elective surgical procedures, 100 of which were for general surgery and 100 for orthopedics, performed in the data collection period, which lasted from April to August 2016. The sample was defined in accordance with to

the recommendations of the Manual of Evaluation of the Practices of Hospital Infection Control[12], base methodological framework of the research, which determines the amount of observations listed as sufficient and valid to the assessment of the indicators. The surgical specialties were intentionally chosen in line with the epidemiological profile of the research site. The defined inclusion criteria were: elective surgery of the specialties referred to and performed during the daytime period from Monday to Friday, which were used for all surgeries until the sample was filled.

Data was collected by the direct observation of a single researcher in order to attenuate the biases that may occur in observational studies, as well as by extraction of information in a documentary source, using the anesthetic-surgical reports and electronic medical records of the patients. There was previous training to the collection by another researcher from the area of HCAI, a PhD nurse in full activity in education and research in the studied area. In case of simultaneous surgeries between the specialties evaluated, the researcher opted for the observation of one of them, for convenience, and followed the procedure of filling the sample. Over the five months of data collection, the mean observation time of each surgery and its evaluation components was of about 45 minutes, totaling approximately 150 hours of evaluation.

The data collection was done by filling out forms based on the reference of the study[12]. The forms included the extraction of the trichotomous variables of evaluation (conformity, nonconformity and no application) or dichotomous (yes/no) of the following indicators: Indicator 1: Evaluation of the patient's conditions in the preoperative period; Indicator 2: Evaluation of the asepsis conditions in the intraoperative period; and Indicator 3: Assessment of the structural conditions of the SC. Each indicator has evaluation criteria (which define its compliance or nonconformity), sources of information and its own structuring items/components.

Indicator 1 results in the assessment of the following aspects: risk of anesthetic death as a surrogate marker of the patient's overall clinical condition (ASA risk – criteria of the American Society of Anesthesiologists); investigation of remote/pre-surgical site infections; and time that (and if) hair removal was performed. The evaluation of this indicator is done through the existence of documentary records that prove that these preoperative conditions are being monitored in the patient, and their compliance criteria are clear in the manual[12].

Indicator 2 relates to the evaluation of the use of full and correct gowning by the surgical team; adequate antisepsis of the surgical field; and drainage by closed system, when indicated. The source of information for this indicator is observational, that is, the surgical procedure itself and its compliance criteria are also well defined to the recommendations of the chosen methodological framework[12].

Finally, Indicator 3 is concerned with the assessment of the structure conditions of the SC, by means of direct observation and/or contact with the professionals working in the unit, on the following aspects: circulating nurse in the operating room; anesthetist in the operating room; air conditioning with positive pressure inside operating rooms; washbasin; taps for hand scrubbing; availability of antiseptic product; adequate dispensing of the antiseptic product; slop hopper; ward cleaning routine; restriction of access to the ward; and operating room doors. The (non)conformity of each item of the indicator is also clear in the manual used[12], and the evaluation of the aspects that surround it were performed dichotomously (yes/no).

The data collected and recorded on the forms was fed into spreadsheets. After tabulation, the data was submitted to descriptive and inferential statistical analysis, using R® software. The conformity of each item and general conformity of each indicator evaluated were obtained by means of their own recommended formulas, which use percentage ratio relations[12].

The general conformity of the indicators is obtained through the number of procedures evaluated (separate cases), in which all the structuring elements of the indicator were adequate. That unfolds in percentage relation by the total cases observed. All indicators have ideal conformity ("standard") recommended at 100%[12]. The non-parametric Chi-Square test ($x^2$) was used for proportions, considering a statistical significance of 5%, expressed as p-value.

The research project that enabled this study was submitted and approved by the Ethics Committee in Research with Human Beings of the State University of Western Paraná, receiving protocol n. 1447.806/2016 and CAAE: 50066815.8.0000.0107.

## RESULTS

The study analyzed 200 elective surgical procedures to assess their SSI prevention conditions. Of these cases, 100 were in the specialty of general surgery and 100 were in orthopedics.

Table 1 shows that all the components analyzed in relation to the preoperative conditions of the patient were, in their majority, in accordance with the recommended levels, with overall conformity at 85.5%. The component that presented the greatest nonconformity is the ASA record, which is related to the patient's safety during the anesthetic act, indicating an unfavorable situation in this regard.

Table 2 illustrates the findings related to the assessment of Indicator 2: Evaluation of the asepsis conditions in the intraoperative period.

The assessment of the structural conditions of the SC - Indicator 3 - achieved overall conformity of 90%, since nine of ten observed items were in agreement with the recommended levels.

Regarding the SC structure, of the 10 components evaluated, only one did not meet the criteria. This element concerns the presence of

**Table 1.** Relative frequency distribution of the occurrence of sanitary processes in ports of Manaus, from 2007 to 2010.

| Components of the Indicator | Conformity (%) | Nonconformity (%) | No application |
|---|---|---|---|
| ASA record* | 179 (89.5) | 21 (10.5) | - |
| Previous Infection | 192 (96.0) | 8 (4.0) | - |
| Hair removal | 29 (96.6) | 1 (3.4) | 170 |
| General conformity of the indicator | 171 (85.5) | 29 (14.5) | - |

* Risk classification for anesthetic procedures according to criteria of the American Society of Anesthesiologists.

a dedicated anesthetist for each surgical procedure, that is, it indicates that this professional should provide integral care to the patient during the entire intraoperative period, which was not observed.

Table 3 summarizes the results related to the association between the surgical specialties we studied and the components of Indicator 1.

**Table 2.** Conformity of components and general conformity of Indicator 2: Evaluation of asepsis conditions in the intraoperative period (n = 200). Cascavel, Paraná, Brazil, 2016

| Components of the Indicator | Conformity (%) | Nonconformity (%) | No application |
|---|---|---|---|
| Full gowning | 200 (100.0) | 0 | - |
| Correct gowning | 161 (80.5) | 39 (19.5) | - |
| Hand scrubbing | 184 (92.0) | 16 (8.0) | - |
| Antisepsis | 200 (100.0) | 0 | - |
| Drainage | 1 (100.0) | 0 | - |
| General conformity of the indicator | 148 (74.0) | 52 (26.0) | - |

**Table 3.** Association between the components of Indicator 1: Evaluation of the patient's conditions in the preoperative period, with specialties of orthopedics and general surgery (n = 200). Cascavel, Paraná, Brazil, 2016.

| Components of the Indicator | Specialty | Conformity (%) | Non conformity (%) | No application | p-value[a] |
|---|---|---|---|---|---|
| ASA record* | Orthopedics | 91 (91.0) | 9 (9.0) | - | 0.644 |
| | General surgery | 88 (88.0) | 12 (12.0) | | |
| Previous Infection | Orthopedics | 92 (92.0) | 8 (8.0) | - | 0.003* |
| | General surgery | 100 (100.0) | 0 | | |
| Hair removal | Orthopedics | 17 (94.5) | 1 (5.5) | 82 | 0.35 |
| | General surgery | 12 (100.0) | 0 | 88 | |

[a] $x^2$ Test for proportions; *Statistically significant value.

**Table 4.** Association between the components of Indicator 2: Evaluation of the asepsis conditions in the intraoperative period, with specialties of orthopedics and general surgery (n = 200). Cascavel, Paraná, Brazil, 2016.

| Components of the Indicator | Specialty | Conformity (%) | Non conformity (%) | No application | p-value[a] |
|---|---|---|---|---|---|
| Full gowning | Orthopedics | 100 (100.0) | 0 | - | - |
| | General surgery | 100 (100.0) | 0 | | |
| Correct gowning | Orthopedics | 76 (76.0) | 24 (24.0) | - | 0.15 |
| | General surgery | 85 (85.0) | 15 (15.0) | | |
| Hand scrubbing | Orthopedics | 96 (96.0) | 4 (4.0) | - | 0.068 |
| | General surgery | 88 (88.0) | 12 (12.0) | | |
| Antisepsis | Orthopedics | 100 (100.0) | 0 | - | - |
| | General surgery | 100 (100.0) | 0 | | |
| Drainage | Orthopedics | - | - | 100 | - |
| | General surgery | 1 (100.0) | 0 | | |

[a] $x^2$ Test for proportions.

Finally, Table 4 shows the results of association between the conformities of the components of Indicator 2 and the surgical specialties.

## DISCUSSION

This study provides a broad picture of the situation of the actions that favor SSI prevention. We verified that none of the indicators evaluated achieved the recommended ideal conformity value (100%) according to the evaluative measures of the framework[12]. The results performed better compared to another survey[11] conducted in the Brazilian state of Goiás, where the general conformity of other indicators related to the prevention of SSI was of only 35.4%. However, it should be pointed out that the mentioned study measured some indicators that were different from those used in this research. For example, antimicrobial prophylaxis up to 1 hour before the surgical incision, duration of antimicrobial prophylaxis ≤ 24 hours, glycemic control in the postoperative period of diabetic patients, temperature control of patients in the intraoperative and number of surgical boxes with inspection record[11].

Given the above, it is agreed that a comparison between the results of indicators of quality, productivity and organizational performance is a challenge in today's globalized world, since local realities may be different and the evaluation mechanisms tend to be little standardized in Brazil, with not many clear standards of what is acceptable in a given health event[14].

In relation to the components of Indicator 1 (Table 1), one result to be highlighted is the nonconformity in more than 10% of the ASA record. This component of the indicator is related to the patient's greater safety during the anesthetic act, since the ASA risk is determined by the observation of medical records, history, requests for laboratory tests, investigation of previous anesthesia, medications in use, among others[15]. Therefore, the result in question denotes an unfavorable prospect of perioperative quality in the SC survey, in the context of anesthesia safety.

The data of this research diverges from a study carried out in a school hospital in Goiânia, Brazil, in which, of the 70 patients with surgery that resulted in SSI, of a total of 700 medical records, there was no description of absence of the ASA risk record[16]. In this aspect, it is understood that the information described converges to the best surgical-anesthetic document quality, since its absence and other records in the medical record regarding the preoperative clinical condition of the patient presuppose team failures with direct consequences to the patient. The application of ASA risk effectively allows the procedure to be performed with greater safety, avoiding unnecessary harm to the patient during the procedure and, consequently, the occurrence of complications[15].

Also in relation to Indicator 1, the component that addresses hair removal was found to be 96.6% in conformity, considered positive/favorable, among the 30 cases in which the procedure had evaluative applicability (Table 1). According to the Manual of Indicators we used, this component is assessed under the following compliance criteria: when the hair removal is done within a period up to 2 hours before the beginning of the surgery. If it was

not done, record this in the evaluation worksheet as "No Application" and it will not be considered in the percentage of conformity of the component[12]. In the case of this research, it was counted in 170 cases.

The moment of hair removal was evaluated as an indicator of prevention of SSI in another study that determined the suitability of the procedure at less than or equal to 2 hours before the surgical procedure in 82.5%[17], which possibly reinforces the positive outlook of the component of the indicator evaluated in this investigation. Still, it should be noted that the ideal value (100%)[12] was not achieved.

In another study carried out in four hospitals in the city of Pelotas, Brazil, with a sample of 1,500 patients, only two institutions respected the time of hair removal, with 100% and 93.4% conformity in the appropriate time indicator. The other two institutions presented 52.2% and 16.7%, that is, discrepant values[18]. In view of the results of this research and the overview of the literature described, we agree with the authors who say that, although hair removal is very well defined in the recommendations of best practices by regulatory agencies, it still falls short of being standardized in healthcare services[17].

It should be noted that official national recommendations state that hair removal should not be done routinely, and that if hair should be removed, this should be done immediately before the surgery using electric hair clippers outside the operating room. The use of razor blades is contraindicated[4]. This was not an aspect analyzed in the study and is a limitation of this research. However, in clinical practice, we know that the organization's usual routine for hair removal tends to use electric hair clippers, which is in line with the current guidelines.

In relation to Indicator 2: Evaluation of intraoperative asepsis conditions, despite having presented the majority of the components with 100% conformity, i.e. ideal, achieved the worst overall conformity among the three indicators we evaluated (Table 2). This may have occurred because two components of this measure obtained unfavorable results in terms of ideal conformity, especially the component that addresses correct gowning, estimated in 80.5%, that is, with 19.5% of nonconformity between observations.

The purpose of surgical gowning is to establish a microbiological barrier against the penetration of microorganisms into the patient's surgical site. These microorganisms may come from the patient, from professionals, health products and ambient air. Surgical gowning also protects the surgical team from contact with patients' fluids and blood[4]. There is, therefore, a clear relationship between the protection process and the safety of both patients and healthcare professionals.

The conformity of the correct gowning could be reflected in its impossibility in case the organization does not provide all the necessary items. However, the adequacy in 100% of complete gowning, to a certain extent, denounces the process in question adopted in the SC we surveyed. Therefore, we believe that the negative result found in the study is related to the surgical team's poor compliance with proper gowning.

In order for gowning to be considered adequate, all members of the surgical team (including the anesthesiologist and circulating nurse) should be wearing caps fully covering their scalp and hair, masks covering their upper airways (nose and mouth), and completely closed aprons[12]. Considering that the protective items were present in the SC, it is inferred that there is a need for greater supervision on the part of the leaders and immediate heads, such as the clinical and nursing directors, about the workers' compliance with correct gowning, in addition to more effective actions from the Infection Control Service (ICS).

An observational study done in Belo Horizonte, Brazil, showed that the use of surgical gowning in 70 observations (professionals that could be the same, due to repetition of surgical procedures) resulted in 14.3% of use of protective eyewear; 58.6% compliance with shoe covers; 7.2% of adequate use of the surgical cap, covering hair and ears; 100% compliance with the use of the cape (apron); 97.1% correct use of surgical mask; and 100% for surgical gloves[19]. It is noteworthy that the aforementioned study went beyond the evaluation of compliance with the correct gowning. However, we believe that the results demonstrated in this research suffice to warrant improvement actions, such as in-service training and supervision.

In another investigation carried out in a general hospital of Porto Alegre, Brazil, through observation of 65 surgeries, the use of masks had the lowest adequacy ratio (69%) identified among anesthetist physicians[20]. Although it is not a justification for proper compliance with surgical gowning, the result mentioned in the literature may be reflected in the findings of this research in relation to Indicator 3, which addressed the structural conditions of the SC. That is the indicator where the only nonconformity found was the non-presence of an anesthetist in all operating rooms. That is, perhaps due to the impossibility of attending exclusively to a patient, the professionals in question may have contributed to the poor compliance with correct gowning and affected the surgical safety of the research site.

Resolution n. 1,802, of November 1, 2006, of the Federal Medicine Council, which provides for the practice of the anesthetic act, updates and repeals decisions of the previous resolution. It mentions in one of the subsections of its Article 1 that in order to conduct general or regional anesthesia safely, the anesthesiologist must keep his patient under constant surveillance[21]. Considering that there was no total availability of anesthesia care in all the surgeries evaluated, we believe that the SC and the clinical directors of the hospital should reconsider this possible disagreement with the aforementioned ethical guideline, certainly contributing to the safety of the surgical patient in that context.

We should emphasize that the aforementioned allusion is only a reflexive interpretation of the facts allied to the related literature. It cannot be taken as a statement or inference of the research. Nevertheless, it is worth mentioning that intraoperative SSI prevention practices deserve to be reevaluated, since

the Indicator that addressed these issues obtained the worst result. Moreover, because the structure conditions of the SC tend to play a favorable role in improving surgical quality (Chart).

Surgical scrubbing was another aspect that did not achieve ideal conformity (92.0%). This is certainly a practice of much interference in the prevention of SSI. The evaluation of surgical scrubbing by the team was a laborious task, since the verification of the conformity of the component should meet the following criteria for all members of the surgical team: using an antiseptic product approved by governmental legislation or recommendation of clinical guideline; with or without a brush for at least two minutes, on the entire surface of each upper limb, from the fingernails to the elbow; and rinsing the limbs from the fingers to the elbows, keeping them elevated so that the rinse water does not return from the elbows to the fingers[12].

Considering that the structural aspects of the SC were in favor of this and other practices of SSI prevention, like the provision of one toilet for every two operating rooms; automatic taps and the provision of antiseptic products for hand scrubbing, although the proportion of conformity of the scrubbing component was "high", it is possible to think that the adequacy of this item of Indicator 2 was due to the lack of compliance of the professionals rather than because of structural shortcomings.

We highlight that surgical hand scrubbing was a more positive evaluative component among the orthopedic team (96.0%) compared to general surgery (88.0%), with a p-value (0.068) close to the statistical significance for association (Table 4). This, in spite of being an isolated fact between the two surgical specialties, also favors more rational decision-making in favor of better compliance with the practice of surgical hand scrubbing. It also suggests the general surgery team is the one that needs more engagement in the pursuit of better compliance.

The infection component prior to the operative procedure of Indicator 1, referring to the preoperative conditions, presented a positive statistical association (0.003) in the verification of conformity by specialties, in which the orthopedic team had inferior results (Table 3). This means that there was an observation of non-presentation of medical records that indicate the possible presence (or investigation) of an infection prior to the surgical procedure[12] in orthopedic procedures.

Surgeries of the orthopedics and traumatology specialty are very common at the research site, which is a reference center in trauma care. We know that surgical procedures of this type often involve the placement of fasteners, prostheses, and other bodies that may have SSI facilitated if in the presence of a prior infectious process, which should be investigated via laboratory exams[4]. Having said that, it is necessary to review the medical practice in the preoperative context of the specialty in question, so that the surgical planning can be safer and thus contribute more assertively to the prevention of SSI.

Among the other components compared by statistical association, we can see that the general surgery and orthopedics specialties had similar behaviors. However, in the proportions of conformity, orthopedics showed greater inadequacy in three of eight components of the indicators we evaluated (Tables 3 and 4). General surgery had its worst result in the ASA risk item, which in fact, would not be a failure of the surgical team itself, but rather a failure in the anesthetic team; and the evaluative component on surgical hand scrubbing. The other items were matched and scored 100.0% of conformity between both specialties. Therefore, as a whole, surgical safety in the context of SSI prevention tended to be better in the specialty of general surgery.

Since this study is limited to the evaluation of some SSI prevention practices and factors, it is not possible to infer that its suitability interferes with the incidence of the infectious process. Therefore, it is prudent to say that further research is necessary, as in studies of cause and effect, in order to verify the impact of prevention measures on the actual occurrence of SSI.

**Chart.** Observation of compliance with the evaluation components of the SC structure. Cascavel, Paraná, Brazil, 2016

| SC Structure Components | Conformity |
|---|---|
| An exclusive circulating nurse for each operating room in all periods | Yes |
| A dedicated anesthetist for each surgical procedure | No |
| Positive-pressure air-conditioning inside operating rooms | Yes |
| One toilet for every two operating rooms | Yes |
| Taps activated without hands | Yes |
| Arrangement of antiseptic products for the hands | Yes |
| Slop hopper | Yes |
| Ward cleanup routine | Yes |
| Rules for restricting the circulation of people in the ward | Yes |
| Mechanism to keep doors closed | Yes |

SC: Surgical Center.

## CONCLUSIONS

We could outline a scenario of the actions that involve SSI prevention through evaluation based on indicators. The following findings stood out: no ideal conformity (100%) in any of the three evaluative measures, but for several of their structuring components; better quality in the requirements of the preoperative and structural conditions of the SC compared to those of intraoperative antisepsis; and, similar behavior between the general surgery and orthopedics specialties. However, we found worse results for the latter.

We conclude that the evaluation of the indicators shows that there is clear room for improvement in SSI prevention and that there was statistical association only for the component of record of infection prior to the operative procedure, pointing to the need for more urgent improvement in the specialty of orthopedic surgery. Additionally, antisepsis practices in the intraoperative period; the ASA risk record and the presence of anesthesiologist in all procedures also deserve further attention.

The limitations of this research are due to the impossibility of generalization of the results, the inclusion of only two surgical specialties, and others referring to the indicators themselves. However, we believe that the study contributes to the advancement of the knowledge on SSI prevention, since it brings a solid diagnosis of the practices that surround it. Furthermore, it reaffirms the importance of the evaluation, control and valid measures for the planning of actions toward perioperative patient safety.

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Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.