

# RECEPTION AND CLEANING AREA OF THE CENTRAL STERILE SERVICES DEPARTMENT: MAINTENANCE OF THE USE (OR NOT) OF PARTICULATED RESPIRATOR BY WORKERS AFTER THE COVID-19 PANDEMIC

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Since the end of 2019, the world has been challenged by what would become an acute respiratory infection pandemic, the so-called coronavirus disease 2019 (COVID-19), diagnosed for the first time in China and caused by the new human coronavirus<sup>1</sup>. It is a single-stranded ribonucleic acid virus measuring 60 to 140 nm (0.06–0.14  $\mu\text{m}$ ) in diameter, with an incubation period of between three and seven days to two weeks<sup>2</sup>. Its transmission occurs, primarily, through the respiratory route, through droplets (>5–10  $\mu\text{m}$  in diameter) or direct contact with a colonized/infected person or, indirectly, through contact with contaminated surfaces and/or objects. Therefore, standard precautions and those based on the form of transmission, droplets and contact, are recommended when assisting patients with suspected or confirmed infection. Additionally, in situations where aerosols are generated (<5  $\mu\text{m}$  in diameter), such as in endotracheal aspiration, aerosol precautions should be adopted, which include the use of disposable particulate respirators (N95 mask, PFF2 or PFF3)<sup>3-5</sup>.

In the face of this new pandemic scenario, changes in the behavior of populations and, particularly, in health practices, have become necessary and have been adjusted as evidence on the confrontation of this new infectious agent is published. In this sense, the Brazilian Association of Surgical Center Nurses, Anesthetic Recovery, and Central Sterile Services Department published recommendations for teams working in the operating room, in the central sterile services department (CSSD), and in endoscopy services, aiming at the specificities in patient care with suspected or confirmed COVID-19, including those related to the processing of reusable medical devices (RMD). Among the guidelines, there is the use of particulate respirator and of N95 mask by workers for manual cleaning of RMD, given the potential for aerosol formation during this process<sup>6</sup>.

It is known that, despite the recommendation of automated cleaning as preferred for the processing of RMD, a

CSSD with the availability of a structure that allows only manual cleaning of these devices is a reality, especially in low and middle-income countries, which includes Brazil<sup>7</sup>. Even for services equipped for automated cleaning, the current Brazilian legislation for RMD processing, Resolution of the Collegiate Board No. 15, of 2012, requires manual cleaning to precede the automated cleaning of complex-design devices<sup>8</sup>. Additionally, there is evidence of the generation of aerosols in the use of equipment for automated cleaning of RMD in a CSSD, such as ultrasonic washers<sup>9</sup>.


The current legislation for the processing of RMD in the country<sup>8</sup>, when dealing with “Safety and Health at Work”, does not specify the use of the N95 mask in the area of RMD reception and cleaning. However, in article 31, paragraph 3, it ensures that “when not specified, the protective equipment must be compatible with the risk inherent in the activity”<sup>8</sup>. The publication of the Ministry of Health, in April 2020, on “Recommendations for the protection of health service workers in the care of COVID-19 and other flu syndromes” (emphasis added) indicates the use of particulate respirators for aerosol-generating procedures and reinforces the need to use personal protective equipment (PPE) “compatible with the risk inherent in the activity”<sup>4</sup>.

Thus, given that the activities carried out in the area of reception and cleaning of the CSSD generate aerosols and that, in their daily work, workers in this area are unaware of the diagnosis of the users of the RMD to be processed, in addition to the difficulty imposed by the current pandemic scenario in estimating the safe time for the return of the use of surgical masks — or if it is safe —, it is considered opportune for CSSD workers and managers to reflect on the maintenance (or not) of the use of particulate respirators, such as the N95 mask, by workers in the reception and cleaning area.

The continued use of this PPE, therefore, will incur additional costs to the health system. However, these costs have not yet been estimated, as well as the direct and indirect

costs of treating a worker who develops a respiratory infection resulting from work exposure during RMD cleaning. Regardless of this relationship, it is worth mentioning that the promotion and protection of workers' health are the responsibility of the Unified Health System and the State<sup>10</sup>.

Furthermore, it is notorious that the pandemic moment spelled out numerous gaps related to the protection of healthcare workers who must be part of the nurses' study and research agendas, since they lead the largest team in the health area. In addition, scientific evidence is needed to guide the implementation of measures that minimize occupational risks. It is also worth mentioning that, in Brazil, the professionals in this team are historically those involved in the management and execution of RMD processing<sup>11</sup>.

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# SURGICAL SUSPENSION RATE: ASSISTANCE QUALITY INDICATOR

*Taxa de suspensão cirúrgica: indicador de qualidade da assistência*

*Tasa de suspensión quirúrgica: indicador de calidad de asistencia*

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**ABSTRACT: Introduction:** There are countless reasons for surgical suspensions, which must be known to give greater organicity and quality to management and care processes. **Objectives:** To identify the rate of suspension of elective surgeries in a public hospital in the State of Rio de Janeiro and to analyze the main causes of suspension, stratifying the findings by surgical clinics. **Method:** Quantitative, descriptive, retrospective study that used 7,931 forms of surgical suspension from January 2015 to December 2017. 28 forms were excluded which did not present the reason for the suspension, analyzing 7,903. The analysis was performed using descriptive statistics and calculation of the surgical suspension rate. **Results:** The hospital's surgical suspension rate was 18.5% in 2015, 20.5% in 2016 and 16.8% in 2017. The unfavorable clinical condition of the patient for the surgery was the most evident reason in the clinics General Surgery, Urology and Gynecology in the analyzed period. **Conclusion:** There are several consequences of surgical suspension, both for the patient and for the institution. The adoption of measures to reduce these rates implies an improvement in the management and organization of the health service.

**Keywords:** Elective surgical procedures. Organization and administration. Quality indicators, health care. Surgery department, hospital. Perioperative care.

**RESUMO: Introdução:** Inúmeros são os motivos das suspensões cirúrgicas, que importam ser conhecidos para dar maior organicidade e qualidade aos processos gerenciais e assistenciais. **Objetivos:** Identificar a taxa de suspensão de cirurgias eletivas de hospital público do Estado do Rio de Janeiro e analisar as principais causas de suspensão, estratificando os achados pelas clínicas cirúrgicas. **Método:** Estudo quantitativo, descritivo, retrospectivo, que utilizou 7.931 formulários de suspensão cirúrgica de janeiro de 2015 a dezembro de 2017. Excluíram-se 28 formulários que não apresentavam o motivo da suspensão, analisando-se 7.903. Realizou-se a análise por meio de estatística descritiva e cálculo da taxa de suspensão cirúrgica. **Resultados:** A taxa de suspensão cirúrgica do hospital foi de 18,5% em 2015, 20,5% em 2016 e 16,8% em 2017. A condição clínica do paciente desfavorável para a realização da cirurgia foi o motivo mais evidente nas clínicas de Cirurgia Geral, Urologia e Ginecologia no período analisado. **Conclusão:** Vários são os reflexos da suspensão cirúrgica, tanto para o paciente quanto para a instituição. A adoção de medidas para a redução dessas taxas implica melhora da gestão e da organização do serviço de saúde.

**Palavras-chave:** Procedimentos cirúrgicos eletivos. Organização e administração. Indicadores de qualidade em assistência à saúde. Centro cirúrgico hospitalar. Assistência perioperatória.

**RESUMEN: Introducción:** existen innumerables razones para las suspensiones quirúrgicas, cuyas causas deben ser conocidas para dar mayor organicidad y calidad a los procesos de gestión y atención. **Objetivos:** identificar la tasa de suspensión de cirugías electivas en un hospital público en el estado de Río de Janeiro y analizar las principales causas de suspensión, estratificando los hallazgos de las clínicas quirúrgicas. **Método:** estudio cuantitativo, descriptivo,

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retrospectivo, utilizando 7,931 formas de suspensión quirúrgica desde enero de 2015 hasta diciembre de 2017. Se excluyeron 28 formas que no presentaron el motivo de la suspensión, analizando 7,903. El análisis se realizó utilizando estadísticas descriptivas y el cálculo de la tasa de suspensión quirúrgica.

**Resultados:** la tasa de suspensión quirúrgica del hospital fue del 18,5% en 2015, del 20,5% en 2016 y del 16,8% en 2017. La condición clínica desfavorable del paciente para la cirugía fue la razón más evidente en las clínicas Cirugía general, urología y ginecología en el período analizado. **Conclusión:** la suspensión quirúrgica tiene varias consecuencias, tanto para el paciente como para la institución. La adopción de medidas para reducir estas tasas implica una mejora en la gestión y organización del servicio de salud.

**Palabras clave:** Procedimientos quirúrgicos electivos. Organización y administración. Indicadores de calidad de la atención de salud. Servicio de cirugía en hospital. Atención perioperatoria.

## INTRODUCTION

The performance of an elective surgical procedure is not a trivial act. It requires the incorporation of different care and managerial technologies related to the structure, processes and desired results for the institution and the client<sup>1</sup>.

Operational and tactical plans must contain the definition of operating rooms, medical staff (surgeons and anesthesiologists), nursing staff (surgical instrumentation and circulating room) and transportation service; availability of specific resources and equipment; logistical actions with support resources, such as laboratory, pharmacy, supplies, hemotherapy, clothes and cleaning service for the entire perioperative period<sup>1</sup>.

According to the characteristics of the pathology, the temporal need for the intervention and the clinical evolution of the patient, the surgeries can be classified as elective, when a certain date is programmed, in accordance with the patient and the doctor; in urgent cases, if it is possible to maintain a waiting time for patient preparation; and emergency, as they are immediate interventions given the critical conditions, with the risk of death for the patient<sup>2</sup>.

The surgical procedure is a time that involves several unknowns for patients. Emotions and feelings of fear of anesthesia arise, fear of death or disability, fear of feeling pain and uncertainty of the prognosis. In many cases, prolonged fasting, the removal of underwear and dental prostheses already causes patient discomfort<sup>1</sup>.

Elective surgery suspensions have been a concern of health professionals, in view of the direct implication in ineffective results for patients, family and the institution. In addition, in the daily routine of exhaustive and agitated shifts, health professionals may not notice the anxiety, distress and suffering of patients when receiving the news of the surgical procedure cancellation<sup>1-3</sup>.

Information about the suspension of the surgery can occur by telephone call to the patient, at home, in the hospital bed or inside the Surgical Center (SC). These last two moments can be considered to have the greatest impact, due to the vulnerability in which the patient finds himself, outside of their home, often alone and under institutional routines and rules<sup>1</sup>.

Studies indicate that the practice of surgical suspension is frequent, both by surgeons and anesthesiologists. In a study carried out with the latter, the suspension of surgeries was related to two main aspects: governmental and administrative, represented by “insufficient or incorrect transfer of funds from the State to public institutions”<sup>3</sup> and the mismanagement of these entities, and personal ones, characterized by internal problems at clinics, such as scheduling a high number of procedures<sup>3</sup>.

In general, the monitoring of these suspensions occurs through the institutions’ own daily and printed record, but the numbers for the discussion of data and implementation of new conducts are not statistically presented, aiming at improving the service provided to the population and the institution/patient relationship<sup>4</sup>.

Based on these considerations, the object of this study is the rate of surgical suspension of a public hospital in the State of Rio de Janeiro.

This investigation is justified by the situational diagnosis of the rates and reasons for surgical suspension, which can guide new practices for the organization of the service, with improvement in the clinical evaluation of patients, decreased hospitalization time or unnecessary hospitalizations, reduction of institutional costs, reduction of the psychological impact to patients and family members regarding the failure to perform the surgical procedure, as well as mitigating socioeconomic changes by withdrawing from work activity and changes in lifestyle changes.

## OBJECTIVES

- Identify the rate of suspension of elective surgeries in a public hospital in the State of Rio de Janeiro;
- Analyze the main causes of suspension, stratifying the findings by surgical clinics.

## METHOD

This is a retrospective study, with a quantitative approach, performed in the operating room of a public hospital in the State of Rio de Janeiro, a reference in medium and high complexity care in oncology, hemodialysis, dentistry and adult and pediatric intensive care.

Currently, surgical procedures are performed in the following specialties: general surgery, proctology, urology, gynecology, vascular surgery, dentistry, ophthalmology, gastroenterology and pediatrics.

The SC has seven Operating Rooms (OR), four of which are used for elective procedures from 7 am to 7 pm, from Monday to Friday, one is exclusively for ophthalmic surgery, one for dental procedures in patients with special needs and one for urgent and emergency procedures. During the night, as well as on holidays and weekends, it attends urgent and emergency situations. For data collection, 7,931 forms from surgical suspension completed by the medical team were analyzed, with a time frame from January 2015 to December 2017.

This is justified by the fact that the ophthalmology clinic stopped performing surgical procedures at this institution in 2018.

The information is related to the patient's information (date, proposed surgery, clinic, surgical and anesthetic team), the reason for the suspension of the scheduled surgery and additional information in a field designated for this. Data were collected in March 2018.

In total, 28 forms were excluded from the study, for which no reason was indicated or justified by the responsible team, 7,903 forms were included in the survey.

The reasons for surgical suspension are divided into three fields, which include factors related to the patient, the hospital structure and the health team, coded as follows:

- Regarding the patient: lack of clinical conditions, lack of adequate fasting, improvement of the clinical condition without surgical indication, use of medication, absence, death and refusal of the individual;

- Regarding the structure: incomplete or unfilled medical documentation, lack of material/ instruments in the OR, lack of external material/ instruments, lack of blood/blood products, lack of Intensive Care Unit (ICU) vacancy, or vacancy in the ward (Inpatient Unit - IU), absence of building maintenance and overbooking;
- Regarding the team: incomplete exams, out-of-date exams, lack of anesthesiologists, lack of surgical staff, lack of external staff and lack of nursing staff.

Concerning data tabulation, the Microsoft Excel® 2010 program was used and the analysis was carried out using descriptive statistics, obtaining the absolute (N) and relative (%) frequencies, as well as the surgical suspension rate by clinic. Data were grouped by surgical clinics and reasons for suspension.

The relative frequency (%) was calculated using Equation 1:

$$N / \text{sample size} \times 100 \quad (1)$$

In which:

N = the total of a given reason for suspension;

sample size = total surgical cancellations for the year studied.

The rate of surgical suspension is represented by the formula in Equation 2<sup>5</sup>:

$$\text{suspension rate} = \frac{\text{number of surgeries suspended}}{\text{number of scheduled surgeries}} \times 100 \quad (2)$$

This research was approved by the Research Ethics Committee of the institution, under the Presentation Certificate for Ethical Appreciation (CAAE) number: 82301818.0.0000.8066. Data collection started after approval, in compliance with ethical principles, as stipulated in Resolution No. 466/2012, of the National Health Council<sup>6</sup>.

The Informed Consent Form was waived due to the research method adopted. It is noteworthy that the anonymity of patients, professionals of the health team and the hospital was maintained.

## RESULTS

In 2015, the surgical suspension rate in the referred hospital was 18.5% (n = 455), showing an increase to 20.5% in 2016 (n = 595) and reduction in 2017 to 16.8% (n=430).

Regarding the causes of surgical suspension stratified by clinic, Chart 1 presents the values found in the years 2015 to 2017.

Among the causes that presented the highest absolute frequencies (N), motivating the suspensions in the analyzed period, the following were identified: lack of clinical conditions of the patient (category “related to the patient”), followed by overbooking (category “related to the structure”).

In the context of the health institution studied, overbooking is understood as scheduling a number of surgeries in addition to the operational capacity during the sector’s operating period, that is, from 7 am to 7 pm, from Monday to Friday.

### Surgical suspensions related to the category “related to the patient”

In the years analyzed, the reason “lack of clinical conditions of the patient” was the most evident, representing 30.3% of suspensions (138 occurrences) in 2015, 27.2% (162 occurrences) in 2016 and 37.6% (162 occurrences) in 2017.

In 2015, general surgery presented 33 cancellations due to “lack of clinical conditions for the patient”, becoming the clinic with the most cancellations for that reason.

In 2016 and 2017, urology registered 52 and 56 cancellations, respectively, due to “lack of clinical conditions of the patient”, presenting itself as the clinic with the most cancellations for this reason in these two years.

The second most evident reason was “patient absence”, which represented 14.5% of surgical suspensions

(66 occurrences) in 2015, 15.7% (94 occurrences) in 2016 and 25.1% (108 occurrences) in 2017.

### Surgical suspensions referring to the category “related to the structure”

The reason “overbooking” appeared as the most evident in the category “related to the structure”, with frequencies of 16.9% (77 occurrences) in 2015, 17.4% (102 occurrences) in 2016 and 10.4% (45 occurrences) in 2017, considering all the specialties analyzed in the period.

In 2015 and 2017, urology showed a higher relative frequency of the “overbooking” reason in relation to all the others, registering 35 and 22 occurrences, respectively. In 2016, the clinic that obtained the most suspensions for this reason was general surgery, registering 43 suspensions.

Cancellations due to “lack of SC material/ instruments” represented the second reason for cancellation in 2015 (6.1%) and 2017 (3.9%). In 2016, the reason “lack of external material/ instruments” was the second most evident, corresponding to 8% of suspensions, considering all the analyzed clinics.

### Surgical suspensions referring to the category “related to the team”

Regarding the category “from the team”, the reason “incomplete exams” represented 3, 3.3 and 3.7% in the years analyzed and, secondly, the reason “lack of external staff” presented, in

**Table 1.** Rate of surgical suspension per clinic in the period from 2015 to 2017.

Clinics	2015			2016			2017		
	SP (n)	PR (n)	SF (%)	SP (n)	PR (n)	SF (%)	SP (n)	PR (n)	SF (%)
General Surgery	109	624	17.4%	157	605	25.9%	98	533	18.3%
Proctology	6	50	12%	8	111	7.2%	13	125	10.4%
Urology	152	791	19.2%	195	876	22.2%	153	851	17.9%
Gynaecology	56	334	16.7%	95	437	21.7%	62	388	15.9%
Vascular surgery	34	147	23.1%	24	155	15.4%	19	141	13.4%
Odontology	33	144	22.9%	33	222	14.8%	41	260	15.7%
Ophthalmology	20	91	21.9%	48	187	25.6%	8	20	40%
Gastroenterology	11	63	17.4%	18	93	19.3%	9	31	29%
Pediatrics	34	213	15.9%	17	211	8%	26	200	13%
Total	455	2.457	18.5%	595	2.897	20.5%	430	2.549	16.8%

SP: suspended; PR: scheduled; SF: suspension fee.

**Chart 1.** Reasons for suspension of elective surgeries, according to the type of surgical clinic and the year of occurrence in a public hospital.

Reasons	Year	GS	PR	UR	GY	VS	OD	OP	GE	PD	N	F (%)
Related to the patient												
Lack of patient's clinical condition	2015	33	3	32	22	8	18	6	4	12	138	30.3
	2016	38	1	52	30	6	9	13	6	7	162	27.2
	2017	36	6	56	26	3	15	2	4	14	162	37.6
Lack of adequate fasting	2015	2	0	1	0	0	0	0	2	2	7	1.5
	2016	1	0	2	2	0	1	0	0	1	7	1.1
	2017	1	0	1	0	2	2	0	0	1	7	1.6
Improvement of the clinical picture without surgical indication	2015	4	1	6	1	3	1	0	0	2	18	3.9
	2016	2	0	11	3	5	1	0	1	0	23	3.8
	2017	5	0	2	1	2	2	0	0	0	12	2.7
Patient on medication	2015	0	0	2	4	1	0	0	0	0	7	1.5
	2016	1	0	1	1	0	0	1	0	0	4	0.6
	2017	2	0	0	2	0	1	0	0	1	6	1.3
Absence of the patient	2015	13	2	10	4	7	13	9	0	8	66	14.5
	2016	12	3	29	9	5	19	11	1	5	94	15.7
	2017	16	2	52	6	0	19	1	5	7	108	25.1
Patient death	2015	0	0	0	0	0	0	0	0	0	0	0.0
	2016	1	0	0	0	0	0	0	0	0	1	0.1
	2017	0	0	0	0	0	0	0	0	0	0	0.0
Patient refusal	2015	1	0	1	0	2	0	0	0	1	5	1.0
	2016	2	0	5	0	1	1	1	2	0	12	2
	2017	1	0	2	1	0	0	1	0	0	5	1.1
Related to structure												
Incomplete or unfilled medical documentation	2015	3	0	1	2	1	0	0	2	0	9	1.9
	2016	8	0	9	4	1	0	7	5	1	35	5.8
	2017	1	0	0	2	0	1	1	0	0	5	1.1
Lack of SC material/instrumental	2015	8	0	16	1	2	1	0	0	0	28	6.1
	2016	9	0	3	2	2	0	0	0	0	16	2.6
	2017	3	0	5	2	7	0	0	0	0	17	3.9
Lack of external material/instrumental	2015	3	0	13	0	4	0	0	0	0	20	4.3
	2016	9	0	27	8	2	0	2	0	0	48	8
	2017	0	0	4	1	2	0	0	0	0	7	1.6
Lack of blood/blood products	2015	2	0	15	5	0	0	0	0	5	27	5.9
	2016	3	0	2	6	0	0	0	1	1	13	2.1
	2017	3	2	0	4	0	0	0	0	3	12	2.7
Lack of ICU vacancy	2015	4	0	3	3	1	0	0	0	0	11	2.4
	2016	19	3	6	6	0	0	0	0	2	36	6
	2017	4	2	2	2	0	0	0	0	0	10	2.3
Lack of vacancy in the ward (hospitalization)	2015	0	0	0	0	0	0	0	0	0	0	0.0
	2016	0	0	0	0	0	0	0	0	0	0	0.0
	2017	0	1	0	0	0	0	0	0	0	1	0.2

Continue...

Chart 1. Continuation.

Reasons	Year	GS	PR	UR	GY	VS	OD	OP	GE	PD	N	F (%)
Absence of building maintenance	2015	0	0	0	0	0	0	0	0	0	0	0.0
	2016	0	0	0	0	0	0	0	0	0	0	0.0
	2017	0	0	0	0	0	0	1	0	0	1	0.2
Overbooking	2015	31	0	35	9	2	0	0	0	0	77	16.9
	2016	43	0	39	16	2	1	0	1	0	102	17.1
	2017	16	0	22	5	2	0	0	0	0	45	10.4
Related to the team											N	F (%)
Incomplete exams	2015	4	0	3	1	3	0	2	1	0	14	3
	2016	9	0	6	3	0	1	0	1	0	20	3.3
	2017	7	0	2	3	1	1	2	0	0	16	3.7
Expired exams	2015	0	0	1	0	0	0	0	0	0	1	0.2
	2016	0	1	1	1	0	0	0	0	0	3	0.5
	2017	0	0	0	1	0	0	0	0	0	1	0.2
Lack of anesthetist	2015	0	0	1	0	0	0	3	0	0	4	0.8
	2016	0	0	0	1	0	0	0	0	0	1	0.1
	2017	0	0	5	0	0	0	0	0	0	5	1.1
Lack of surgical team	2015	1	0	4	3	0	0	0	2	0	10	2.1
	2016	0	0	0	2	0	0	13	0	0	15	2.5
	2017	4	0	0	5	0	0	0	0	0	9	2
Lack of external team	2015	0	0	8	0	0	0	0	0	4	12	2.6
	2016	0	0	0	1	0	0	0	0	0	1	0.1
	2017	0	0	0	1	0	0	0	0	0	1	0.2
Lack of nursing team	2015	0	0	0	1	0	0	0	0	0	1	0.2
	2016	0	0	2	0	0	0	0	0	0	2	0.3
	2017	0	0	0	0	0	0	0	0	0	0	0.0

GS: general surgery, PR: proctology, UR: urology, GY: gynecology, VS: vascular surgery, OD: odontology, OP: ophthalmology, GE: gastroenterology, PD: pediatrics; N: absolute frequency; F: relative frequency; CC: operating room; CTI: intensive care center.

2015, the 2.6% frequency. In 2016 and 2017, the reason “lack of surgical staff” was the second most evident, registering 2.5 and 2% of suspensions, respectively.

## DISCUSSION

The cancellation of a surgery increases the operating and financial costs of the institution, reducing the efficiency of the service offered, and is a reality in health institutions. Its repercussions are relevant and result in negative physical, emotional and socioeconomic effects to the patient and his family<sup>7</sup>.

Regarding the surgical suspension rate, the studied hospital had rates of 18.5, 20.5 and 16.8% in the years 2015, 2016 and 2017, respectively. There is a decline, but these rates are considered high compared to another study, which found a rate of 13.3%<sup>7</sup>.

The patient’s unfavorable clinical condition for performing the surgery was the most evident reason in all the years studied, which can also be observed in other studies that addressed the theme<sup>8-10</sup>. Colombian researchers identified that 52% of patients had their surgeries suspended due to unfavorable clinical conditions<sup>10</sup>.

The suspension of surgery should be avoided, since the patient is anxious to have his health needs met<sup>1</sup>. Some measures



taken by the health institution are directly related to certain situations. This is the case of patients who present without clinical conditions even after the preoperative evaluation and preparation, and each service unit is responsible for establishing specific measures to reduce the rate of surgery suspension<sup>9,10</sup>.

The preoperative visit, whether performed by a nurse or an anesthesiologist, can identify the patient's clinical and psychological conditions that lead to the suspension of surgery, consisting of an early intervention that would avoid this problem<sup>11</sup>.

A Brazilian study points out that the expectation of an institution is deposited in the anesthesia clinic to reduce the number of suspensions, however, as the authors describe, "due to the socioeconomic shortage, patients are hospitalized without presenting the ideal clinical conditions for surgery"<sup>12</sup>.

Another major reason for surgical suspensions was overbooking; this condition represents an important indicator of organizational improvement and planning in the institution. It is necessary to think about all the preparation, both on the part of the patient and in the logistical sense, for the performance of surgery.

Studies show that 16.5% of surgeries are canceled because they exceed the routine hours of the institutions analyzed. Scheduling surgeries in excess of what can be performed reflects an organizational failure in planning and surgical routine<sup>8,13</sup>.

It is essential to plan the surgical map, taking into account the availability of professionals, equipment and essential materials to perform the anesthetic-surgical act<sup>14</sup>.

The cancellation of scheduled surgeries has a significant impact on health, resources, cost and quality of care. To plan a solution, it is necessary to understand the reasons for the cancellations<sup>15,16</sup>.

The patient's absence was also the reason for a large number of cancellations of surgeries in the analyzed period. This reason requires further investigation through an active search service, in order to confirm the patient's hospitalization, making it effective for surgeries scheduled for up to 48 hours after hospitalization<sup>13</sup>.

An important point to consider is the role of the Material and Sterilization Center (CME) in surgical suspensions. Despite presenting a low relative frequency in the years analyzed, the lack of material and/ or instruments must be considered, since this sector has the responsibility to provide health products for patient care, directly reflecting on the quality of the care provided<sup>17</sup>.

Joint actions must be taken by those involved in caring for the surgical patient - outpatient, UTI, ICU, CME and SC - in order to achieve a reduction in the rates of surgical suspensions.

The lack of registration regarding the reason for the suspension in some forms, which, in turn, were eliminated from the study, can be highlighted as a limitation of the study. In addition, there are incomplete data, such as, for example, the type of medication that prevented the surgery or whether the patient's clinical condition evolved to death. It is noteworthy that the data were compiled from forms filled out by the medical team of the institution under analysis.

## CONCLUSION

After analyzing and discussing the data, it was possible to identify that the main reasons for surgical suspensions at the institution in question were: lack of clinical conditions for the patient and overbooking in 2015 and 2016, respectively; and patient's absence in 2017.

The rates of surgical suspensions show the need to reassess the practices adopted by the institution and by health professionals involved in the perioperative process.

The identification of previous clinical changes, the prescription and planning of care to improve or correct the condition and the adoption of effective administrative measures, such as scheduling the number of daily surgeries according to the hospital structure, managing the time of the OR, availability of a multidisciplinary team and pre-operative outpatient visit can help to reduce the rate of surgical suspension.

By reducing the cancellation of surgical procedures, there is an improvement in this indicator, with a reduction in unnecessary expenses by the institution.

In relation to the patient and his family, the cancellation of surgery generates dissatisfaction with the service, in addition to changes in routine, creating new expectations for the surgical procedure. Confirming the date of the surgery on days closer to the procedure can help to reduce the "patient's absence" reason.

Measures such as control and investigation of the reason for the suspension can help to identify changes early, even before surgical scheduling. It is noteworthy that it is essential to raise the awareness of those involved in devoting efforts to the implementation of measures that reduce the rates of surgical suspension, in addition to monitoring this quality indicator.

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# PATIENT SAFETY IN THE SURGICAL CENTER: NURSING PROFESSIONALS PERCEPTIONS

*Segurança do paciente em centro cirúrgico: percepção dos profissionais de enfermagem*

*Seguridad del paciente en centro quirúrgico: percepción de los profesionales de enfermería*

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Aline Helena Appoloni Eduardo<sup>4</sup> , Juice Ishie Macedo<sup>5</sup> , Adriana Aparecida Mendes<sup>4\*</sup> 

**ABSTRACT: Objective:** To know the actions aimed at patient safety performed by nursing professionals in Surgical Centers (SC), and in accordance with these professionals' perceptions. **Method:** This is an exploratory and descriptive field research with a qualitative approach. Data were collected in a SC through a recorded interview guided by a structured script with four open questions based on the Discourse of the Collective Subject (DCS) method, focusing on patient safe care practices in the SC. The sample was constituted by 12 nursing professionals, one of which was an auxiliary and 11 were technicians. Data were organized and analyzed according to the DCS method. **Results:** The answers resulted in six discourses that revealed concern with patient safety regarding identification, communication between multiprofessional team and patient, fall prevention, safe practices, intersectoral communication, and equipment maintenance. **Conclusion:** Nursing professionals understand the importance of patient safety in the SC, and consider that the set of practices performed should be aligned in a way that will minimize adverse events and provide qualified assistance in the benefit of the patient's quality of life. **Keywords:** Patient safety. Surgicenters. Nursing.

**RESUMO: Objetivo:** Conhecer as ações realizadas pelos profissionais de enfermagem direcionadas à segurança do paciente no ambiente de centro cirúrgico (CC), segundo discurso desses profissionais. **Método:** Trata-se de uma pesquisa de campo, de caráter exploratório e descritivo, com abordagem qualitativa. Os dados foram coletados em um CC por meio de entrevista gravada norteada por roteiro estruturado com quatro questões abertas fundamentadas no método do discurso do sujeito coletivo (DSC), com foco na prática da assistência segura para o paciente no CC. A amostra foi composta de 12 profissionais de enfermagem, sendo um auxiliar e 11 técnicos. Os dados foram organizados e analisados segundo método do DSC. **Resultados:** As respostas deram origem a seis discursos, que revelaram preocupação em manter a segurança do paciente por meio de identificação, comunicação entre equipe multiprofissional e paciente, prevenção de quedas, ações para a prática segura, comunicação intersectorial e manutenção de equipamentos. **Conclusão:** Os profissionais de enfermagem compreendem a importância da segurança do paciente no CC e consideram que o conjunto de práticas realizadas deve estar alinhado, de modo que minimize eventos adversos e proporcione assistência qualificada, em benefício da qualidade de vida do paciente. **Palavras-chave:** Segurança do paciente. Centros cirúrgicos. Enfermagem.

**RESUMEN: Objetivo:** Conocer las acciones tomadas por los profesionales de enfermería para la seguridad del paciente en el entorno del Centro Quirúrgico (CQ), según el discurso de estos profesionales. **Método:** Esta es una investigación de campo exploratoria y descriptiva, con un enfoque cualitativo. Los datos se recopilieron en un CQ a través de una entrevista grabada guiada por un guión estructurado con cuatro preguntas abiertas basadas en el método del Discurso del Sujeto Colectivo (CSD), con un enfoque en la práctica de la atención segura de los pacientes en el CQ. La muestra estuvo compuesta por 12

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profesionales de enfermería, un asistente y 11 técnicos. Los datos fueron organizados y analizados de acuerdo con el método DSC. **Resultados:** Las respuestas dieron lugar a seis discursos, que revelaron preocupación por mantener la seguridad del paciente a través de la identificación, la comunicación entre el equipo multidisciplinario y el paciente, la prevención de caídas, las acciones para la práctica segura, la comunicación intersectorial y el mantenimiento del equipo. **Conclusión:** Los profesionales de enfermería entienden la importancia de la seguridad del paciente en el CQ y consideran que el conjunto de prácticas realizadas debe estar alineado, para minimizar los eventos adversos y proporcionar asistencia calificada, en beneficio de la calidad de vida del paciente.

**Palabras clave:** Seguridad del paciente. Centros quirúrgicos. Enfermería.

## INTRODUCTION

Safe surgery corresponds to the Second Global Patient Safety Challenge, a campaign proposed by the World Health Organization (WHO) aiming to promote the improvement of surgical safety and to reduce deaths and complications rates during surgery<sup>1,2</sup>.

The concept of safe surgery involves measures adopted to reduce the risk of adverse events that may occur before, during and after surgery, such as: Surgical Site Infection (SSI) prevention, safe anesthesia, well-prepared surgical team, and surgical care evaluation<sup>2</sup>.

Faced with this, the WHO developed the Surgical Safety Checklist, which should be followed by teams of health professionals in order to reduce errors that jeopardize the life and well-being of surgical patients<sup>2,3</sup>.

Thus, the implementation of the Surgical Safety Checklist should occur at three different moments: in the period that precedes anesthetic induction (identification – sign in), before the surgical incision (confirmation – timeout), and after the surgical procedure, with the patient still in the operating room (OR) (registration – sign out)<sup>2</sup>.

According to the WHO, this task may be performed by a member of the nursing team in the OR or by a physician taking part in the surgical procedure<sup>4</sup>.

Among adverse events in the hospital environment, SSI may be highlighted, which increase mortality rate and costs as well as readmission, and may be related to the pathology itself or to the invasive procedures performed<sup>5</sup>. In critical sectors such as surgical centers (SC), there is high incidence of infections, since surgical wounds can be an entry gateway for microorganisms<sup>6</sup>.

In this context, the Brazilian Association of Surgical Center Nurses, Anesthesia Recovery and Material and Sterilization Center (SOBECC) describes that the performance of a team in a SC exceeds the technical capacity and interaction with patients and their family<sup>7</sup>.

Data from a study conducted in two hospitals in Rio Grande do Norte showed that low adherence to the Surgical Safety Checklist possibly had a reflection on the occurrence of adverse events in surgery, such as prolonged stay in the hospital environment, risk of readmission, need for intensive care, mortality rate, among other events<sup>8</sup>.

It should be noted, in SC, that there is a representative number of nursing professionals working in continuous care sectors, playing an important role in surgical patient safety.

## OBJECTIVE

To know patient safety actions performed by nursing professionals in the SC environment, according to the point of view of these professionals.

## METHOD

This is an exploratory and descriptive field research, with a qualitative approach, conducted in a SC of a philanthropic hospital in the countryside of the state of São Paulo, Brazil.

The 35 nursing professionals (nurses, auxiliaries, and technicians) working in the SC according to the schedule of service were invited to participate in the study. The inclusion criteria were: professionals working in the sector for a period equal to or longer than 12 months, considering here the necessary time to adapt to their routines, who agreed to participate in the study, and signed the informed consent form. Absentees due to absence, vacation or leave were excluded at the time of data collection.

Among these 35 professionals, 23 did not meet the inclusion criteria, totaling 12 participants remaining: one nursing

auxiliary (8.3%) and 11 nursing technicians (91.7%); predominantly women (9/75.0%) in comparison to the number of men (3/25.0%).

Their age ranged from 21 to 51 years, with a predominant group (8/66.7%) ranging from 21 and 30 years. Regarding their qualification, nine (75%) were nursing technicians with 1 to 10 years of technical degree; two (16.7%) of them graduated 10 years ago; and one (8.3%) was a nursing auxiliary with more than 10 years of training.

In relation to the function in the sector, 83.3% (10) were circulating and 16.7% (2) did patient transportation. With regard to time in the function, 41.7% (5) had been working for one or two years; 25% (3) for three or four years; and 33.3% (4) for more than five years.

The researchers conducted the interviews in periods of morning, afternoon and night, using the schedule of service of the sector as a reference to identify and invite professionals to participate in the study.

Data collection took place in a reserved area of the SC, previously indicated by the nurse in charge for the sector. The instrument used for data collection was constituted of items intended to characterize the participant, and a structured interview script with four open guiding questions, according to the proposal of the Discourse of the Collective Subject (DCS) method<sup>9</sup>:

1. You know that safe care practices in health care facilities are on the agenda of priorities, as it directly reflects the quality of care provided to the patient. Could you talk about patient safety?
2. Are you aware that the nursing team, during patient care, continuously carries out actions aimed at promoting patient safety in the SC environment? Could you talk about these actions?
3. Safe care practices implemented by the nursing team intends to promote patient safety. Tell me about the importance of these actions in the SC environment.
4. Do you consider that in your daily work at the SC there is the possibility of developing new actions aimed at patient safety? Could you talk a little about that?

The answers obtained were registered in a voice recorder and transcribed in its entirety after exhaustive listening. Data were analyzed according to the DCS method, which guides the selection of key expressions (KE) and central ideas (CI) from the interview transcripts based on the theory of social representations<sup>9</sup>.

This research took into account ethical aspects in accordance with the determinations of Resolution no. 466/2012 of the National Health Council<sup>10</sup>, and it was evaluated and approved by the Research Ethics Committee, under statement No. 1.768.388 and Certificate of Presentation for Ethical Appreciation (CPEA) No. 59561516.9.0000.5383.

## RESULTS

The six discourses below resulted from the analysis of the four guiding questions of the interviews.

### DCS 1: Concern about patient data identification and check in the surgical center

Nursing professionals stated that the correct identification of the patient is a primordial factor for safe care in the SC.

For me, patient safety here in the SC is to check the bracelet [...], patients arrive [...] you ask their name [...], identification before they enter. Asking their name is a security you have, the medical chart, date of birth, age [...], the name of the doctor, if he or she is the correct surgeon, these are some security measures we have. You'll use the name patients tell you as a reference in the paperwork, the surgery they will undergo [...], you ask them: are you going to undergo surgery on your right leg? He or she: no, [...] it is on the left one. So they know, most of them have this knowledge [...], you have to be very concerned in order to have no error in the surgery, [...] if they take any medication, if they have allergies from any medications, [...] sometimes they can't say [...], ask them if they have any diseases, [...] diabetes, high blood pressure, whether they have already been submitted to any kind of surgery other than that one, [...] identify if the patient remains fasting, [...] without dental prostheses, [...] check medical charts. The anesthesiologist asks the questions again in the operating room to be sure. The highest priority here in the SC, [...] is safe care by checking if you are with the correct patient, paying attention to his or her complaints, and trying to provide them with the best assistance.

## DCS 2: Importance of verbal communication between the multiprofessional team and patients in the surgical center

The participants also pointed out the importance of verbal communication among the professionals working in the SC, focusing on patient safety.

I believe that patient safety is extremely important in the SC, sometimes communication fails [...] with patients and [...] with doctors, [when] they do not know if the patient has any disease, sometimes the patient is confused, aged [...], this safety is very important to avoid failures both in the procedure and in the care provided.

## DCS 3: Patient safety related to fall risk

Nursing professionals also expressed concern in relation to fall risk in patients in the SC while they remain either on the stretcher or on the operating table.

So security is: [...] the patient is on a stretcher, it has to be with the bars up, [...] you have to be near the patient [...] on the operating table, because the patient may fall [...], you have to pay a lot of attention, to take good care of the patient in the SC.

## DCS 4: Actions for safe care practices in the surgical center

Another remark from the participants was related to the importance of actions aimed at ensuring safe care in the SC, minimizing adverse events.

In the SC [...] patients will undergo surgery, so everything has to be correct. Safety is everything [...] because we have to make sure we are with the right patient, in the correct surgery. Patients often arrive at the SC with a pre-anesthesia [...] so we cannot confirm all their data, and you can lead patients into what [...] will be done, [...] which doctor, you have to know the correct identification of the patient, [...] because there can be

two patients with the same name, [...] and they [...] being under pre-anesthesia cannot confirm anything. You have to get other information like [...] the surgical map, for example, directly from the surgeon. Safety is everything, [...] because with these actions you avoid errors in the surgery, [...] of patient, whether or not patients really have allergies from any medication [...], identify the accesses [...], surgical count during the surgery is safety. So it ends up turning into a sequence [...], you do the right thing, doctors do the right thing, anesthesiologists do the right thing, and then it turns into a circle where everything works, [...] and even if someone suddenly fails, nurse identify and manage to avoid [...] anything from happening with the patient, and we must ensure patient safety, always asking questions to prevent any disorder from happening. [...] As I have been talking about patient safety, [...] when they are on a stretcher or in a crib, you have to lift the bars so that patient do not fall [...], because patients ends up coming back from anesthesia very agitated, [...] with the bars lifted [...] patient will not fall.

## DCS 5: Relevance of intersectoral communication focusing on patient safety in the surgical center

The concern about maintaining effective multiprofessional communication between different sectors in favor of patient safety should be emphasized.

I think [...] you need information exchange for improvements [...] from the SC to the sector [...] to always correctly pass duty to others. And this kind of information is missing, [...] it would be hospitalization, emergency, SC, one thing has to be connected to the other, [...] information exchange, when one of these areas fails, the other has to provide it anyway [...], imagine if at the end of the surgery you find out that the patient has hepatitis, HIV, sure, you have primary protection [...] but there might be something you don't wear at the moment of the surgery, like goggles for example, and sometimes patients have [...] tuberculosis, pseudomonas, acinetobacter,

H1N1, and nobody uses an N95 all day long here at the SC, we only wear it when necessary. To explain the surgery to patients, [...] what exams they have to bring to the SC, to explain about trichotomy, whether it has to be done or not, about the need for fasting to take medication, because we face a lot of problems, there are patients who don't take the high blood pressure medication because they say they couldn't drink water, [...] but we have to walk them through it. Many times patients have medication allergies, so [...] I think that information and communication are very important and should be reinforced, [...] both in the medical chart and verbally, [...] this link between the sectors, should always be communicated to the supervision or to the doctor in case of any intercurrent.

## DCS 6: The importance of equipment maintenance for patient physical safety in the surgical center

The need for equipment maintenance in the SC was another fact evidenced by the participants as important to keep patient physical safety while they remain in the sector.

I think [...] the only thing we could help to improve [...] is in relation to the [...] rooms, [...] I think patients should at least go up directly to their room, [...] patients will come out of the surgery [...] if they go to such a room, or when there's not a room, sometimes we hold patients here all night because we feel bad for sending them there to be lying on a stretcher [...] understand? [...] Sometimes stretchers are not suitable, sometimes you move the patient and the wheel of the stretcher rolls like [...] a pogo stick, it happens. I think it would be better for patients, because sometimes they undergo surgery and you take them to the room, the stretcher's wheels start swinging, and I think it is not good for patients, [...] the stretchers aren't safe [...], you lift the stretcher, and a wheel may fall off, so there is the risk of causing an accident with the patient, [...] it has never happened to me, but it could happen, sometimes we [...] take an empty stretcher out of here, then a wheel

falls off. What if there was a patient on that stretcher? It's dangerous, the risk of causing an accident with the patient, so I think these things have to be improved.

## DISCUSSION

The hospital environment offers several types of risks to patients' health, which could extend the recovery process. Therefore, the role of professionals in identifying and checking situations that may compromise the patient safety is essential, as well as the importance of evaluating and implementing measures to prevent exposure to risks and harm resulting from incorrect care<sup>11</sup>.

The Surgical Safety Checklist aims to ensure a routine of basic actions targeted at patients in compliance with the International Patient Safety Goals, and to allow improvements in the communication process and in the activities developed among the professional teams, in the place where assistance is provided, regardless of the characteristics of the health institution<sup>2,3</sup>.

According to the professionals' report, this study presented with the concern with a correct patients identification in the SC, as a way of minimizing adverse events and damaging patients' health.

A study conducted in Porto Alegre (Rio Grande do Sul) with the purpose of knowing about the use of identification bracelets in hospitalized patients revealed that information such as name, registration number, and integrity were contemplated. The authors also emphasized the importance of participation and awareness of the patients, staff, and family members in order to comply with practices related to the culture of patient safety<sup>12</sup>.

Another study, conducted in Rio de Janeiro with the objective of analyzing procedures of critically ill patients identification focusing on the identification bracelet, pointed out that 96% of the patients investigated had identification bracelets properly placed, strengthening the patient safety practices and the quality of nursing care<sup>13</sup>.

Correct patient identification is considered to correspond to the first step of all the actions in the perioperative period and is determinant for ensuring patient safety in a SC.

The research also demonstrated the participants' concern in relation to the communication process between patients

and the multiprofessional team as a way of reducing adverse events in the care process.

According to the determinations described in the Surgical Safety Checklist, the safe practices reinforcement associated with effective communication among the professionals working in the area is essential<sup>2,3</sup>.

An integrative review conducted in national databases aiming to analyze scientific publications that approached nurses' performance with a focus on promoting surgical patient safety, revealed that, among the 28 studies analyzed, there is still an absence of dialogue between patients and professionals about patients' fears, anxieties, and doubts in the postoperative period<sup>4</sup>.

Effective communication between patients and the surgical team is essential, as it contributes to early identification of possible adverse events, reducing or preventing their occurrence.

The concern with patients' falls was another aspect explored by the study. This type of occurrence may cause negative impacts on patients' mobility, including fear, anxiety, and depression, predisposing them to an increased risks for other falls<sup>14</sup>.

WHO data point out that falls are responsible for 646,000 deaths worldwide, especially among elderly patients, suggesting practices such as education, safe environments, and policies aimed at reducing this type of occurrence<sup>15</sup>.

Patients falls in hospital areas are related to physical environmental factors such as uneven floors, objects on the ground, inadequate height of the furniture, age over 85 years, recent fall history, reduced mobility, urinary incontinence, postural hypotension, and use of medicines<sup>14</sup>.

The importance of preventing patient fall in SC should be emphasized, since, according to the reports of the participants in this study, patients are sedated or in a situation of mental confusion related to anesthetics that increase fall risks, since they are found on stretchers, operating tables or beds with reduced space for their accommodation and mobility.

Permanent patient monitoring in the SC as well as a routine of maintaining the stretcher bars raised is an important alternative to reduce fall risks. Another suggestion is staying by the patients side until they are in a safe condition.

Complex tasks that require attention to patients care as well as agility and precision in the execution of care practices are performed by the SC professionals<sup>4</sup>. There is a worldwide concern about the quality of care related to surgical and anesthetic procedures due to the high number of adverse events<sup>3</sup>.

In relation the nurses' role in patient safety practices, an integrative review identified, in articles published from 2013 to 2017, that the implementation of protocols such as the Systematization of Perioperative Nursing Care (SPNC) and the Surgical Safety Checklist were fundamental to ensure the patient safety, serving as facilitators for the identification and reporting of adverse events, especially by nurses. It was also highlighted the relevance of training as a way of qualifying assistance and reducing adverse events<sup>16</sup>.

In such a context, it is possible to affirm that nurses play a key role in leading the nursing team to achieve qualified safe care in the perioperative period. Therefore, the importance of SC professionals' training and qualification IS noted, reinforcing safe care practices for the benefit of the patient.

It is important to emphasize that effective communication among the members of the surgical team benefits patients, and communication between the sectors at the time of patient transportation is crucial for the safety of both patients and professionals. Communication failures due to lack of necessary information are reported as the main causes which contribute to adverse events<sup>17</sup>.

The Surgical Safety Checklist is fundamental for communication in the SC routine, considering the International Patient Safety Goals preconizations, emphasizing the need for effective communication among teams<sup>3</sup>.

The results of a study conducted in a philanthropic hospital in the city of São Paulo with the objective of knowing the professionals who built protocols for on-call duty in the SC and in the Intensive Care Unit revealed that communication between professionals is essential for an appropriate planning of the needs and for the critically ill patients care sector safety<sup>18</sup>.

The nurses' role in keeping updated and recorded information about preventive maintenance of equipment for patients' transportation and accommodation, aiming to reduce falls and other adverse events is also worth mentioning.

A study conducted with 220 SC nurses from different regions in Brazil indicated in order to describe the recommendations of nurses regarding patient safety practices pointed out that adequate physical, human and material resources contribute to the quality of care<sup>19</sup>. Thus, routines aimed at assessment and maintenance of ideal environmental conditions in the SC are necessary for suitable patient safety care practices.



## FINAL CONSIDERATIONS

The results of this study showed that nursing professionals understand the importance of patient safety in the SC, since they pointed out that essential care practices such as patient identification, medical chart review, interpersonal communication between multiprofessional teams and patients, check and equipment maintenance, aiming to minimize adverse events, are essential for that purpose.

Therefore, patient safety should be considered as more comprehensive than just checks, since it involves a set of practices that must be aligned so that adverse events can be

reduced and care can be qualified in an integral way for the benefit of patient quality of life.

The absence of nurses in the research was considered a limiting factor in this study, since their managerial role in the SC contributes directly to patient safe care practices, a fact that would improve for sure the results of this study.

Another fact to be considered is the non-inclusion of other professionals of the SC due to the short time for the research. Future studies approaching this theme may expand the knowledge about an area with a still limited number of publications.

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# SURGICAL HAND ANTISEPSIS WITH ALCOHOL SOLUTION: MICROBIAL REDUCTION AT DIFFERENT APPLICATION TIMES IN THE SURGICAL CENTER

*Antissepsia cirúrgica das mãos com preparação alcoólica: redução microbiana em diferentes tempos de uso no centro cirúrgico*

*Antissepsia quirúrgica de las manos con preparación alcohólica: reducción microbiana en diferentes tiempos de uso en el centro quirúrgico*

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**ABSTRACT: Objective:** To evaluate the microbial reduction after surgical hand antiseptis performed with alcohol solution at different application times among surgeons. **Method:** This is a pragmatic prevalence field study carried out in a Brazilian tertiary hospital. Microbiological samples were collected from the hands of 54 surgeons after simple washing to determine the baseline microbial flora and after surgical antiseptis with an alcohol solution to evaluate the immediate microbial reduction. We categorized the microbial reduction results as mild (up to 50% bacterial flora reduction), moderate (51 to 80%), and high (more than 80%). The research was submitted to and approved by the Research Ethics Committee of the private hospital (study site) and the federal institution of higher education. **Results:** Techniques performed in less than 90 seconds showed an 80% high reduction, 6.7% moderate reduction, and 13.3% mild reduction. In applications that lasted more than 180 seconds, all samples presented bacterial count reduction, which did not occur in shorter antiseptis times. **Conclusion:** When the recommended technique and time are followed, the bacterial reduction is greater compared to lower durations.

**Keywords:** Antiseptis. Colony count, microbial. Disinfection. Hand disinfection. Surgical procedures, operative.

**RESUMO: Objetivo:** Avaliar a redução microbiana após antissepsia cirúrgica das mãos dos cirurgiões, realizada com preparação alcoólica, em diferentes tempos. **Método:** Estudo de prevalência, pragmático, de campo, realizado em hospital terciário do Brasil. Coletaram-se amostras microbiológicas das mãos de 54 cirurgiões após lavagem simples, para determinar a flora microbiana basal e, após a antissepsia cirúrgica alcoólica, para avaliar a redução microbiana imediata. Categorizaram-se os resultados da redução microbiana em redução leve (até 50% de redução da flora bacteriana), moderada (de 51 a 80%) e alta (acima de 80%). A pesquisa foi submetida e aprovada pelo Comitê de Ética e Pesquisa da instituição hospitalar privada, sede do estudo, e da instituição de ensino superior federal. **Resultados:** Nas técnicas realizadas em menos de 90 segundos, houve 80% de redução severa, 6,7% de redução moderada e 13,3% de redução leve. Nas técnicas desempenhadas em mais de 180 segundos, todas as amostras apresentaram redução de contagem bacteriana, o que não ocorreu em tempos menores de antissepsia. **Conclusão:** Quando a técnica e o tempo recomendados são seguidos, maior é a redução bacteriana, em comparação aos tempos menores.

**Palavras-chave:** Antissepsia. Contagem de colônia microbiana. Desinfecção. Desinfecção das mãos. Procedimentos cirúrgicos operatórios.

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**RESUMEN:** **Objetivo:** evaluar la reducción microbiana después de la antisepsia quirúrgica de las manos de los cirujanos, realizada con preparación alcohólica, en diferentes momentos. **Método:** Estudio pragmático de prevalencia de campo realizado en un hospital terciario de Brasil. Muestras microbiológicas recogidas de las manos de 54 cirujanos después de un simple lavado, para determinar la flora microbiana basal y después de la antisepsia quirúrgica alcohólica, para evaluar la reducción microbiana inmediata. Los resultados de la reducción microbiana se clasificaron como leves (hasta un 50% de reducción en la flora bacteriana), moderados (del 51 al 80%) y altos (más del 80%). La investigación fue presentada y aprobada por el Comité de Ética e Investigación de la institución del hospital privado, sede del estudio y de la institución federal de educación superior. **Resultados:** en las técnicas realizadas en menos de 90 segundos hubo una reducción severa del 80%; 6,7% de reducción moderada; 13,3% de ligera reducción. En las técnicas realizadas durante 180 segundos, todas las muestras presentaron una reducción en el recuento bacteriano, lo que no ocurrió en tiempos de antisepsia más cortos. **Conclusión:** Cuando se siguen la técnica y el tiempo recomendados, mayor es la reducción bacteriana, en comparación con los tiempos más cortos. **Palabras clave:** Antisepsia. Recuento de colonia microbiana. Desinfección. Desinfección de las manos. Procedimientos quirúrgicos operativos.

## INTRODUCTION

Healthcare-associated infections (HAIs) are important adverse events to which patients are exposed, as well as relevant indicators of the quality of care provided<sup>1</sup>. Since the 19<sup>th</sup> century, hand hygiene (HH) is recognized as an essential measure to prevent infections<sup>1</sup>. Studies by Semmelweis have proven its impact on puerperal fever mortality rates, as the lack of HH among health professionals caused maternal death to remain above 18% in the Vienna General Hospital<sup>1,2</sup>.

The Centers for Disease Control and Prevention (CDC) from the United States of America, one of the main guiding agencies for HH practices, publishes guidelines for this measure since the 1970s<sup>3-6</sup>. Surgical site infections (SSIs) are complications that can occur during surgical procedures, manifesting in the incision or the manipulated organ. In Brazil, SSIs hold the third place among the HAIs, striking 14 to 16% of hospitalized patients<sup>5</sup>. American data indicate that SSIs affect 500 thousand patients, resulting in a significant increase in the length of stay and hospital costs, in addition to the physical, emotional, and financial damage to patients and their families<sup>6</sup>.

SSI is a multifactorial complication that depends on factors related to the patient, the team, and the surgery<sup>3</sup>. Regarding the procedure, one of the most relevant factors is the hand antisepsis of the team, as it acts on reducing the microbial load on the hands<sup>3,9</sup>. The traditional preoperative HH method consists of using brushes soaked in antiseptics<sup>10</sup>; however, alcohol solutions have been widely recommended by the World Health Organization (WHO), given their advantages, which include less time spent in hand preparation, reduction in dermatological effects, economy in the use of resources, such as water and sponges, besides the decrease in waste<sup>10</sup>.

A study on the substitution of brushing for alcohol antiseptic at the Surgical Center (SC) of a private hospital in Southern Brazil revealed that the adherence to the proper technique for the use of alcohol solution by surgeons and scrub nurses was 35.8%<sup>11</sup>. Rubbing time was the main issue observed (94.2%)<sup>11</sup>, as it was shorter than the recommended by the manufacturer of the product (2 minutes). The literature has few references that suggest lower times of alcohol antisepsis. These factors motivated the present study.

## OBJECTIVE

To evaluate the microbial reduction of surgical hand antisepsis with alcohol solution performed by surgeons at different application times, under practical conditions of use in SC.

## METHOD

This is a pragmatic prevalence field study conducted at the SC of a private hospital in Southern Brazil, after approval by the Research Ethics Committee. Culture processing and microbial count were performed in the Microbiology Laboratory of the Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA). Data were collected from April to June 2017. We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) as a reference for the research.

The non-probabilistic sample consisted of surgeons working in the institution. Samples were collected from the hands of 54 random and non-deliberately selected surgeons before the procedure. The inclusion criteria comprised agreeing to participate in the research, signing the Informed Consent

Form (ICF), choosing to perform surgical hand preparation with the alcohol solution, employing the proper technique (step by step) for surgical hand antisepsis, not using hand jewelry/accessories (such as rings, watches, or bracelets), and having no hand lesions. We excluded surgeons who performed antisepsis for emergency procedures from the sample.

Considering a 90% power to test the difference between the mean contamination at moments 1 and 2 of the procedure, we estimated that the sample should include 44 surgeons, adopting a  $p < 0.05$ .

The participants signed the ICF. The study was submitted to and approved by the Research Ethics Committee of the private hospital, under the Certificate of Presentation for Ethical Consideration (*Certificado de Apresentação para Apreciação Ética – CAAE*): 59234816.9.3001.5328, and the federal institution of higher education, under CAAE: 59234816.9.0000.5345.

The product evaluated in the test was Purell Surgical Scrub® (gel), produced by GOJO Industries Inc., available in the institution for the surgical hand antisepsis of the professionals. Its formulation consists of 70% ethanol (weight/weight — w/w) in gel form. Data were collected by non-participant observation and microbiological cultures.

The first part involved direct observation of the surgical hand antisepsis with the alcohol solution to determine the application time and verify the adherence to the standardized technique, using an instrument to record the characterization of the professional, their specialty, and the time to perform the technique. The researcher did not interfere with the technique used by the surgeon for surgical antisepsis with the alcohol solution; however, she instructed the participants to proceed with simple hand washing. We considered the surgical antisepsis with alcohol solution adequate when the movements were performed as recommended by WHO<sup>10</sup>, which succinctly proposes the hygiene of nail beds, fingers, palm and back of one hand, and forearm, followed by the same procedures in the opposite hand. The proper technique was based on the manufacturer's recommendations, which indicate an application time of 120 seconds, or 2 minutes.

Culture samples were collected after hand washing to determine the baseline microbial flora of the professional and after the surgical hand antisepsis with the alcohol solution to identify the immediate microbial count reduction.

The surgeon removed the resident hand flora by simple hand washing with the triclosan-based antiseptic soap available in SC, using the standard technique of the

institution. The distal phalanges of both hands were rubbed for 1 minute in a Petri dish containing 10 mL of tryptic soy broth (TSB) and neutralizers (3% polysorbate 80, 3% saponin, 0.1% histidine, and 0.1% cysteine) to determine the colony-forming unit (CFU) values in the two collection times (pre- and post-antisepsis). A 0.1-mL aliquot of this broth, as well as the same amount of broth diluted in 1 mL (1:10) and 0.1 mL of the latter preparation diluted in 1 mL (1:100), was streaked onto a tryptic soy agar (TSA) plate. The interval between collection and streaking did not exceed 30 minutes. The plates were transported to the laboratory of the university for incubation at  $37^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and read after 24 hours.

We chose this methodology based on studies that used the EN-12054 European method<sup>12,13</sup>, but with adaptations:

- the methodology proposes intentionally contaminating the hands with strains of *Escherichia coli*; however, this research evaluated the microbiota in real conditions, that is, in the work environment of health professionals;
- the comparison performed in this study was not between the antiseptic solution and the reference product, as indicated by the methodology. We compared the microbial counts of hands cleaned with the same product, but at different application times;
- the plates were incubated for 24 hours at  $37^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

We identified the number of CFUs for each dilution and multiplied this value by the dilution factor to find the number of CFUs per mL of liquid sample. We used CFU counts at the 1:10 dilution to compare the pre- and post-antisepsis moments. The difference between pre- and post-antisepsis counts was established, followed by its representation in percentage and logarithmic reduction factor ( $\log_{10}$ ). We categorized the percentage of reduction as mild (up to 50%), moderate (51 to 80%), and high (above 80%). This classification is not referenced in the literature and was proposed to enable comparisons between the reductions, stratifying them by time categories. We grouped the results of microbial reduction in three categories of application time: up to 90 seconds, 90 to 180 seconds, and above 180 seconds.

This work was presented orally as an education session of AORN Global Surgical Conference & Expo in the United States of America, in 2019, under the title "A comparison of microbial counts with different procedure lengths of alcoholic surgical hand antisepsis."

## RESULTS

Samples were collected from 54 subjects, and nine (16.7%) were excluded for suspicion of contamination, evidenced by the significant number of CFUs in the post-antiseptic cultures. Thus, the research comprised 45 participants.

The distribution of surgeons by specialty was: orthopedics and traumatology (n=14, 31%); general surgery (n=12, 27%); head and neck (n=5, 11%); vascular surgery (n=4, 9%); urology (n=3, 7%); gynecology (n=3, 7%); plastic surgery (n=2, 4%); and neur surgery (n=2, 4%).

Out of the 45 samples considered valid, seven (15.5%) showed no bacterial count reduction after antiseptic with the alcohol solution. We calculated the logarithmic reduction factor of microbial count for each sample by subtracting

the post-antiseptic count value from the pre-antiseptic sample, obtaining the data presented in Table 1.

Considering only the samples that showed microbial count reduction (n=38), we estimated the percentage of microbial reduction in post-antiseptic samples when compared to pre-antiseptic cultures, classifying them according to the expression of this reduction. Figure 1 demonstrates this distribution.

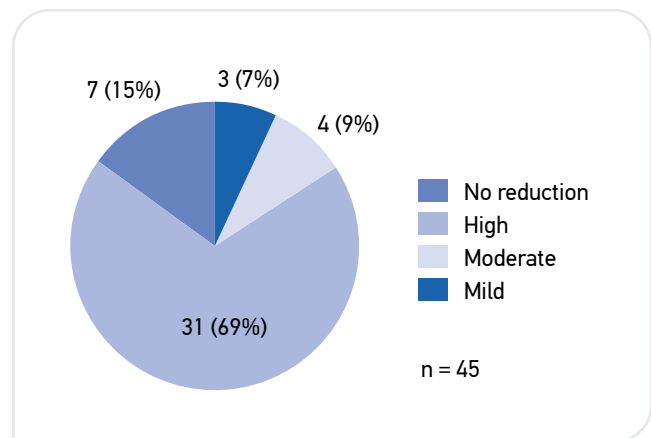
The mean application time was 116±97 seconds. Table 2 presents and describes the distribution of microbial count reduction grouped by the application time category.

The findings are heterogeneous in their distribution, making unreliable the comparisons between the categories. For this reason, we regrouped the time categories into ≤ 90 seconds and > 90 seconds so that the comparisons could be consistent (Table 3). We also excluded cases with no microbial reduction from the analysis, totaling 38 procedures.

**Table 1.** Descriptive analysis of the logarithmic reduction in the bacterial count and standard deviation pre- and post-hand antiseptic among surgeons.

		Mean log <sub>10</sub> (SD)		
		Initial bacterial count	Final bacterial count	Reduction factor (pre/post)
Application time	Up to 90 s N=18	1.53 (0.60)	1.74 (0.60)	0.79 (0.54)
	90 to 180 s N=22	1.78 (0.88)	0.67 (0.69)	1.12 (0.86)
	More than 180 s N=5	1.40 (0.72)	0.48 (0.66)	0.92 (0.90)

SD: standard deviation.



**Figure 1.** Samples according to the category of microbial count reduction post-hand antiseptic among surgeons.

**Table 2.** Classification of microbial count reduction according to hand antiseptic time among surgeons.

Classification of microbial count reduction					
Application time	Mild	Moderate	High	No reduction	Total
<90 seconds (absolute number)	2	1	12	4	19
% of the application time	11%	5%	63%	21%	
% of the total sample	4%	2%	27%	9%	
90–180 seconds (absolute number)	0	2	16	3	21
% of the application time	0%	10%	76%	14%	
% of the total sample	0%	4%	36%	7%	
>180 seconds (absolute number)	1	1	3	0	5
% of the application time	20%	20%	60%	0%	
% of the total sample	2%	2%	7%	0%	
<b>Total</b>	<b>3</b>	<b>4</b>	<b>33</b>	<b>7</b>	<b>45</b>

**Table 3.** Classification of microbial count reduction according to hand antiseptic time among surgeons, after regrouping the time categories.

Classification of cases with reduction					
Application time	Mild	Moderate	High	No reduction	Total
<90 seconds (absolute number)	2	1	12	15	
% of the application time	13.30%	6.70%	80.00%	100.00%	
% of the total sample	5.30%	2.60%	31.60%	39.50	
>90 seconds (absolute number)	1	3	19	23	
% of the application time	4.30%	13.00%	82.60%	100.00%	
% of the total sample	2.60%	7.90%	50.00%	60.50%	
Total	3	4	31	38	

We used the  $\chi^2$  test to check the equivalence of proportions or independence between application time and the outcome analyzed (microbial count reduction), confirming the lack of significant association between them ( $\chi^2$  1.284;  $p = 0.526$ ).

## DISCUSSION

With respect to sample characterization, the surgical specialties participating in the study were compatible with the production distribution of the hospital. In total, 15% ( $n=7$  of the 45 analyzed) of the samples showed no bacterial count reduction after the performance of the technique. This fact is alarming, since the transient bacterial flora on the hands prepared for the surgical procedure should be eliminated, and the resident flora should be reduced to the minimum possible<sup>3</sup>.

The use of sterile gloves is an additional barrier to the transference of bacteria from hands to the surgical site; nonetheless, sterile gloves have a perforation rate of around 11%, which are imperceptible to the surgical team in 31 to 34% of cases in surgeries lasting more than 2 hours<sup>14,15</sup>. The median and mean application time were 97 and 116 seconds, respectively. These values are compatible with a Finnish study, in which the mean identified was 110 seconds, but below the recommended by the manufacturer<sup>16</sup>.

While grouping the time frequencies, we found similarities between the number of professionals who performed the technique in 90 seconds ( $n=19$ ) and 90 to 180 seconds ( $n=21$ ), with lower frequency in the category above 180 seconds ( $n=5$ ). A study shows that the antiseptic lasted 180 seconds in 42% of observations, contrary to the percentage detected in this investigation – 11% ( $n=5$ )<sup>16</sup>. When considering the application time recommended by the manufacturer – 120 seconds –, this study presented only 40% (18/45) adherence. These findings

demonstrate the difficulties of the surgical team in adhering to the indicated antiseptic technique. Since the professionals were being observed during the procedure, the Hawthorne effect (subject's change of behavior as a result of knowing they are being watched) may have occurred. Thus, the results related to adherence to the application time indicated might be worse in the daily routine. A previous study conducted in the same institution where this research took place revealed that time was the main issue in the antiseptic technique employed by surgeons<sup>11</sup>. Another study identified the same scenario, reporting that 10% of participants performed the surgical antiseptic with alcohol solution in less than 60 seconds<sup>17</sup>.

Although the application time was not adequate in comparison to the recommended, when we analyzed the sample distribution according to the category of microbial count reduction, most cases (82%) showed high reduction after antiseptic.

Among the professionals who performed antiseptic in up to 90 seconds, 80% ( $n=12$  out of 15) presented high reduction, a frequency similar to that found in the category above 90 seconds – 82.6% ( $n=19$  out of 23). The  $\chi^2$  analysis confirmed the lack of association between application time and the category of microbial reduction ( $\chi^2$  1.284;  $p = 0.526$ ). Even though 90 seconds of application time is not recommended by WHO or referenced by the European standard (EN-12791)<sup>3,18,19</sup>, a study demonstrated that its effectiveness could be equivalent to that of 2 or 3 minutes with the use of formulations containing isopropanol and n-propanol, as well as mectronium ethylsulfate, which do not correspond to the tested product<sup>20</sup>.

In applications that lasted more than 180 seconds, all samples presented bacterial count reduction, which did not occur in shorter times. This finding implies that the odds of bacterial reduction are higher when the recommended technique and time are followed when compared to lower durations,

despite the lack of association between application time and bacterial reduction. We underline that only five professionals performed antisepsis for more than 180 seconds, which restricts the use of this information.

The logarithmic reduction factor identified in our study was  $1.72 \pm 0.74$ , that is, above the recommended for experimental studies aimed at validating products complying with the EN-12791 standard. According to this standard, an alcohol product for surgical hand antisepsis is considered effective when it presents values not significantly greater than those of the reference product listed in the regulation (60% n-propanol), immediately after its application and after 3 hours. In this standardization, the median logarithmic reduction was  $3.27 \pm 1.13$  for that specific alcohol formulation. In contrast, the study identified that the expected reductions in the resident microbiota are between 1 and 1.3 log<sub>10</sub> for formulations containing 70% ethanol<sup>21,22</sup>. Therefore, the reduction values found in this test were not satisfactory in comparison with the product referenced in the standard. However, compared to the study mentioned, which evaluated only ethanol-based products, our results proved to be acceptable.

This research aimed to identify the effect of the product tested on reducing the microbial population on the hands of surgeons in real conditions of use and relate the results with application time. The findings showed no significant association between application time and the category of microbial reduction on the hands. Nevertheless, when antisepsis time was higher than 180 seconds, all cases presented reduction, contrary to the other time categories. Based on this information, we can infer that the longer the application time, the greater the (high) microbiological reduction in absolute percentage, but with non-significant  $\chi^2$ .

The present study has some limitations, among which we highlight: the volume of alcohol solution used by the professionals was not controlled, which may have influenced the microbial count values on the hands after antisepsis. Also, the Hawthorne effect may have influenced the technique employed by surgeons for hand preparation, interfering

with its quality and duration<sup>23</sup>. Moreover, the results cannot be generalized because the sample by specialty was not significantly representative of the population of surgeons of the institution. In addition, we tested only one brand of alcohol solution, which prevents us from extrapolating the findings to other products available in the market. Another variable that can be considered a limiting factor is the fact that, despite the adequate sample calculation, the extracts generated restricted the comparisons between them.

This study demonstrates the importance of using antisepsis techniques with application times validated and recommended by the manufacturer to reduce the microbial load on the hands. The effective performance of the technique allows a safe surgical procedure, ensuring the safety of patient care. In this scenario, the nursing staff, in its active role of promoting risk-free care, may guide and encourage other professionals to apply the proper hand antisepsis technique following an evidence-based practice.

## CONCLUSION

After evaluating the surgical hand antisepsis with alcohol solution performed by surgeons at different application times under practical conditions of use in SC, we found bacterial count reduction in most cases when the technique was executed in  $\leq 90$  seconds and  $> 90$  seconds; however, the difference was not statistically significant. In applications that lasted more than 180 seconds, all samples presented bacterial count reduction, which did not occur in shorter times. The results show that bacterial reduction is greater when the recommended technique and time are followed, as indicated by WHO, compared to lower durations. Experimental studies with adequate control of variables are necessary to confirm this hypothesis.

The mean application time found in this study was 116 seconds, lower than the recommended by WHO. Application time remains a major challenge for surgical hand antisepsis with an alcohol solution.

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# ASSESSMENT OF ADEQUACY IN THE USE OF SURGICAL ATTIRE

*Avaliação da adequação no uso da paramentação cirúrgica*

*Evaluación de la aptitud en el uso de paramentación quirúrgica*

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**ABSTRACT: Objective:** To analyze the adequacy of the surgical attire used by healthcare professionals who work in the surgical center of a teaching hospital in Northeastern Brazil. **Method:** This is a cross-sectional descriptive quantitative observational study. The sample consisted of 100 healthcare professionals. **Results:** The items with the best adequacy were: donning disposable shoe covers and gloves (100%), followed by places where professionals circulate with surgical scrubs and donning the surgical cap (99%). The use of safety glasses (5%) and the proper place for keeping the surgical mask (8%) had lower rates of adequacy. We found surgical mask inadequacies related to professionals who do not change the item when it gets dirty or wet and in surgeries lasting more than approximately two hours (23%). **Conclusion:** Although most (18 of the 20) items had high rates of adequacy, others presented regular and low rates. Professional categories with the highest rates of inadequacy were anesthetists (35%), nurses (27%), and nursing technicians (22%). These percentages must be improved to provide safer care for surgical patients.

**Keywords:** Surgicenters. Perioperative nursing. Quality control. Safety.

**RESUMO: Objetivo:** Analisar a adequação da paramentação cirúrgica pelos profissionais de saúde que prestam assistência em um centro cirúrgico de um hospital de ensino no Nordeste do Brasil. **Método:** Estudo transversal, descritivo, quantitativo e de natureza observacional. A amostra foi composta de 100 profissionais de saúde. **Resultados:** Os itens de maior adequação foram: no momento da colocação do propé e das luvas (100%), seguido da circulação da roupa privativa e do momento de colocação do gorro (99%). Obtiveram-se menores taxas de adequação no uso dos óculos (5%) e quanto ao local de guarda da máscara (8%). As inadequações relacionadas à máscara cirúrgica ocorreram pela não troca mediante sujidade ou umidade e em cirurgias com duração maior de duas horas aproximadamente (23%). **Conclusão:** Apesar de a maioria (18 dos 20) dos itens estar com boas taxas de adequação, outros apresentaram taxas consideradas medianas e baixas. As categorias profissionais que apresentaram maiores inadequações foram anestesistas (35%), enfermeiros (27%) e técnicos de enfermagem (22%). Esses percentuais necessitam ser melhorados, a fim de oferecer aos pacientes cirúrgicos uma assistência mais segura.

**Palavras-chave:** Centro cirúrgico. Enfermagem perioperatória. Controle de qualidade. Segurança.

**RESUMEN: Objetivo:** analizar la adecuación del apósito quirúrgico por parte de profesionales de la salud que brindan asistencia en un centro quirúrgico de un hospital universitario en el noreste de Brasil. **Método:** estudio transversal, descriptivo, cuantitativo y observacional. La muestra estuvo compuesta por 100 profesionales de la salud. **Resultados:** Los artículos más adecuados fueron: al colocar las polainas y al ponerse un guante (100%), seguido de la circulación de ropa privada y el momento en que se colocó la gorra (99%). Se obtuvieron tasas más bajas de adecuación en el uso de gafas (5%) y en términos de la ubicación de la máscara (8%). Las deficiencias relacionadas con la máscara quirúrgica ocurrieron debido al no intercambio

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debido a la suciedad o la humedad, y en cirugías que duraron más de dos horas, aproximadamente (23%). **Conclusión:** Aunque la mayoría (18 de los 20 ítems) tuvieron buenas tasas de adecuación, otros tuvieron tasas consideradas medianas y bajas. Las categorías profesionales que mostraron las mayores deficiencias fueron anestesistas (35%), enfermeras (27%) y técnicos de enfermería (22%). Es necesario mejorar estos porcentajes para ofrecer a los pacientes quirúrgicos una atención más segura.

**Palabras clave:** Centros quirúrgicos. Enfermería perioperatoria. Control de calidad. Seguridad.

## INTRODUCTION

Surgical center (SC) is the place most prone to offering risks, and the presence of adverse events during anesthesia and surgical procedures is estimated at 37.6%<sup>1</sup>. According to a study conducted by the Brazilian Ministry of Health (MoH), surgical site infection (SSI) in Brazil has a rate of 11% in relation to the total surgical procedures analyzed<sup>2-5</sup>. Therefore, healthcare professionals must implement some care measures, including the appropriate use of surgical attire and personal protective equipment (PPE), aiming to perform surgical procedures in a proper and safe way for the patient and the professionals involved<sup>2-6</sup>. These facts justify our research.

Surgical attire consists of a set of barriers against the invasion of microorganisms in surgical sites and to protect professionals from exposure to the patients' blood and other bodily fluids. These barriers include surgical scrubs, surgical hat/cap, disposable shoe covers, surgical mask, safety glasses, surgical gown, and surgical gloves<sup>3,7-10</sup>.

Changing surgical scrubs is indicated whenever the professional enters the restricted area of the SC, according to the Association of periOperative Registered Nurses (AORN), and they must be removed when leaving the SC (daily or at the end of each shift) or when the clothing is wet, dirty, or contaminated<sup>6,11</sup>. The use of a surgical cap is deemed appropriate when it fully covers the hair, so no strands are exposed, as they can fall into the open surgical site<sup>6,10,12</sup>.

The Brazilian Association of Nurses in Surgical Center, Anesthetic Recovery and Center for Material and Sterilization (SOBECC)<sup>2</sup> recommends the use of surgical masks and eye protectors, indicating that the surgical mask should be replaced every two hours, when dirty or wet, and kept in the pocket of the surgical coat.

Footwear/disposable shoe covers must be clean, without holes, and completely closed, and their use is only intended for the SC environment. Surgical gloves should be changed in case of suspected contamination, if they are punctured, and every 90 to 150 minutes during surgery. When donning the surgical gown, professionals can only touch the inner

surface, since the anterior external side is sterile, and the posterior one is unsterile<sup>2</sup>.

Taking this into consideration, we intend to answer the following questions: which surgical attire elements have the best adequacy of use in a higher education institution? What is the percentage of adequacy according to the professional category?

Due to the importance of safe surgery, we aim at directly assisting the institution where the research was carried out by establishing the behavioral diagnosis of professionals who work in the SC, in such a way that they can make more conscious and appropriate use of the surgical attire, in addition to contributing to a safer and higher-quality provision of multidisciplinary care for patients.

## OBJECTIVE

To analyze the adequacy of the surgical attire used by healthcare professionals who work in the SC of a teaching hospital in Northeastern Brazil.

## METHOD

This is a cross-sectional descriptive quantitative observational study. The cross-sectional approach allows us to examine the situation of a population at a given time. The main objective of descriptive and quantitative investigations is to describe the characteristics of a certain population or phenomenon or to establish a relationship between variables, using standardized data collection techniques such as questionnaires and systematic observation<sup>13</sup>.

The study site was a teaching hospital, located in Northeastern Brazil (in the municipality of Aracaju, state of Sergipe). This hospital provides medium and high complexity care, is considered medium-sized, and is affiliated with the Brazilian public health system (*Sistema Único de Saúde* – SUS). It has 109 hospital beds, distributed in medical, surgical, and pediatric clinics, SCs, and intensive care units.

The observation unit was the SC, which has five operating rooms (ORs), though only four are in use, a post-anesthesia care unit (PACU) with five beds, and a room for admission and preparation. On average, this unit performs 176 elective surgeries of different specialties per month.

The target population of the study consisted of 192 health professionals: 6 nurses, 26 nursing technicians, 34 surgeons, 42 anesthetists, 9 anesthesiology residents, and 75 surgery residents. However, the sample comprised 100 professionals. The sampling of this research was non-probabilistic and intentional.

The sample size was estimated as  $n \times$  number of items, with  $n$  being the elected number of participants and “number of items” being the number of items in the research instrument. To obtain an ideal sample size for this study, five participants were chosen per each responded item, whose instrument consisted of 20 items. Hence, the sample of this research comprised 100 professionals working in the SC, which corresponds to an adequate sample, according to Mokkink<sup>14</sup>.

Inclusion criteria for the sample were: being assigned to the SC, agreeing to participate in the research by signing an informed consent form, and being present in the sector at the time of data collection. Exclusion criteria were: health-care professionals of the SC who work on the night shift and who were on vacation, leave of absence, day off or absent during the period of data collection.

Researchers conducted the interviews in the morning and afternoon shifts, from Monday to Friday, between June and July 2019. To that end, the authors prepared a structured questionnaire containing 20 closed-ended questions, distributed into surgical scrubs, surgical cap, disposable shoe covers, surgical mask, surgical gown, surgical gloves, and safety glasses. For the last three items, the collection was restricted to surgeons, surgery residents, and scrub technicians, and the last item included circulating technicians. The questionnaire was based on the guidelines of AORN, SOBECC, and the World Health Organization (WHO) as well as on scientific articles. Variables for each item were categorized as adequate, inadequate, and not applicable. Initially, the pilot test was administered, and the observed inconsistencies were corrected and reapplied.

Two systematic and indirect observations were made to avoid causing embarrassment, from the professional's arrival at the SC for donning the surgical attire to their exit. A researcher conducted each round of observation on different days and per professional category, in order to verify data reliability.

Collected data were compiled into a Microsoft Office Excel (version 2007) database, using the CONT.SE function. The

researchers performed double data entry to minimize the possibility of errors. Next, we conducted a data analysis by absolute frequencies and simple percentage. We present the results in tables for better visualization. They were analyzed and discussed according to relevant and updated literature.

The development of the study complied with the ethical standards and procedures for research with human beings and was approved by the Research Ethics Committee, CAAE no. 68030317.4.0000.5546, under opinion number: 2,099,033.

## RESULTS

A total of 100 professionals participated in the study, corresponding to 52.08% of the population. The sample consisted of 25 surgeons, 24 surgery residents, 4 anesthesiology residents, 15 anesthetists, 6 nurses, and 26 nursing technicians, with 20 circulating and 6 scrub technicians.

The mean age of the research subjects was 38.4 years – surgeons, 44.72 years; residents, 29.32 years; anesthetists, 42.8 years; nurses 35.5 years; and nursing technicians, 38.84 years.

Regarding gender, we observed a similar percentage between men and women, corresponding to 59 (59%) and 41 (41%), respectively.

We identified greater adequacy for donning disposable shoe covers and gloves (100% each), followed by places where professionals circulate with surgical scrubs and donning the surgical cap (99%), a percentage similar to that of donning the surgical gown and the way of tying the gown (96%). In contrast, items of highest inadequacy were the use of safety glasses (95%), the proper place for keeping surgical masks (92%), surgical cap model (64%), and surgical cap coverage (35%) (Table 1).

By analyzing the use of surgical attire per professional category, we found that surgeons, residents, nurses, and nursing technicians showed 100% adequacy regarding the following items: places where professionals circulate with surgical scrubs and donning the surgical cap, disposable shoe covers, and gloves. Among these items, the category of anesthetists was 100% adequate only when donning disposable shoe covers (Table 2).

We found the highest rates of inadequacy, in all professional categories, in the non-use of safety glasses and the surgical cap not fully covering the scalp, with a prevalence of surgeons and anesthetists (64 and 47%, respectively). Noteworthy, nurses and anesthetists showed 100% inadequacy concerning the proper place for keeping surgical masks (Table 2).

Regarding the general adequacy in the use of surgical attire per professional category, we found higher rates of

**Table 1.** Use of surgical attire according to adequacy and inadequacy criteria.

Items		Number	Adequate (%)	Inadequate (%)	Total (%)
Surgical scrubs	Circulation	100	99	1	100
	Size	100	87	13	100
Surgical cap	Donning	100	99	1	100
	Coverage	100	65	35	100
	Model	100	36	64	100
Disposable shoe covers	Donning moment	100	100	0	100
	Model	100	78	22	100
Surgical mask	Coverage	100	75	25	100
	Environment of use	100	91	9	100
	Change	100	78	22	100
	Place for keeping it	100	8	92	100
Surgical gown*	Donning	100	96	4	100
	Change	100	87	13	100
	Way of tying the gown	100	96	4	100
	Donning moment	100	84	16	100
	Size	100	93	7	100
Surgical glove*	Size	100	94	6	100
	Change	100	91	9	100
	Donning moment	100	100	0	100
Safety glasses**	Environment of use	100	5	95	100

\*Surgical gown, surgical glove, and safety glasses used by surgeons, scrub technicians, and surgery residents; \*\*safety glasses include circulating technicians.

**Table 2.** Use of surgical attire per professional category, according to adequacy and inadequacy criteria.

Professional category	Adequacy n=100 (%)	Surgeon				Anesthetist				Resident				Nurse				Nursing technician			
		n	A	I	T	n	A	I	T	n	A	I	T	n	A	I	T	n	A	I	T
Surgical scrubs	Circulation	25	100%	0%	100%	15	93%	7%	100%	28	100%	0%	100%	6	100%	0%	100%	26	100%	0%	100%
	Size	25	80%	20%	100%	15	93%	7%	100%	28	89%	11%	100%	6	50%	50%	100%	26	96%	4%	100%
Surgical cap	Donning	25	100%	0%	100%	15	93%	7%	100%	28	100%	0%	100%	6	100%	0%	100%	26	100%	0%	100%
	Coverage	25	36%	64%	100%	15	53%	47%	100%	28	68%	32%	100%	6	67%	33%	100%	26	69%	31%	100%
	Model	25	16%	84%	100%	15	20%	80%	100%	28	32%	68%	100%	6	83%	17%	100%	26	58%	42%	100%
Disposable shoe covers	Donning moment	25	100%	0%	100%	15	100%	0%	100%	28	100%	0%	100%	6	100%	0%	100%	26	100%	0%	100%
	Model	25	92%	8%	100%	15	87%	13%	100%	28	82%	18%	100%	6	67%	33%	100%	26	58%	42%	100%
Surgical mask	Coverage	25	92%	8%	100%	15	33%	67%	100%	28	82%	18%	100%	6	50%	50%	100%	26	81%	19%	100%
	Environment of use	25	92%	8%	100%	15	73%	27%	100%	28	96%	4%	100%	6	83%	17%	100%	26	96%	4%	100%
	Change	25	80%	20%	100%	15	73%	27%	100%	28	79%	21%	100%	6	100%	0%	100%	26	73%	27%	100%
	Place for keeping it	25	92%	8%	100%	15	0%	100%	100%	28	18%	82%	100%	6	0%	100%	100%	26	4%	96%	100%
Surgical gown	Donning	25	96%	4%	100%	NA	NA	NA	NA	24	96%*	4%*	100%	NA	NA	NA	NA	6	100%**	0%**	100%
	Change	25	84%	16%	100%	NA	NA	NA	NA	24	92%*	8%*	100%	NA	NA	NA	NA	6	83%**	17%**	100%
	Way of tying the gown	25	96%	4%	100%	NA	NA	NA	NA	24	100%*	0%*	100%	NA	NA	NA	NA	6	83%**	17%**	100%
	Donning moment	25	96%	4%	100%	NA	NA	NA	NA	24	71%*	29%	100%	NA	NA	NA	NA	6	83%**	17%**	100%
	Size	25	96%	4%	100%	NA	NA	NA	NA	24	96%*	4%*	100%	NA	NA	NA	NA	6	67%**	33%**	100%
Surgical glove	Size	25	100%	0%	100%	NA	NA	NA	NA	24	87%*	13%	100%	NA	NA	NA	NA	6	100%**	0%**	100%
	Change	25	88%	12%	100%	NA	NA	NA	NA	24	92%*	8%*	100%	NA	NA	NA	NA	6	100%**	0%**	100%
	Donning moment	25	100%	0%	100%	NA	NA	NA	NA	24	100%*	0%*	100%	NA	NA	NA	NA	6	100%**	0%**	100%
Safety glasses	Environment of use	25	8%	92%	100%	NA	NA	NA	NA	24	8%*	92%*	100%	NA	NA	NA	NA	26	0%	100%	100%

\*Rates refer to surgery residents; \*\*numbers refer to scrub technicians; A: adequate; I: inadequate; NA: not applicable; n: absolute number; T: total.

inadequacy in the following order: anesthetists (35%), nurses (27%), and nursing technicians (22%) (Table 2).

We analyzed the items of the variables disposable shoe covers, surgical mask, surgical gown, and surgical gloves to understand the issue better (Table 3).

We observed that the most inadequate item of disposable shoe covers consisted of footwear with holes, with predominant use by the categories: scrub technicians (50%), circulating technicians (40%), and nurses (33%) (Table 3).

**Table 3.** Items of surgical attire representing adequacies and inadequacies, per professional category.

Analyzed items				Professional category													
				Surgeon		Anesthetist		Surgery resident		Anesthesiology resident		Nurse		Circulating technician		Scrub technician	
				n	x (%)	n	x (%)	n	x (%)	n	x (%)	n	x (%)	n	x (%)	n	x (%)
Disposable shoe covers	Model	Adequate	Disposable shoe covers	25	80	15	73	24	75	4	50	6	50	20	45	6	33
			Footwear without holes	25	12	15	13	24	8	4	25	6	17	20	15	6	17
		Inadequate	Footwear with holes	25	8	15	13	24	17	4	25	6	33	20	40	6	50
			Does not use them	25	0	15	0	24	0	4	0	6	0	20	0	6	0
Surgical mask	Coverage	Adequate	Full coverage throughout the surgery	25	92	15	33	24	87	4	50	6	50	20	75	6	100
			Partial coverage at the beginning or the end	25	4	15	27	24	0	4	0	6	17	20	5	6	0
		Inadequate	Partial coverage throughout the surgery	25	4	15	33	24	13	4	50	6	33	20	20	6	0
			Does not use it	25	0	15	7	24	0	4	0	6	0	20	0	6	0
	Change	Adequate	Changes it every two hours	25	0	15	0	24	0	4	25	6	0	20	0	6	0
			Changes it when it is dirty/wet	25	0	15	0	24	0	4	0	6	0	20	0	6	0
			NA	25	80	15	80	24	75	4	75	6	100	20	80	6	67
		Inadequate	Does not change it in the above situations	25	20	15	20	24	25	4	0	6	0	20	20	6	33
Surgical gown	Change	Adequate	Changes it when it is dirty/wet	25	4	NA	NA	24	0	NA	NA	NA	NA	NA	NA	6	0
			Changes it when it is contaminated	25	0	NA	NA	24	4	NA	NA	NA	NA	NA	NA	6	0
			NA	25	80	NA	NA	24	88	NA	NA	NA	NA	NA	NA	6	83
		Inadequate	Does not change it when it is contaminated	25	0	NA	NA	24	4	NA	NA	NA	NA	NA	NA	6	17
			Does not change it when it is dirty/wet	25	16	NA	NA	24	4	NA	NA	NA	NA	NA	NA	6	0
			Changes it after two hours	25	4	NA	NA	24	12	NA	NA	NA	NA	NA	NA	6	0
Surgical glove	Change	Adequate	Changes it when it is punctured	25	8	NA	NA	24	0	NA	NA	NA	NA	NA	NA	6	33
			NA	25	76	NA	NA	24	76	NA	NA	NA	NA	NA	NA	6	0
			Does not change it when S>2 hours	25	12	NA	NA	24	12	NA	NA	NA	NA	NA	NA	6	67
		Inadequate	Does not change it when it is punctured	25	0	NA	NA	24	0	NA	NA	NA	NA	NA	NA	6	0

\*S: surgery; \*\*NA: not applicable; n: absolute number; x: variable.

With respect to the use of surgical masks, we identified the highest rates of inadequacy in anesthetists (67%), who presented partial coverage at the beginning or end of surgery (27%), partial coverage throughout the surgical procedure (33%), and non-use of the surgical mask (7%), followed by nurses (50%). As to the periodicity for changing the surgical mask, we detected the highest rates of inadequacy among scrub technicians (33%), surgery residents (25%), and surgeons (20%) (Table 3).

Regarding the recommended intervals for changing the surgical gown, we found no changes made by scrub technicians, surgeons, and surgery residents in 17, 16, and 8% of the surgeries, respectively (Table 3).

Concerning the change of surgical gloves, which must be performed two hours after the beginning of surgery and in case of perforation, we identified the highest percentages of inadequacy in the following categories: 67% among scrub technicians, 12% among surgery residents, and 12% among surgeons (Table 3).

## DISCUSSION

The use of surgical attire is important because it creates a microbiological barrier against the penetration of microorganisms directly into the patients' surgical site, which may come from patients themselves, the professionals involved in the surgery, and equipment, among others<sup>9,10,15</sup>.

The size of surgical scrubs is adequate when it fully covers the waist and lower limbs, avoiding the exposed area<sup>10,15,16</sup>. In our study, we found that 87% of the observations were adequate (Table 1). This finding is relevant, since the use of surgical scrubs is one of the most effective tools in preserving the health and physical integrity of healthcare professionals, thus assisting in preventing contamination. Therefore, its incorrect use may affect this process<sup>6</sup>.

Regarding the surgical cap, according to the scientific literature, it must fully cover the scalp, have an elastic opening, and it can be made of reusable cotton or *Spunbond Meltblown Spunbond* (SMS) fabric, i.e., single-use non-woven fabric<sup>2,12,15</sup>. Over half (65%) of healthcare professionals properly covered their heads. We found similar rates of inadequacy in relation to the surgical cap model used (Table 1). A study carried out in a teaching hospital in the city of Belo Horizonte (state of Minas Gerais, Brazil)<sup>7</sup> found a different result – the use of surgical cap was inadequate about nine times less than in our study.

Surgical masks must completely cover the nose, mouth, and cheeks, and should be kept in the pocket of the surgical scrubs. Putting the mask on the neck is inappropriate, as it can lead to early exposure to bacterial colonization<sup>6,12</sup>. Its use is mandatory when entering the operating room and the toilet<sup>2,15</sup>. The use of surgical masks in places where it is mandatory was adequate and performed, in our research, by 91% of the professionals (Table 1), corroborating a study that evaluated adherence to measures to prevent SSI in the SC of a public hospital<sup>7</sup>. Good adherence to the use of surgical masks may be justified because there are no controversies regarding its effectiveness in controlling infections.

The surgical gown should fully cover the torso from the neck, upper limbs up to the wrists, and lower limbs up to the knees, allowing freedom of movement. It must be used by surgeons, surgery residents, and scrub technicians right after the degermation and drying of the hands, and must be worn until the end of the surgery and changed in case of contamination or whenever wet or dirty<sup>10,15</sup>. In this regard, most of the participants properly used the item, accounting for almost all of the observations concerning donning the gown, the way of tying it, its size, and changing the gown (Table 1). These results are similar to those observed in a study<sup>7</sup> in which the entire surgical team properly used the surgical gown.

Surgical gloves must be of good quality as to flexibility, impermeability, and resistance to surgical duration and movements. Therefore, they must be made of latex, sterilized, disposable, and replaced whenever they are punctured and in long surgeries<sup>6,10,15</sup>. This item presented the highest rates of adequacy in relation to its timely change and donning, close to all observations (Table 1). These results corroborate a study that found 100% adequacy in the correct use of gloves<sup>7</sup>. This finding is extremely relevant, since, as reported by some authors<sup>12,17</sup>, the use of sterile surgical gloves is a paramount measure for preventing SSI, acting as a physical barrier for microorganisms present in the hands of healthcare professionals, in the environment, and in patients. Furthermore, integrity failure enables the transfer of microorganisms, doubling the risk of SSI.

The use of safety glasses is indicated for occupational protection, since they prevent direct contact of the eyes with the patients' exudates<sup>10,15,18</sup>. Nevertheless, we have observed resistance to adherence, probably because they reduce visual acuity and for the fogging of the lens due to breathing<sup>10,15</sup>. When selecting safety glasses, professionals must consider the presence of wide visors made of acrylic or glass and face

shields against fluids<sup>15</sup>. The lack of supply of this PPE, as determined by the legislation in force, might justify the fact that this item presented the lowest adherence rate (Table 1) among all items of surgical attire, corroborating the study conducted by Freiburger et al.<sup>18</sup>

Scrub shoes and disposable shoe covers create barriers against pathogenic organisms present in footwear. Their relevance in controlling SSI lies in the likelihood of hand contamination when touching the shoes<sup>15</sup>. Currently, their mandatory use is controversial, since they do not prevent environmental contamination and can transfer microorganisms to the hands of workers when they touch their feet to remove their shoes and do not wash them straightaway<sup>12,19</sup>. Thus, according to some authors<sup>9,12</sup>, disposable shoe covers should not be considered an environmental protection barrier, since their use only prevents the shoes from being soiled by blood and other bodily fluids.

In our study, this PPE had the highest adequacy rate (100%) in all categories (Table 1). It is noteworthy that the PPE with the best adequacy was precisely the one with no evidence of effectiveness in preventing infections. Different results were obtained in a study with lower usage rates<sup>7</sup>, probably because the professionals were aware of the lower importance of disposable shoe covers due to controversies in relation to their effectiveness in preventing surgical infections.

After analyzing the adequacy/inadequacy of surgical attire per professional category, the use of safety glasses and surgical masks had the highest rates of inadequacy. Regarding the first, we found rates of inadequacy in surgeons (92%), surgery residents (92%), and scrubs technicians (100%) (Table 1). Although the use of safety glasses by surgeons, surgery residents, scrub technicians, and, sometimes, by circulating technicians and anesthetists (when there is a risk of splashing) is recommended from the beginning to the end of the surgery, our results stand out because this item had the highest percentage of inadequacy (about 100%) in all categories<sup>15</sup>. Our results were similar to those of other studies<sup>7,18,20</sup>, which proves the difficulties of the surgical team in adhering to the use of safety glasses.

The PPE with the second-highest rate of inadequacy per professional category was the surgical mask regarding the proper way of using it. We found that anesthetists (67%) and nurses (50%) had the highest rates of inadequacy in the observed situations (Table 1). The result is concerning, given that, according to the literature<sup>2</sup>, the proper use of surgical mask is an effective measure in the control of surgical infections. Studies<sup>7,12</sup> with much higher adherence to the correct

use of surgical masks, when compared with our research, presented different results.

We highlight as adequate the circulation of professionals wearing surgical scrubs, the size and the moment of donning the surgical glove by surgeons, residents, and nursing technicians. This finding is significant, since, according to the literature, surgical gloves must be put on close to the start of surgery and after donning the gown, thus reducing exposure to microorganisms<sup>21</sup>.

As for the characterization of the main items of surgical attire (surgical gloves and masks), the correct change of gloves occurred mainly in cases of perforation and surgeries lasting more than two hours and were made by surgeons, surgery residents (88% each), and scrub technicians (33%) (Table 3). Authors of another study found a divergent result, with a higher percentage of changes made by surgeons, followed by nursing assistants and scrub technicians in equal percentages<sup>7</sup>. We underline a study<sup>17</sup> that pointed out the importance of evaluating the quality of the products, since tests performed on surgical gloves did not present risk of perforations.

With respect to the mandatory change of surgical masks in surgeries lasting more than two hours and when they are wet and dirty, no changes were made by scrub technicians in 33% of the observations; by surgery residents in 25%; and by surgeons in 20% (Table 3). Despite the low rates of inadequacy, they are nonetheless significant, considering their importance as microbiological barriers<sup>2</sup>.

Finally, the use of PPE and its low adherence among healthcare professionals in invasive procedures still represent a behavior that directly or indirectly influences the safety of the professional and, especially, of the patient, posing risks to them<sup>20</sup>.

In this sense, among the tasks performed by healthcare professionals working in surgery to prevent factors related to this procedure, researchers include adequate surgical attire<sup>7</sup> and the importance of its use as a means to reduce infection rates<sup>12</sup>. Therefore, within the surgical team, nurses must have a prominent role as relevant agents in providing safe care, as well as guiding and supervising the use of surgical attire.

The limitations of our study involved those traditionally related to observational research. In this specific case, we can mention: the period of observation of surgical procedures, since some surgeries lasted less than two hours, cancellation of surgeries, and shortage of material resources.



## CONCLUSION

After analyzing the data, we can infer that most, 18 out of a total of 20 (90%), surgical attire items showed percentages of adequacy ranging from 5 to 100%. We highlight donning the surgical glove and disposable shoe covers, with 100% adequacy, while the lowest rates corresponded to the use of safety glasses (5%) and the proper place for keeping the surgical masks (8%).

The professional categories with the highest rates of inadequacy were anesthetists (35%), nurses (27%), and nursing technicians (22%).

Moreover, we concluded that, although most of the observed items had percentages equal to and over 75% of adequacy, others had percentages deemed very low (5 and 8%). Hence, rates must be urgently improved in order to provide surgical patients with increasingly safer care.

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# EVALUATION OF THIRST DIMENSIONS IN ORTHOPEDIC SURGICAL PATIENTS

*Avaliação das dimensões da sede no paciente cirúrgico ortopédico*

*Evaluación de las dimensiones de la sede en pacientes quirúrgicos ortopédicos*

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**ABSTRACT: Objective:** To evaluate thirst dimensions (presence, intensity, and discomfort) in orthopedic surgical patients in the immediate postoperative period. **Method:** Cross-sectional, exploratory, and descriptive research with a quantitative approach. The sample consisted of 98 patients over the age of 18. A semi-structured form was used, including sociodemographic information and three scales – Visual Analogue Scale (VAS), Verbal Numeric Scale (VNS), and Perioperative Thirst Discomfort Scale (*Escala de Desconforto da Sede Perioperatória*, EDESP) – to characterize thirst. **Results:** Of the 98 evaluated patients, the average age was 47.3±20.1 years, and most of them were men (60.2%). Based on VAS, 65.3% patients reported moderate thirst; as for VNS, 48.0% reported mild thirst; and as for EDESP, 92.9% of patients reported thirst at the time of the interview. Regarding nursing care, we found no documentary record for proving the care provided to reduce thirst. **Conclusion:** There was a high prevalence of thirst in patients during the immediate postoperative period, and no palliative measures were taken to reduce it. We suggest the nursing team to be trained and oriented as for the application of the scales used in the present study.

**Keywords:** Thirst. Postoperative period. Perioperative nursing. Perioperative care.

**RESUMO: Objetivo:** Avaliar as dimensões da sede (presença, intensidade e desconforto) no paciente cirúrgico ortopédico no período pós-operatório imediato. **Método:** Pesquisa transversal, de caráter exploratório, descritivo, com abordagem quantitativa. A amostra foi composta de 98 pacientes com idade acima de 18 anos. Foi utilizado formulário semiestruturado contemplando informações sociodemográficas e três escalas — escala visual analógica (EVA), escala verbal numérica (EVN) e escala de desconforto da sede perioperatória (EDESP) — para caracterização da sede. **Resultados:** Dos 98 pacientes avaliados, a idade média foi de 47,3±20,1 anos, e a maioria era do sexo biológico masculino (60,2%). Com base na EVA, 65,3% relataram sede moderada; já na avaliação da sede pela EVN, 48,0% relataram sede leve; e pela EDESP, 92,9% dos pacientes relataram sede na ocasião da entrevista. No que concerne à assistência de enfermagem, não foi encontrado nenhum registro documental que comprovasse a assistência prestada para a diminuição da sede. **Conclusão:** Houve alta prevalência da sede nos pacientes durante o pós-operatório imediato e não foi realizada nenhuma medida paliativa para sua redução. Sugere-se que a equipe de enfermagem seja capacitada e orientada quanto à aplicação das escalas utilizadas neste estudo.

**Palavras-chave:** Sede. Período pós-operatório. Enfermagem perioperatória. Assistência perioperatória.

**RESUMEN: Objetivos:** Evaluar las dimensiones de la sed (presencia, intensidad y malestar) en el paciente quirúrgico ortopédico en el postoperatorio inmediato. **Método:** Investigación transversal, exploratoria, descriptiva con enfoque cuantitativo. La muestra consistió en 98 pacientes mayores de 18 años. Para caracterizar la sed se utilizó una forma semiestructurada que contenía información sociodemográfica y tres escalas (Escala visual analógica-EVA, Escala numérica verbal-ENV y Escala de incomodidad de la sed en el período perioperatorio-EDESP). **Resultados:** De los 98 pacientes evaluados, la edad media fue de 47,3±20,1 años; la mayoría del sexo biológico masculino (60,2%). Según la EVA, el 65,3% reportó sed moderada; por otro lado, la evaluación de sed de ENV, 48,0% reportó sed leve y por EDESP, 92,9% de los pacientes reportaron sed al momento de la entrevista. Con respecto al cuidado de

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enfermería, no se encontró ningún registro documental que probara la asistencia brindada para disminuir la sed. **Conclusión:** Hubo una alta prevalencia de sed en pacientes durante el postoperatorio inmediato y no se tomaron medidas paliativas para reducirla. Se sugiere que el equipo de enfermería esté capacitado y orientado sobre la aplicación de las escalas utilizadas en este estudio.

**Palabras clave:** Sed. Periodo posoperatorio. Enfermería perioperatoria. Atención perioperatoria.

## INTRODUCTION

Thirst means the excessive desire to drink water, which patients in the immediate postoperative period (IPP) are unable to visibly express, and may go unnoticed by healthcare professionals<sup>1,2</sup>. The prevalence of thirst in the IPP can reach up to 81.3% when patients are still fasting<sup>3</sup>.

The main factors that lead to thirst in patients in the IPP are: prolonged fasting, anesthetic procedure, anxiety, bleeding during the surgical procedure, drugs used during the anesthetic procedure, pain, nervousness related to the duration and type of surgery, among others<sup>4</sup>.

In the perioperative period, thirst can be a dominant symptom, overcoming even pain, and result in dehydration, anxiety, and distress. The signs and symptoms most reported by patients are thick saliva, dry tongue and lips, bad taste in the mouth, dry throat, desire to swallow, feeling of suffocation, and weakness<sup>5</sup>.

Because it is a subjective and multifactorial symptom, it is necessary to assess thirst in its entirety. There are several ways for assessing or measuring thirst, such as with the Visual Analogue Scale (VAS), Faces Pain Scale (FPS), Verbal Numeric Scale (VNS), and the Likert-type scale – used for evaluating patients who undergo surgeries, and which was denominated Perioperative Thirst Discomfort Scale (*Escala de Desconforto da Sede Perioperatória* – EDESP). These instruments are used to assess pain in different populations<sup>2,5,6</sup>.

Thirst dimensions aim at enabling healthcare professionals to take actions for the management and relief of thirst. According to authors of experimental studies, a decrease in the intensity of thirst was found with the application of ice to hydrate lips, and also with the use of mint candies, which have been shown to promote a sensation of freshness and relief of such symptom<sup>7,8</sup>.

## OBJECTIVE

To evaluate thirst dimensions, including its presence, intensity, and discomfort in orthopedic surgical patients in the IPP.

## METHOD

This is a cross-sectional, exploratory, descriptive study, with a quantitative approach carried out from July 5 to August 5, 2018 in the post-anesthesia care unit (PACU) of a hospital for urgency and emergency care located in Campina Grande City, Paraíba State, Brazil. The hospital exclusively serves patients from the Brazilian Unified Health System (SUS), accounting for 292 beds, and a surgical center (SC) with 6 operating rooms. In the PACU there are 7 beds, which is in accordance with the rules of the Board Resolution no. 50/2002<sup>9</sup>.

The definition of the sample size was based on the number of orthopedic surgical procedures performed at *Hospital de Emergência e Trauma* [Hospital for Trauma and Emergencies] (170 elective surgeries/month), considering a prevalence of 81.3% of thirst in the IPP<sup>8</sup>. Thus, sample size was calculated by using the Epi Info™ calculator, adopting a 95% confidence level, and 98 patients were needed to obtain a representative sample.

The inclusion criteria were patients over 18, of both sexes; who were SUS users, had undergone orthopedic surgery, and presented good visual acuity and good oral communication to spontaneously verbalize their thirst when applying the VNS and VAS scales. Those who did not have clinical and psychological conditions were excluded, because they compromised the application of scales to assess thirst dimension.

Data collection started after obtaining authorization from the nurse responsible for the SC, and it was carried out by the researcher and a guest nurse working in the center, who had been previously trained.

The researcher made the preoperative visit the day prior to the surgery to fill in data from the research form at the surgical ward of the hospital. The form included data on patients and their sociodemographic profile for the better characterization of the sample.

Variables of sociodemographic characteristics were evaluated as follows: skin color (classified as white and

non-white); age (analyzed as a continuous variable and later categorized into less than 60 years old and  $\geq 60$  years old); biological sex (male or female); and place of residence (city of origin).

To measure thirst, we used VNS for recording its intensity in numerical values, which ranged from 0 to 10, in which 0 indicates no thirst, and 10, intense thirst. The application of this scale was verbalized to the patients, demanding good cognitive skills from them.

Concerning VAS, we adopted it for patients who had good visual acuity to identify the level of their thirst according to the scale classification, in which 0 indicates “not at all” and 10, “extremely thirsty.” The scale was interpreted as follows: if there was no thirst at all, the classification would be 0; if there was moderate thirst, the classification would be 5; and if the thirst was extreme, the classification would be 10.

Regarding the three-point Likert scale (EDESP), it was interpreted as follows: the final score 0 indicated “not bothered,” the score 1 indicated “slightly bothered,” and 2 indicated “very bothered,” in order to achieve a score from 0 to 14, 14 being equivalent to the most intense discomfort related to thirst.

In addition, we used the surgical procedure record book available in the SC, from which we collected the information required to fill in the research form, such as previous fasting time, surgery duration, type of anesthesia, presence or absence of venoclysis, and presence of comorbidities. Furthermore, there was also a search for records of the patients’ clinical evolution in their own medical record, such as information on thirst after surgery and nursing care provided to the patient when verifying this discomfort.

Regarding data analysis, the program Statistical Package for the Social Sciences version 22.0 was used, considering a probability of less than or equal to 5% for rejecting the null hypothesis or the non-association in all analyses.

Initially, a descriptive analysis of the sample was performed, using mean and standard deviation to assess age and the absolute and relative frequencies of categorical variables. For analysis purposes, age was classified into two groups: less than 60 years old and  $\geq 61$  years old.

The study followed the standards of Resolution No. 466/2012 of the National Health Council, which provides the guidelines that regulate research involving human beings<sup>10</sup>. The project was submitted to the CESED Ethics Committee, having approval on July 3, 2018, under Opinion No. 2.751.250 and

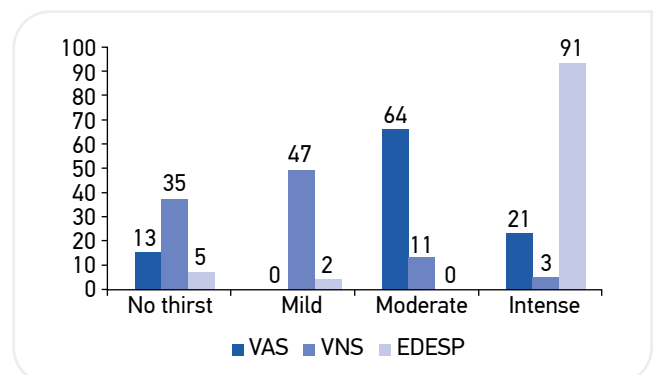
Certificate of Presentation for Ethical Appreciation 90721418.6.0000.5175.

We could read the Informed Consent Form and the Researchers’ Term of Commitment to the patients, both written in a language compatible with the subjects’ understanding. Moreover, patients were guaranteed freedom not to participate in or to withdraw from research, as well as privacy, confidentiality, and anonymity.

## RESULTS

We analyzed 98 patients in IPP of orthopedic surgeries, from July 5 to August 5, 2018. The average age was  $47.3 \pm 20.1$  years, with great variation, with a minimum of 18 and a maximum of 105 years old; 30 patients (30.6%) were older than 60. Of the total, we verified a predominance of male patients (60.2%), from neighboring municipalities of Campina Grande (60.2%), non-white skin color (72.4%), and with an average of  $3.1 \pm 2.4$  years of education.

Regarding the evaluation of thirst dimensions (Figure 1), based on VAS, 65.3% (n=64) reported moderate thirst, whereas 21.4% indicated they were extremely thirsty. As for the VNS evaluation of thirst, 48.0% (n=47) of the patients reported mild thirst. Concerning EDESP, 92.9% (n=91) of patients reported they were thirsty at the time of the interview. It is worth noting this discomfort so that relief measures are taken. In Table 1 we describe the distribution of parameters assessed with the EDESP scale.



**Figure 1.** Evaluation of thirst dimensions (presence, intensity, and discomfort) in 98 orthopedic surgical patients in the immediate postoperative period, by applying the Visual Analog Scale (VAS), the Verbal Numeric Scale (VNS), and the Perioperative Thirst Discomfort Scale (EDESP).

**Table 1.** Parameters evaluated for 98 orthopedic surgical patients attended at Hospital de Emergência e Trauma de Campina Grande (Paraíba State), Brazil, using the Perioperative Thirst Discomfort Scale.

Evaluated Aspect	n	%
Patient is thirsty		
Yes	91	92.9
No	7	7.1
Spontaneous complaint		
Yes	3	3.1
No	95	96.9
Dry mouth		
Not bothered	14	14
Slightly bothered	56	57.1
Very bothered	28	28.6
Dry lips		
Not bothered	21	21.4
Slightly bothered	55	56.1
Very bothered	22	22.4
Thick tongue		
Not bothered	67	68.7
Slightly bothered	27	27.6
Very bothered	4	4.1
Thick saliva		
Not bothered	42	42.9
Slightly bothered	48	49.0
Very bothered	8	8.2
Dry throat		
Not bothered	17	17.3
Slightly bothered	45	45.9
Very bothered	26	36.7
Bad taste in the mouth		
Not bothered	31	31.6
Slightly bothered	38	38.8
Very bothered	29	29.6
Desire to drink water		
Not bothered	12	12.2
Slightly bothered	31	31.6
Very bothered	55	56.1

We evaluated the presence of thirst by the two scales, VAS and VNS, with a prevalence of 86.7 (n=85) and 64.2% (n=61), respectively, and an average between the two scales of 75.4 % (n=73). The relation between VNS, VAS, and EDESP scales is satisfactory for assessing thirst; VNS and VAS, for assessing intensity; and EDESP, for assessing patients' discomfort in the IPP.

The scale used for evaluating thirst discomfort, EDESP, is a recently created instrument; therefore, studies on the scale still lack, which makes it difficult to compare the used data. It is an instrument used for evaluating the measurement of thirst in addition to its intensity, and it has been positively contributing to thirst relief<sup>6</sup>.

Considering data presented in Table 1, we found that 92.9% of patients were thirsty in the IPP; among them, 96.9% did not report having spontaneous complaints.

Regarding signs and symptoms of thirst, patients reported they were slightly bothered as to dry mouth (57.1%), followed by dry lips (56.1%). In the item for assessing the issue of thick tongue, the prevalence was 68.7% of patients, who reported not feeling bothered. However, 49% reported having thick saliva, feeling slightly bothered by this symptom; 38.8% of the patients said they were slightly bothered concerning the bad taste in their mouths; and, in relation to the desire to drink water, there was a predominance of 56.1% who were very bothered. According to the patients' responses, dry mouth and thick tongue consisted in the EDESP items that most bothered them.

## DISCUSSION

Our data were like those of a study whose authors obtained a 74.6% prevalence of male patients in orthopedic surgeries<sup>8</sup>. This prevalence is due to the fact that the hospital where research was carried out serves many patients of trauma, which mostly result from traffic accidents, affecting more male individuals. Corroborating this statement, researchers of another study showed that injuries from traffic accidents are among the main causes of hospital admissions<sup>11</sup>.

Regarding the age group, our research was compatible with those from such study, in which the average age of participants was 41.5 years. However, there was a divergent prevalence as for sex, considering that there was a predominance of women (63.7%) in the aforementioned study due

to the most performed type of surgery – gynecological and obstetric procedures (31.8% )<sup>12</sup>.

Our results (Table 1) agree with that of other studies, whose authors show a high prevalence of thirst (81.3%)<sup>3</sup>. The “dry mouth” item also had a high prevalence in another study, accounting for 87.3% of patients<sup>12</sup>.

We assessed thirst dimensions in the first six hours of the IPP at the PACU. Thus, in an observational way, we verified the care provided by nurses to patients under this condition, because, when analyzing the patients’ clinical evolution in their own medical records, we identified failure in recording such care.

After applying the scales, some patients reported intense thirst, in such a way we called a member of the nursing team to perform relief measures, according to the needs of each patient. As alternatives, the use of ice chips in contact with the patient’s lips and/or gargling with ice water have been suggested, because they refresh the mouth and consist in low-cost practices that could contribute to positive results<sup>13</sup>. Nonetheless, the adoption of such measures was unsuccessful: the nursing team reported that none of these practices were part of the PACU routine.

Researchers showed that nursing professionals did not recognize symptoms related to thirst because they were unable to identify it by their patients’ expressions. Hence, evaluating such symptoms was not part of the work routine. Moreover, members of the nursing team also believed that, considering patients were fasting, they could not drink fluids. Therefore, given that there are no protocols for measuring thirst, the nursing team does not take actions for reducing this discomfort and, when any measure is taken, it is not recorded<sup>4</sup>.

In order to change this reality, there is research in the implementation of measures to relieve thirst. Authors of a study used instruments to measure thirst and ice popsicles, with a small volume of liquid, as a strategy to minimize such symptom, and promoted the training of the nursing team to highlight the importance of using protocols for evaluating thirst and strategies to reduce this symptom. The study motivated the nursing team and raised awareness of a humanized care to be provided to patients in IPP. After six months of use and adherence, the study proved to be effective, because patients felt relief in relation to thirst, and the nursing team adhered to the protocol in a positive way<sup>13</sup>.

During research, it was possible to observe that the prolonged fasting time in the preoperative period favored the increase of patients’ thirst. All patients had a minimum fasting time of eight hours, but some even fasted for up to 22 hours.

The use of relief measures in the preoperative period, such as the use of chewing gums, is effective when it comes to discomfort, making it a feasible alternative with good acceptance on the part of patients and presenting a positive response to discomfort<sup>14</sup>. Corroborating these findings, in another study carried out in the PACU, researchers used mentholated resources (lip balms and ice popsicles) for relieving thirst<sup>8</sup>.

Taking this into consideration, there are several ways to attenuate the patient’s thirst; however, paradigms must be broken and the care routine must change, requiring the adherence of the multidisciplinary team, aiming at the well-being and quality of the care provided to surgical patients.

## CONCLUSION

According to the results of our study, most of the 98 patients that comprised the sample are men, of non-white skin color, and reside in the neighboring cities of Campina Grande. Regarding thirst dimensions, we verified a high prevalence in the PACU, where 92.9% of the patients reported this symptom at the time of the interview, according to EDESP. In the evaluation of thirst intensity by VAS, 65.3% had moderate thirst, and in the evaluation by VNS, 48% of the patients indicated having mild thirst.

Considering these findings, the adoption of palliative measures to reduce such discomfort becomes relevant. The multidisciplinary team that provides care to patients during the perioperative period must adopt such measures. It is noteworthy that, during the development of research, we identified no records of care provided for relieving the thirst of patients in the IPP.

Furthermore, training professionals is paramount, as well as the application of the VAS, VNS, and EDESP scales to facilitate the identification of thirst and guide the team in adopting measures for its management, providing comfort and well-being to surgical patients, especially in the IPP.

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# COST OF HEALTHCARE PRODUCTS PROCESSING: AN INTEGRATIVE REVIEW

*Custo de processamento de produtos para saúde: uma revisão integrativa*

*Costo de procesamiento de productos de salud: una revisión integrativa*

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**ABSTRACT: Objective:** To analyze the knowledge produced in the last decade on hospital costs related to the processing of reusable healthcare products (HP) performed in Sterile Processing Departments (SPD) and processing companies. **Method:** Integrative literature review, with searches in the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), Latin American and Caribbean Health Sciences Literature (LILACS), Scopus, and Scientific Electronic Library Online (SciELO). The selected articles were published between 2009 and April 2019. The initial search resulted in 782 articles and, after applying the inclusion and exclusion criteria, the final sample consisted of 15 studies, which were analyzed in full. **Results:** Authors of most studies compared the cost of different technologies employed in the processing of HP to achieve savings, or evaluated the reduction of waste-related expenditures, mainly with the reduction of the size of surgery trays to reduce the processing cost. **Conclusion:** The processing of HP proved to be a measure that promotes economy when properly selecting the technologies involved in the process and avoiding waste.

**Keywords:** Hospital costs. Health management. Economics, nursing. Sterilization.

**RESUMO: Objetivo:** Analisar o conhecimento produzido na última década sobre custos hospitalares relacionados ao processamento de produtos para saúde (PPS) reutilizáveis em Centros de Material e Esterilização (CME) e empresas processadoras. **Método:** Revisão integrativa da literatura, com buscas nas bases de dados Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System On-line (MEDLINE), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Scopus e Scientific Electronic Library Online (SciELO). Os artigos selecionados foram publicados entre 2009 e abril de 2019. A busca inicial resultou em 782 artigos e, após a aplicação dos critérios de inclusão e exclusão, a amostra final compôs-se de 15 estudos, que foram analisados na íntegra. **Resultados:** A maioria dos trabalhos comparou o custo de diferentes tecnologias empregadas no processamento de PPS para obter economia, ou avaliou a redução de gastos com desperdício, principalmente com a diminuição do tamanho de bandejas cirúrgicas para redução de custo com o processo. **Conclusão:** O processamento de PPS mostrou ser medida que gera economia quando se selecionam adequadamente as tecnologias envolvidas no processo e se evitam os desperdícios. **Palavras-chave:** Custos hospitalares. Gestão em saúde. Economia da enfermagem. Esterilização.

**RESUMEN: Objetivo:** Analizar el conocimiento producido, en la última década, sobre los costos hospitalarios relacionados con el procesamiento de productos de salud (PS) reutilizables en los Centros de Materiales y Esterilización (CME) y las empresas de procesamiento. **Método:** revisión integral de la literatura, búsqueda en las bases de datos CINAHL, MEDLINE, LILACS, SCOPUS y SciELO. Los artículos seleccionados se publicaron entre 2009 y abril de 2019. La búsqueda inicial resultó en 782 artículos y, después de aplicar los criterios de inclusión y exclusión, la muestra final consistió en 15 estudios, que se analizaron en su totalidad. **Resultados:** La mayoría de los estudios compararon el costo de diferentes tecnologías utilizadas en el procesamiento de PS para obtener ahorros o evaluaron la reducción de los gastos de residuos, principalmente con la reducción del tamaño de las bandejas quirúrgicas, para reducir el costo del proceso. **Conclusión:** El procesamiento de PS demostró ser una medida que genera ahorros, cuando las tecnologías involucradas en el proceso se seleccionan adecuadamente y se evitan los desperdicios. **Palabras clave:** Costos de hospital. Gestión en salud. Economía de la enfermería. Esterilización.

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## INTRODUCTION

The Sterile Processing Department (SPD) is an integral part of the hospital complex, in addition to being inherent, indispensable, and vital to the healthcare process. It is considered a technical support unit, whose purpose is to provide properly-processed healthcare products (HP) and safe conditions for attending sick and healthy individuals<sup>1</sup>.

Considering the growing increase in healthcare costs, hospital institutions face a constant challenge, which makes it necessary for SPD professionals to acquire knowledge of concepts and techniques related to cost accounting as a tool for resource management<sup>2</sup>.

Cost management is an administrative process, whose focus is to make decisions in order to distribute the available resources in a rational and efficient way. In addition, the aim of this process is to achieve results that meet the purposes of the institution, based on the knowledge of economic analysis, which allows making more assertive decisions<sup>3</sup>.

Waste in the healthcare field aggravates the existing financial difficulties due to scarcity of resources, and is characterized by unnecessary expenditures, by the use of the available resources in an uncontrolled, irrational, and inconsequential way in the production of processes, products, or procedures for assisting the patients<sup>4</sup>.

Thus, at this moment, nurses must have knowledge of hospital costs and thoroughly master the activities that compose the developed work processes, in such a way to improve those that add value to the final product and to eliminate the unnecessary ones, without damages to the quality of the processing result<sup>5</sup>.

Although reducing costs in healthcare services is a difficult task due to the nature of the care provided, healthcare decisions, combined with economic principles, gain more and more prominence when considering the disparity between resources and the growing demands of the population<sup>6</sup>.

Thus, the relevance of the SPD for healthcare quality and costs is highlighted. It is necessary to reflect and economically analyze the costs of HP processed in SPD or in processing companies, in order to outline the planning and decision-making by the nurse manager.

## OBJECTIVE

To analyze the knowledge produced in the last decade on hospital costs related to the processing of reusable HP performed in SPD and processing companies.

## METHOD

This is an integrative literature review study, which was conducted aiming at gathering and synthesizing studies related to the investigated theme. This type of review defines the current knowledge on a specific topic, since it is performed to identify, analyze, and synthesize results from independent publications on the same subject<sup>7</sup>.

In order to confer scientific criticality to this study, such steps were followed: identification of the research problem or question; literature search, which included the definition of inclusion and exclusion criteria of the articles; data evaluation to define information to be extracted from the selected articles; critical analysis of the included studies; and presentation of the integrative review<sup>8</sup>.

Our guiding question was: what is the knowledge produced, according to the literature, on hospital costs related to the processing of reusable healthcare products in SPD and processing companies?

The bibliographic survey was conducted in April 2019 and carried out on the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), based on the EBSCOhost research platform; Medical Literature Analysis and Retrieval System Online (MEDLINE), based on the PubMed platform; Latin American and Caribbean Health Sciences Literature (LILACS); Scopus, from Elsevier; and Scientific Electronic Library Online (SciELO).

Descriptors chosen to conduct the search consisted in terms included in the Health Sciences Descriptors (DeCS) and in the Medical Subject Headings (MeSH) — in Portuguese, Spanish, and English languages — namely: *administração de materiais no hospital / administración de materiales de hospital / materials management, hospital; esterilização / esterilización / sterilization; custos e análise de custo / costos y análisis de costo / costs and cost analysis; and economia da enfermagem / economía de la enfermería / economics, nursing*.

Descriptors were crossed using the Boolean operator “AND” in the following combinations: *materials management, hospital AND sterilization; materials management, hospital AND costs and cost analysis; sterilization AND costs and cost analysis; sterilization AND economics, nursing*. Filters available in the full text and in the Portuguese, English, and Spanish languages were employed.

Articles of the sample consisted in those published in the last 10 years, between 2009 and April 2019, which were

available at no cost, full text, in English, Portuguese, and Spanish, and whose title and/or abstract referred to the theme. Literature reviews, letters, editorials, theses, dissertations, and monographs were excluded.

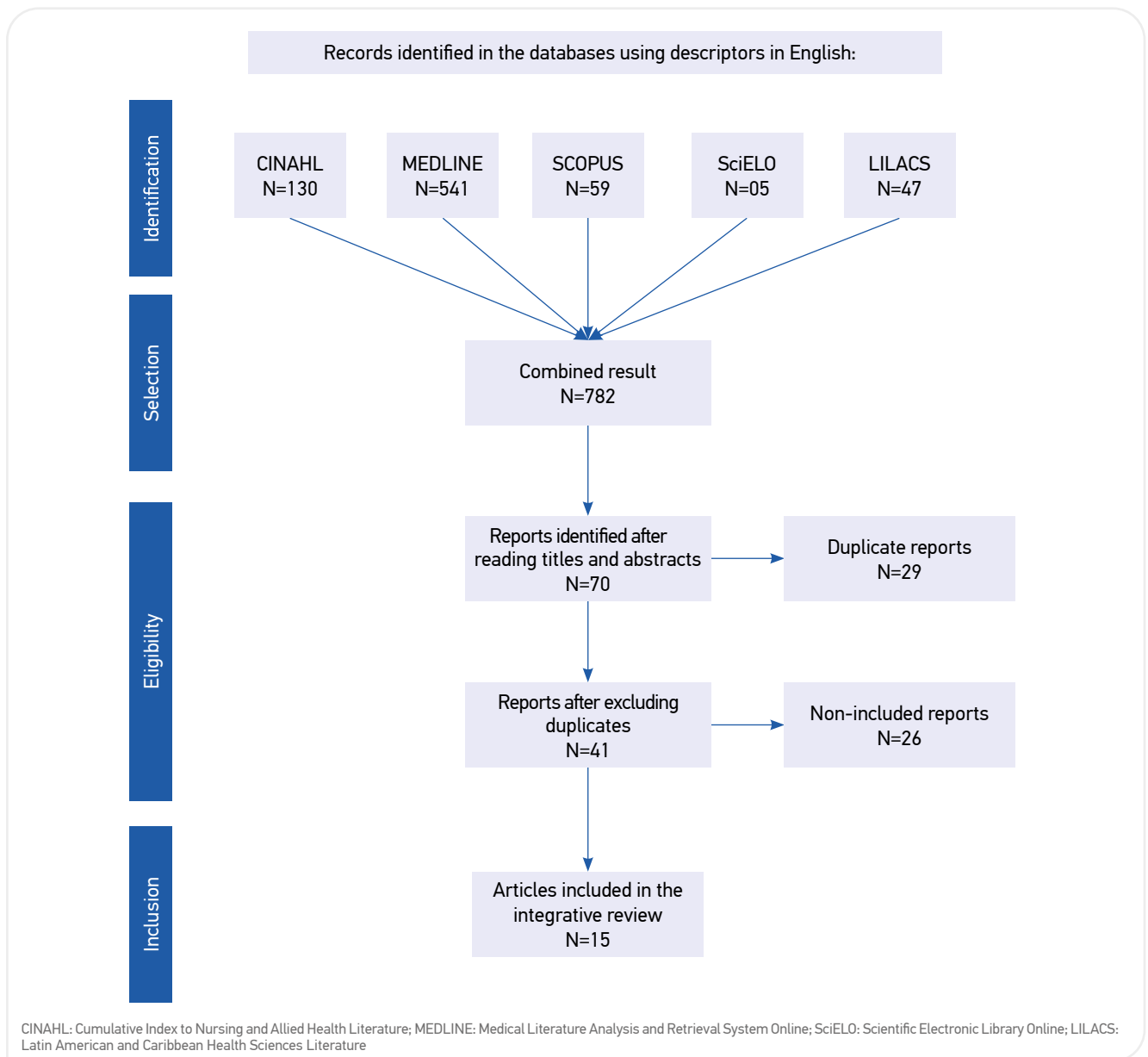
Initially, the title and/or abstract were analyzed, as demonstrated in Figure 1.

For data collection, an instrument adapted from the model validated by Ursi and Galvão<sup>9</sup> was used, which included the following items: identification of the original article, methodological characteristics of the study, evaluation of methodological rigor, studied interventions, and findings.

Data extracted from the studies included in the research were descriptively compiled in a previously-prepared chart, which included the following aspects: name of the article; authors and year of publication; objectives; results; conclusions. A descriptive synthesis of the collected data was carried out.

## RESULTS

Of the 15 articles analyzed, 7(46%) were selected from the MEDLINE database; 4 (27%), from LILACS; 3 (20%), from CINAHL; and 1



**Figure 1.** Selection process for inclusion of studies in the integrative review.

(7%), from Scopus. No article was linked to the SciELO database, since those found in such platform were repeated in other databases. Regarding the research locations, 7 (46%) were developed in the United States of America; 6 (40%), in Brazil; 1 (7%), in Germany; and 1 (7%), in Uganda. Of these, 9 (60%) articles were published in English, and 6 (40%) were published in Portuguese.

Based on the analysis of the selected articles, the studies were categorized into three themes: evaluation of costs of different technologies employed in HP processing; evaluation of waste reduction in HP processing; and comparison between the cost of reusable products and single-use ones. Each of these themes is presented in Charts 1, 2, and 3.

**Chart 1.** Evaluation of costs of different technologies employed in the processing of healthcare products.

Authors, year, country	Objective	Method	Results	Conclusions
Souza et al., 2015, Brazil <sup>1</sup>	To evaluate the application of the ABC costing system to the SPD of a public hospital.	Applied, descriptive, exploratory, case-study type of research.	Values of the cost objects were: disinfected product, BRL 3.03; sterilized product, BRL 6.05; light/single packaging, BRL 4.46; small box/clothing, BRL 6.34; and medium box/clothing, BRL 6.18. The large box accounted for BRL 14.16.	ABC costing is effective for evidence-based management practice in SPD.
Vital et al., 2016, Brazil <sup>2</sup>	To analyze the cost of packaging materials used in the SPD by the ABC method.	Descriptive, and observational study with documentary analysis.	A cotton fabric packaging cost, in a processing, from BRL 9.309 (40 × 40 cm) to BRL 13.517 (1.4 × 1.4 m). Values found for double-wrapping of surgical packaging materials ranged from BRL 1.45 (20 × 40 cm) to BRL 1.32 (20 × 50 cm, 30 × 30 cm, and 30 × 40 cm).	The use of surgical packaging materials is the most economical measure for the institution.
Krohn et al., 2019, Germany <sup>10</sup>	To assess the costs of four packaging alternatives, considering equal quality of sterility for the respective systems.	Analytical study. Statistical tests were applied and the <i>EasyFit Professiona</i> software, version 5.6, was used.	The sterile container without inner wrap proved to be the most economical option, at a price of 2.05 Euros. The option of two non-woven wraps proved to be more expensive, at a price of 3.87 Euros.	Different packaging alternatives for sterilization make difference in time and costs. Each SPD must analyze its own situation.
Stipanich et al., 2018, Brazil <sup>11</sup>	To compare the costs of different processes for supplying materials for respiratory therapy in a general hospital.	Observational study, with documentary review.	Purchasing permanent materials with sterilization in SPD-INST consisted in an expensive processing. The greatest difference in values was found in the manual resuscitator: BRL 1.10 (SPD-INST), BRL 1.98 (SPD-OUT), and BRL 26.70 (DM); and the slightest difference were found in the IMV circuits: BRL 1.77 (SPD-INST), BRL 5.52 (SPD-OUT), and R \$ 7.04 (DM).	The supply process carried out in the SPD-INST proved to be more advantageous, with lower costs, in relation to sterilization in SPD-OUT and the purchase of DM.
McCreanor and Graves, 2017, United States of America <sup>12</sup>	To economically evaluate the sterilization of thermosensitive materials, mainly endoscopes, using low-temperature by hydrogen peroxide plasma instead of steam autoclave.	Analytical study using the Monte Carlo simulation.	Low-temperature sterilization is more expensive than steam; however, in the long-term, savings are achieved in the repair of instruments. Based on the model's calculations, these savings are likely to be in the range of USD 738,832 in a 10-year period.	Investments in low-temperature systems promote economy in the long-term by reducing the need for repairs of instruments.

Continue...

**Chart 1.** Continuação.

Authors, year, country	Objective	Method	Results	Conclusions
Jerico and Castilho, 2010, Brazil <sup>13</sup>	To identify the cost of disinfecting and sterilizing hospital devices.	Exploratory, descriptive, and case-study type of research. The ABM model was adopted.	Costs per processing cycle/load: Physical disinfection, BRL 12.63; chemical disinfection, BRL 9.95; LTSF sterilization, USD 255.28; and SSUP sterilization, USD 31.37. Cost per product group: thermosensitive semi-critical, USD 0.28, was the lowest value; and thermo-resistant critical instrumental, USD 1.75, was the highest value.	The application of ABM in the investigated SPD is feasible for cost management.

SPD: Sterilization Processing Department; SPD-INST: Institution's Sterilization Processing Department; SPD-OUT: Outsourced Sterilization Processing Department; DM: Disposable Material; IMV: Invasive Mechanical Ventilation; ABM: Activity-based management; ABC: Activity-based costing; LTSF: Low-temperature-steam-formaldehyde sterilization; SSUP: Saturated steam under pressure

**Chart 2.** Evaluation of waste reduction in the processing of healthcare products.

Authors, year, country	Objective	Method	Results	Conclusions
Nast and Swords, 2019, United States of America <sup>14</sup>	To reduce urology trays in such a way over 50% of the instruments will be used, leading to decrease in costs.	Prospective and analytical study. The Student's t-test was applied.	Authors found trays with a utilization percentage of 21.1% prior to the reduction, and which increased to 48.2% after reduction; and also trays with utilization percentage of 41.9%, prior to the reduction, and which increased to 71.7% after reduction. Savings from USD 7.48 to USD 70.18 per procedure were calculated.	The initiative to reduce the size of surgical trays proved to be an opportunity to reduce costs.
Cichos et al., 2017, United States of America <sup>15</sup>	To show the effect of standardization of surgical trays on the number of sterilized instruments and the impact on costs in a teaching hospital.	Case study, based on the Lean methodology.	The results ranged from trays that contained 79 instruments and decreased to 59 (75%), to trays that contained 113 instruments that decreased to 50 (44%). The estimated savings ranged from USD 55 for each video-assisted thoracoscopic surgery to USD 96 for each thoracotomy.	Reducing the processing of unused instruments reduces costs and the weight of trays, which may reduce the incidence of wet loads.
Isaacson et al., 2017, United States of America <sup>16</sup>	To characterize all aspects of resources used for decontamination and sterilization of reusable flexible ureteroscopes in order to propose cost reduction methods.	Prospective and observational study. The authors applied the ABC costing method.	The average total time of single processing was $229 \pm 74.4$ min, including 47.7 min in the endoscopy service, and $126.5 \pm 55.7$ min of drying. The total cost for reprocessing a ureteroscope was USD 96.13.	Although repair costs consist in the main option for cost reduction, the authors highlighted the drying technique, which can reduce the time and costs of reprocessing.
Van Meter and Adam, 2016, United States of America <sup>17</sup>	To identify and estimate the costs of sterilization of unused instruments in elective gynecological surgeries.	Analytical, observational study with secondary data collection. In the statistical analysis, the z-test was used for two ratios.	The percentage of used instruments was 20.5%. The value found for sterilization of instruments was USD 3.19. This correlates with the value of USD 232.160 concerning wastes of the sterilization of unused instruments.	Reduction of instruments in surgical trays, especially in laparoscopy, has a high potential for cost reduction.

Continue...

**Chart 2.** Continuação.

Authors, year, country	Objective	Method	Results	Conclusions
Paula et al., 2015, Brazil <sup>18</sup>	To quantify the number of instruments used and unused during surgery and to estimate costs of the sterilization process.	Quantitative, descriptive, field, and observational study. The authors also used secondary data.	The average of unused instruments was 52%. There was an average waste per surgical box of BRL 7.28, in the case of cesarean delivery, an average of BRL 9.71 per surgical box used in hysterectomy.	In one month, an average of BRL 1,584.17 would be wasted with the sterilization of unused instruments in surgeries.
Stockert and Langerman, 2014, United States of America <sup>19</sup>	To demonstrate the considerable cost of unused instruments in the institution's SPD.	Observational study. Authors performed descriptive statistics and linear regression for data analysis.	The highest percentage of use was 21.9% in neurosurgery. The average processing cost per instruments can range from USD 0.10 to USD 0.51, or over.	Attention to surgical tray composition may result in immediate and significant cost savings in the work performed at SPD.

ABC: Activity-based costing; SPD: Sterilization Processing Department.

**Chart 3.** Comparison of utilization costs of reusable and single-use products.

Author	Objective	Method	Results	Conclusions
Tomé and Lima, 2015, Brazil <sup>6</sup>	To identify the direct cost of reprocessing cotton-woven surgical drapes that are part of the surgical LAP.	Quantitative, exploratory-descriptive case study.	The average monthly cost for the use of surgical LAP accounts for USD 13,987.08, whereas the average monthly cost for the consumption of disposable surgical kits and disposable drapes for auxiliary tables corresponds to US \$ 29,127.15.	The cost obtained from the processing of cotton-woven surgical drapes, which are part of the surgical LAP packs, was USD 9.72.
Kuznik et al., 2012, Uganda <sup>20</sup>	To compare costs for male medical circumcisions using reusable equipment and disposable kits.	Exploratory study.	The average cost of reusable circumcision kits was USD 8.46. The cost of a disposable kit ranges from USD 15.60 to USD 20.80. Therefore, the average savings per reusable kit ranges from USD 7.14 to USD 12.34, or from 46 to 59%.	The use of reusable kits in male medical circumcision procedures results in savings of 46 to 59%.
Yung et al., 2010, United States of America <sup>21</sup>	To assess the total cost of reusable ultrasonic shears and compare it with the costs of disposable equipment.	Prospective study. Descriptive statistics was performed with SAS software, version 9.1.3 for Windows.	The purchase cost for disposable shears was USD 307, and the total reprocessing cost was USD 43.73 per use. The reuse of ultrasonic shears resulted in savings of USD 196.40 per case.	The use of reusable shear is more economical, with an increase in the number of uses.

LAP: Laparotomy pack.

## DISCUSSION

In the course of hospital health care, with the increasing costs in the field of health care, alternatives have been sought to achieve savings in procedures associated with it, strengthening the need for knowledge related to the basic principles of cost accounting

on the part of professionals working in SPD, mainly nurses. Therefore, these professionals must use their knowledge on the subject as a management tool to support the arguments and negotiations with hospital managers, creating opportunities to improve the efficiency of the service's performance, rationalizing resources, and monitoring the productivity<sup>22</sup>.

Cotton fabric is one of the oldest materials regarding sterilization packages used for the processing of HP. Currently, it is widely used for sterilization with saturated steam under pressure, and its advantages are economy, and properties of memory and resistance, which are close to levels deemed ideal<sup>23</sup>. However, in the literature, the economy of cotton woven fabric as packaging material has not yet been confirmed when compared to the cost of disposable surgical packaging materials<sup>2</sup>.

Authors of a study conducted in the state of Bahia, Brazil, identified a similar result, according to which the cotton fabric packaging material accounted for the highest monthly cost, and surgical packaging paper had the lowest cost when compared to other materials. This demystifies the existing paradigm in Brazilian SPD, according to which cotton fabric would be the cheapest packaging material<sup>24</sup>.

The rigid container is another permanent packaging material that, at the same time, packs and protects surgical instruments, keeping them sterile until their use. These containers can be made of aluminum, stainless steel, or plastic, and use disposable or reusable filters<sup>25</sup>. The high cost of such material would be a disadvantage. However, this value can be diluted by the number of reutilizations, which can promote economy, as demonstrated by research<sup>10</sup>.

When using a rigid container, it is not recommended to use another type of packaging material inside or outside it, since this can hinder the air exit, the penetration of the sterilizing agent, and the drying step<sup>25</sup>.

According to the literature, there are significant differences in cost between different processing methods for reusable HP in SPD, with high-level disinfection being a cheaper process than sterilization, and steam sterilization as a cheaper process than low-temperature sterilization<sup>1,12,13</sup>.

Although more profitable, the excessive use and poor maintenance of equipment make steam sterilization inefficient over time. Nevertheless, replacing this method with hydrogen peroxide plasma sterilization would increase the costs associated with sterilization procedures for the unit<sup>26</sup>. Thus, the simultaneous and appropriate use of both methods, steam sterilization and hydrogen peroxide, may be more convenient<sup>26</sup>.

Regarding the management of the SPD, the outsourcing of HP processing, carried out by processing companies, proved to be a more expensive option than the processing conducted in the institution's SPD, according to a study carried out on ventilatory support materials<sup>11</sup>.

The safety of sterilization conducted in the institution's SPD and in an outsourcing company is the same. Nevertheless, off-site sterilization has higher costs than other options, and

greater possibility of delays in supply<sup>27</sup>. Conversely, with the outsourcing of the processing, there is a reduced need for trained personnel and support of inputs in the hospital<sup>27</sup>.

Checking the instruments in surgical trays, in order to decrease the number of commonly processed instruments that are unused in surgical procedures, has been one of the most adopted strategies by surgery services to reduce waste and, consequently, the costs, achieving significant savings. This fact was pointed out by researchers<sup>14,15,17-19</sup>, especially in cases where surgical trays were used in endoscopic surgeries<sup>15,17</sup>, considering that instruments require more elaborate and time-consuming processing<sup>17</sup>.

Waste is related to the development of activities that do not favor the produced products or services, but rather unnecessary costs and expenses<sup>4</sup>. Thus, the investigation of waste sources related to material resources, processes, and personnel is imperative in public and private organizations. Many steps in the processes can also generate waste, causing inefficiency and delays in the work process<sup>4</sup>.

In addition, the Association for the Advancement of Medical Instrumentation® (AAMI) and the Association of periOperative Registered Nurses (AORN) associate the weight of surgical trays with a higher risk of wet packs after sterilization, recommending a maximum weight of 25 pounds<sup>28</sup>.

The use of costing methods, based on the mapping of steps that compose the processing of materials, has been used as a measure to reduce costs in HP processing, enabling to adopt suggestions for redirecting resources<sup>16</sup>.

Processes involved in healthcare organizations require evaluation and control of their efficiency, productivity, and quality, since cost-related issues have implications for the amount of services provided to patients and, by the mapping, we can visualize the resource consumption and, consequently, its optimization<sup>5</sup>.

Despite technological advances in the manufacture of single-use HP, when economically comparing the use of these materials with equivalent reusable ones, the latter are still more cost-effective, despite the cost of processing carried out in SPD<sup>11,20,21</sup>.

Several devices, such as cotton-woven surgical drapes and surgical instruments, are manufactured to enable reutilization until their maximum effectiveness and functionality, which can lead to cost reduction and reduction in the amount of waste generated by single-use products. Nevertheless, it is necessary to ensure, at the time of decision-making, that these products remain safe for being used with the patient<sup>29</sup>.

This study has limitations, since we cannot assess the environmental impacts caused by certain technologies used in the

processing of HP or by single-use products as well as the impact related to patient safety and health care-associated infections (HAIs).

## FINAL CONSIDERATIONS

According to the analysis of the 15 articles published in national and international journals, it was found that the processing of HP in the institution's SPD proved to be a measure that achieves savings when cost management is employed, by properly selecting the technologies involved in the process and avoiding waste. Moreover, according to our results, despite technological advances in the manufacture

of single-use products that replace reusable HP processed in the institution's SPD, the use of reusable materials is still the most economically-viable alternative.

It should be emphasized that, although the cost variable is a relevant factor, other non-financial aspects must be considered such as patient safety and the environmental impacts that involve the different HP processing methods.

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# CAN NURSING ACTIONS PREVENT SURGICAL WOUND DEHISCENCE?

*Ações de enfermagem podem prevenir deiscência em ferida operatória?*

*¿Pueden las acciones de enfermería prevenir la dehiscencia de la herida operatoria?*

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**ABSTRACT: Objective:** To identify useful nursing interventions for preventing Surgical Wound Dehiscence in scientific literature. **Method:** This is an integrative literature review, guided by the question: *are there nursing actions that can contribute to the prevention of surgical wound dehiscence?* The search was carried out in March 2019, including articles published from 1990 to 2018. We used the following databases and/or portals to select the articles: National Library of Medicine (PubMed); Web of Science; Scopus Info Site (Scopus); Latin American and Caribbean Health Sciences Literature (LILACS), and Cumulative Index to Nursing and Allied Health Literature (CINHAL). **Results:** The search resulted in 64 articles. We excluded four of them for being duplicates, and another 40 that did not meet the inclusion criteria (24 were about treatment, 13 due to the nature of the article, two were not available, and one was in French). Twenty articles were fully evaluated, and 14 were excluded because they did not answer the guiding question of this review. Thus, at the end of this analysis process, we selected six articles that met the inclusion criteria and constituted the final sample. **Conclusion:** The nursing production on the subject was scarce. The main nursing actions for preventing surgical wound dehiscence are associated with the prevention of surgical site infections and the indication and use of negative pressure wound therapy.

**Keywords:** Surgical wound. Surgical wound dehiscence. Surgical wound infection. Perioperative nursing. Perioperative care.

**RESUMO: Objetivo:** Identificar na literatura científica intervenções de enfermagem úteis para a prevenção de Deiscências em Feridas Cirúrgicas. **Método:** Trata-se de uma revisão integrativa da literatura, norteada pela pergunta: *Há ações de enfermagem que possam contribuir para prevenção de deiscência em ferida operatória?* Realizou-se a busca no período de março de 2019, incluindo artigos publicados a partir do ano de 1990 até 2018. Para a seleção dos artigos foram utilizadas as seguintes bases de dados e/ou portais: National Library of Medicine (PubMed); Web of Science; Scopus Info Site (Scopus); Literatura Latino-Americana e do Caribe em Ciência da Saúde (LILACS) e Cumulative Index to Nursing and Allied Health Literature (CINHAL). **Resultados:** A busca resultou em 64 artigos, excluíram-se quatro por estarem duplicados e 40 por não atenderem aos critérios de inclusão (24 por serem sobre tratamento, 13 pela natureza do artigo, dois por não estarem disponíveis e um por ser em francês). Vinte artigos foram avaliados na íntegra e 14 foram excluídos por não responderem à questão norteadora desta revisão. Dessa maneira, ao fim desse processo de análise, foram selecionados seis artigos que responderam aos critérios de inclusão e constituíram a amostra final. **Conclusão:** Houve pouca produção da enfermagem sobre o tema. As principais ações de enfermagem para prevenção de deiscência em feridas cirúrgicas estão associadas à prevenção de infecções de sítio cirúrgico e à indicação e à utilização de terapia de cobertura a vácuo.

**Palavras-chave:** Ferida cirúrgica. Deiscência da ferida operatória. Infecção da ferida cirúrgica. Enfermagem perioperatória. Assistência perioperatória.

**RESUMEN: Objetivo:** identificar en la literatura científica intervenciones de enfermería útiles para la prevención de la dehiscencia en heridas quirúrgicas. **Método:** Esta es una revisión de literatura integradora, guiada por la pregunta: *¿Existen acciones de enfermería que puedan contribuir a la prevención de*

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la dehiscencia en las heridas quirúrgicas? La búsqueda se realizó en el período de marzo de 2019, incluidos los artículos publicados de 1990 a 2018. Para la selección de artículos, se utilizaron las siguientes bases de datos y/o portales: National library of Medicine (PubMed); Web of Science; Scopus Info Site (Scopus); Literatura latinoamericana y caribeña de ciencias de la salud (LILACS) y Cumulative Index to Nursing and Allied Health Literature (CINHAL).

**Resultados:** La búsqueda resultó en 64 artículos, se excluyeron cuatro duplicados, 40 artículos por no cumplir con los criterios de inclusión (24 sobre el tratamiento, 13 por la naturaleza del artículo, dos por no estar disponibles y uno por estar en francés), y 20 los artículos fueron evaluados en su totalidad y 14 fueron excluidos porque no respondieron la pregunta guía de esta revisión. Por lo tanto, al final de este proceso de análisis, se seleccionaron seis artículos que cumplían los criterios de inclusión y constituían la muestra final. **Conclusión:** hubo poca producción de enfermería sobre el tema. Las principales acciones de enfermería para prevenir la dehiscencia en las heridas quirúrgicas están asociadas con la prevención de infecciones del sitio quirúrgico y la indicación y el uso de la terapia de cobertura con vacío.

**Palabras clave:** Herida quirúrgica. Dehiscencia de la herida operatoria. Infección de la herida quirúrgica. Enfermería perioperatoria. Atención perioperatoria.

## INTRODUCTION

Surgical wound dehiscence (SWD) is a postoperative complication that impairs wound healing and increases the length of stay and hospital costs<sup>1-3</sup>. It can be defined as a separation of the edges of a closed wound after a surgical procedure, which usually occurs up to 10 days after surgery, although it may occur until the 30<sup>th</sup> day<sup>4,5</sup>.

The incidence of SWD varies according to the surgical procedures, such as abdominal procedures (1.3 to 4.7%), cesarean sections (13.3%), hip replacements (14.3%), and cardiothoracic surgeries (15.3%)<sup>1</sup>. SWD is associated with an increase in morbidity, mortality, and risk factors<sup>6</sup>.

Healing after dehiscence is slower, and the patient may need a new surgical intervention. In general, SWD is caused by technical factors (choice of thread, incision, and suture technique), mechanical stress (cough, abrupt or vigorous movement), and problems related to the natural healing process<sup>7</sup>. Surgical wound healing involves a combination of factors such as oxygenation and perfusion of the wound bed, and intake of nutrients, which can be impaired by local edema, infection, and skin conditions, such as aging and changes caused by diabetes<sup>7,8</sup>.

Surgical site infection (SSI) is related not only to dehiscence but also to the appearance of incisional hernias<sup>9</sup>. In addition to the connection with SSI, dehiscence may be associated with non-infectious causes (e.g., hematoma or seroma), patients-related factors (e.g., obesity and diabetes), and mechanical stress (e.g., trauma, vomit, and coughing spells)<sup>2,4,10</sup>. Moreover, even when the cause is not infectious, an infection may occur after dehiscence, making the healing process more difficult<sup>2,7,8</sup>.

Studies aimed at developing and validating a risk model for SWD described the following independent risk factors as being more recurrent: advanced age, biological female

gender, chronic lung disease, edema, ascites, anemia, emergency surgery, type of surgery, postoperative cough, smoking, and infection, besides the direct relationship between a greater presence of risk factors and a higher chance of death<sup>4,11</sup>. Evidence shows a higher incidence of dehiscence when, in addition to the surgical wound, there are stomata<sup>12,13</sup>.

Considering the impact of surgical dehiscences on postoperative care, research in this area should try to understand how to prevent it, as well as develop technologies that promote prevention. In particular, nurses are responsible for corroborating the construction of this knowledge, since they act directly on perioperative care and postoperative wound care.

## OBJECTIVE

To identify, in national and international scientific literature, useful nursing interventions for preventing SWD.

## METHODOLOGY

This study is an integrative literature review, a research method that uses evidence-based practice, summarizes the available articles on a determined subject, and allows scientific knowledge to guide the practice<sup>14</sup>.

This study followed the expected stages of an integrative review: identification of the theme and elaboration of the guiding question, search of the literature using inclusion and exclusion criteria, definition of the information to extract from the selected studies based on a previously constructed bibliographic data, data collection, evaluation and critical analysis of the studies included in the review, discussion of results, and submission of the integrative review<sup>14</sup>.

The search was guided by the following question: *are there nursing actions that can contribute to the prevention of surgical wound dehiscence?* The search was carried out in March 2019 and included articles published from 1990 to 2018, taking into account that in the 1990's the number of gastrointestinal surgeries increased significantly, especially bariatric surgeries. We used the following databases and/or portals to select the articles: National Library of Medicine (PubMed), Web of Science, Scopus Info Site (Scopus), Latin American and Caribbean Health Sciences Literature (LILACS), and Cumulative Index to Nursing and Allied Health Literature (CINAHL).

The inclusion criteria were: articles published in Portuguese, English, and Spanish, reporting evidence on the prevention of SWD. The exclusion criteria were: studies about other surgical complications (such as granuloma and seroma) and articles that did not address the objective of this review (articles, editorials, and letters to the editor on dehiscence treatment).

For the search, we selected the following keywords from the Health Sciences Descriptors (*Descritores em Ciências da Saúde – DeCS*) and the Medical Subject Headings (MESH): surgical wound dehiscence, postoperative complications, and

nursing. Due to the characteristics of access to the selected databases, strategies were combined in different ways to conduct a broad search, using the study question and the inclusion criteria previously established as guiding paths (Chart 1).

Two evaluators with experience in review studies participated in all stages of assessment of the articles found in the search and reached a consensus for their inclusion. A first evaluation of the articles was performed taking into account the title and the abstract. For data collection and analysis, we elaborated an instrument containing the following items: article title, journal name, authors, country, language, year of publication, type of study, objective, study population, study period, intervention, evaluation method, statistical analysis, result, and conclusion. We organized the references found using the software EndNote™ web version.

The assessment of the studies was qualitative. For the methodological evaluation of the selected studies, we adopted the Joanna Briggs Institute levels of evidence for effectiveness<sup>15</sup>. The Results section presents a synthesis of the articles in a synoptic table containing the following characteristics: author/year, journal, title, design, result, and level of evidence (Table 2).

**Chart 1.** Database/portal search strategies.

Database	Search strategy
Medline via PubMed	("Surgical Wound Dehiscence"[Mesh] OR "Surgical Wound Dehiscence"[tw]) AND ("Nursing"[Mesh] OR "Nursing Care"[Mesh])
Scopus	("Surgical Wound Dehiscence" AND ("Postoperative Complications" OR "Postoperative Complication") AND (Nursing OR "Nursing Care"))
Web of Science	TOPIC: ("Surgical Wound Dehiscence" AND Nursing OR "Nursing Care")
LILACS	mh: ("Deiscência da Ferida Operatória/NU")*
CINAHL	(MH "Surgical Wound Dehiscence/NU")

PubMed: National Library of Medicine; LILACS: Latin American and Caribbean Health Sciences Literature; CINAHL: Cumulative Index to Nursing and Allied Health Literature. \*Surgical Wound Dehiscence/NU.

**Chart 2.** Corpus of analysis selected. Articles selected as the sample of the study, according to authors, year of publication, journal, title, design, result, and level of evidence.

Author (Year)	Journal	Title	Design	Result	Level of evidence
Sandy-Hodgetts et al., 2016 <sup>1</sup>	Journal of Wound Care	Surgical wound dehiscence in an Australian community nursing service: time and cost to healing	Descriptive and costing analysis	55% of dehiscences (N=70) associated with infection and an increase of 67% in total cost.	3e r(Observational study without a control group)
Stannard et al., 2012 <sup>2</sup>	International Wound Journal	Use of negative pressure wound therapy over clean, closed surgical incisions	Literature review and case series	Positive results in open wounds point to a promising use of negative pressure wound therapy in surgical wounds.	3b (Systematic review that includes cohorts and smaller studies)

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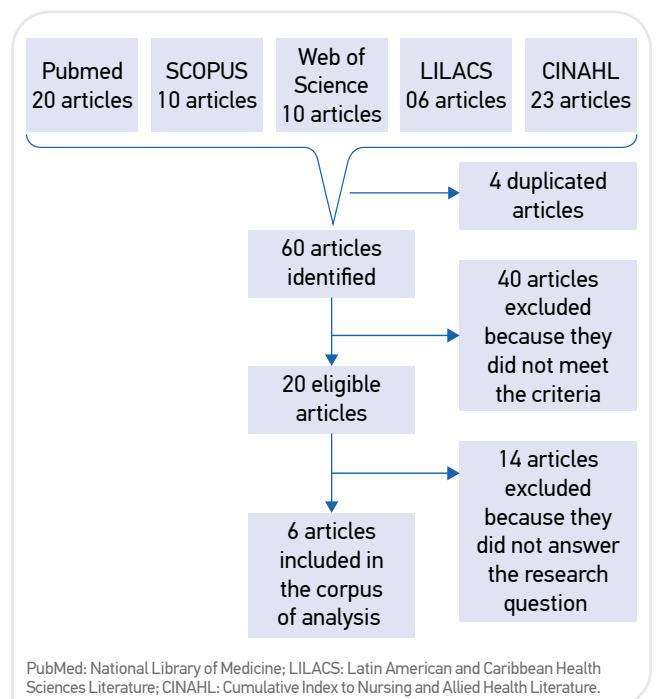
**Chart 2.** Continuation.

Author (Year)	Journal	Title	Design	Result	Level of evidence
Scalise et al., 2016 <sup>16</sup>	International Wound Journal	Improving wound healing and preventing surgical site complications of closed surgical incisions: a possible role of Incisional Negative Pressure Wound Therapy: a systematic review of the literature	Systematic review	The literature showed that negative pressure wound therapy reduced the incidence of infection, sero-hematoma formation, and reoperation rates. A lower level of evidence on dehiscences was found, and the relationship between negative pressure wound therapy and dehiscences was inconclusive.	2b (Systematic review that included even quasi-experimental studies)
Sandy-Hodgetts and Watts, 2015 <sup>17</sup>	JBI Database System Rev Implement Rep	Effectiveness of negative pressure wound therapy/ closed incision management in the prevention of post-surgical wound complications: a systematic review and meta-analysis	Systematic review	There is evidence of the relationship between negative pressure wound therapy and infection decrease, but no direct evidence of the same association with surgical wound dehiscence.	1b (Systematic review of clinical trials and other studies)
Petito et al., 2014 <sup>18</sup>	Journal of Clinical Nursing	The influence of the initiation of an exercise programme on seroma formation and dehiscence following breast cancer surgery	Randomized clinical trial	Women who initiated the rehabilitation exercise programme early (before drain removal) had no different outcomes.	1c (Randomized clinical trial)
Blume et al., 2010 <sup>19</sup>	International Wound Journal	Retrospective evaluation of clinical outcomes in subjects with split-thickness skin graft: comparing V.A.C. <sup>®</sup> therapy and conventional therapy in foot and ankle reconstructive surgeries	Retrospective descriptive	Negative pressure wound therapy was associated with fewer complications (seroma, hematoma, and infection) in skin grafts.	3c (Cohort study with a control group)

## RESULTS

The search of the selected databases resulted in 64 articles, of which four were excluded for being duplicates, and 60 remained. After reading the titles and abstracts, we removed 40 articles that did not meet the inclusion criteria (24 were about treatment, 13 because of the nature of the article, two were not available, and one was in French). Consequently, 20 articles remained. Among them, 14 were fully evaluated and excluded because they did not answer the guiding question of this review. Thus, at the end of the analysis process, we selected six articles that met the inclusion criteria and constituted the final sample. Figure 1 describes the process of selecting and including the articles.

Only six articles comprised the corpus of analysis, all of them in English, and published as of 2010, as presented in Chart 2. The articles show evidence of the association of dehiscences with infections, early-onset of rehabilitation exercises (before the removal of the drains), and use of negative pressure wound therapy.



**Figure 1.** Flow chart of the selection of articles that composed the corpus of analysis.

## DISCUSSION

By crossing the keywords, the low nursing scientific production on the subject became clear. In addition, the articles identified did not directly address strategies for preventing surgical dehiscence. One of the reviews was not included because its method was not sufficiently described. The review not included showed that the early detection of signs of infection and seroma, as well as early intervention, are crucial for stoma maintenance<sup>13</sup>. The other reviews included concluded that negative pressure wound therapy reduces the incidence of infections, but pointed out that evidence of the lower prevalence of dehiscence associated with the use of this method as a prophylactic measure was not sufficient<sup>2,16,17</sup>.

The most common method for closing clean surgical wounds is the combination of suture with gauze as primary dressing; however, adhesive tapes, staples, hydrocolloids, and other more advanced devices are available in the market<sup>2</sup>. For wounds with edges that cannot be pulled together for traditional closure or cases of dehiscence, negative pressure wound therapy has been increasingly used with good results<sup>2</sup>.

We consulted other references to answer the guiding question. The World Union of Wound Healing Societies (WUWHS) published a consensus in 2018 on improving the prevention and outcomes of SWD, which presents its risk factors, classifying them into patient-related, pre-, intra-, and postoperative factors<sup>20</sup>. After analyzing the risk factors presented in the document, it is possible to affirm that nurses can directly collaborate to preventing dehiscences by avoiding hypothermia, mechanical stress – instructing the patients on coughing and postoperative efforts –, and SSI, as well as by timely removing the suture<sup>20</sup>. Only one of the articles found correlated SSI with SWD.

Nonetheless, other references that evaluated risk factors indicated SSI as an important one<sup>1,21-23</sup>.

In the preoperative period, nurses should consider using an instrument to assess the risk of SSI and SWD, in addition to elaborating educational interventions for patients on postoperative self-care related to wounds, drains, coughs, and efforts. Indirectly, all preoperative actions to avoid SSI impact dehiscence prevention<sup>20-23</sup>.

In the intraoperative period, nurses, even if they are not in the operative field, can collaborate by supervising adherence to aseptic techniques, ensuring that they are followed in all stages, by observing and demanding the adequate performance of procedures, from skin preparation to the change of gloves for the closure of the surgical wound<sup>20</sup>.

The nurse also helps to dress the surgical wound. The moment of dressing the wound is crucial and may be

opportune for the identification of other skin lesions resulting from the intraoperative period<sup>24</sup>. We found no studies about this theme, besides the research with negative pressure wound therapy; however, nurses should investigate whether there are more effective types of dressing, evaluating new technologies or old techniques usually observed in surgery centers, such as cryotherapy and the use of bandages and belts to increase tension in chest wounds and the abdominal wall, respectively. Nursing research might answer whether these techniques and other technologies can reduce the incidence of dehiscence. The WUWHS consensus recommends the dressing of surgical wounds for at least 48 hours unless stricter monitoring of early signs and symptoms is necessary<sup>20</sup>. Cryotherapy studies are more related to pain relief than the prevention of infection or dehiscence<sup>22</sup>.

Regarding early exercises, one of the articles in the corpus of analysis showed that patients with drains did not have worse results than those who had theirs removed. Although its level of evidence is not good, it may indicate, for nursing, the need for further research on early ambulation in order to confirm it as a protective factor in the intraoperative period<sup>18</sup>.

The current guideline of the World Health Organization for the prevention of SSI presents evidence of the association of hypothermia with SSI and SWD, in addition to parameters for interventions aiming at the prevention of perioperative hypothermia<sup>25</sup>.

After synthesis of evidence, the WUWHS consensus suggests using the negative pressure wound therapy before the patient leaves the operating room to prevent dehiscence whenever they present a major risk factor (body mass index  $\geq 40$  kg/m<sup>2</sup>, diabetes mellitus, and procedures with a high incidence of dehiscence) or two or more moderate risk factors<sup>20</sup>.

## CONCLUSION

The search of the literature revealed that the nursing contribution to academic research on the subject is scarce, since we found few articles, and their level of evidence was moderate.

Based on studies and references which corroborated the discussion about the findings, we can affirm, in response to the initial questioning of this review, that the main nursing actions for preventing SWD relate to the prevention of SSI and the indication and use of negative pressure wound therapy. Other types of dressing should be researched, as well as the use of bands, belts, and dressings that increase tension on the surgical wound.

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# SURGICAL POSITIONING IN PEDIATRIC ROBOTIC SURGERY: EXPERIENCE REPORT

*Posicionamento cirúrgico em cirurgia robótica pediátrica: relato de experiência*

*Posicionamiento quirúrgico en cirugía robótica pediátrica: relato de experiencia*

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**ABSTRACT: Objective:** To report the experience of the first six cases of pediatric robotic surgery and the role of nurses who are specialists in robotic surgery in an oncology institution. **Method:** This is an account of experience report in clinical practice which encouraged the discussion about the first six cases of pediatric robotic surgery, which occurred between 2017 and 2019. **Results:** The process of implantation of pediatric robotic surgery started in 2017, with two initial cases (adrenalectomy and nephrectomy). All cases were followed up and performed in the presence of the proctor urologist surgeon to assist the pediatric oncology surgeon. Surgical positioning depends on the location to be approached and the robotic procedure that will be performed. **Conclusion:** The need for a realistic simulations with the participation of all team members to improve the care processes and permanent education in team formation was identified.

**Keywords:** Perioperative nursing. Robotics. Pediatrics.

**RESUMO: Objetivo:** Relatar a experiência dos primeiros seis casos de cirurgia robótica pediátrica e a atuação dos enfermeiros especialistas em cirurgia robótica em uma instituição oncológica. **Método:** Trata-se de um relato de experiência vivenciada na prática clínica que fomentou a discussão acerca dos primeiros seis casos de cirurgia robótica pediátrica, ocorridos entre 2017 e 2019. **Resultados:** O processo de implantação da cirurgia robótica pediátrica começou em 2017, com dois casos iniciais (adrenalectomia e nefrectomia). Todos os casos foram acompanhados e executados na presença do cirurgião urologista *proctor* para auxiliar a cirurgiã oncológica pediátrica. O posicionamento cirúrgico depende do local a ser abordado e do procedimento robótico que será realizado. **Conclusão:** Identificou-se a necessidade de uma simulação realística com a participação de todos os membros da equipe para melhoria dos processos assistenciais e da educação permanente na formação da equipe.

**Palavras-chave:** Enfermagem perioperatória. Robótica. Pediatria.

**RESUMEN: Objetivo:** informar la experiencia de los primeros seis casos de cirugía robótica pediátrica y el papel de las enfermeras especialistas en cirugía robótica en una institución de oncología. **Método:** Este es un relato de la experiencia en la práctica clínica, que fomentó la discusión sobre los primeros seis casos de cirugía robótica pediátrica, que ocurrieron entre 2017 y 2019. **Resultados:** El proceso de implantación de cirugía robótica pediátrica comenzó en 2017, con dos casos iniciales (adrenalectomía y nefrectomía). Todos los casos fueron seguidos y realizados en presencia del cirujano urólogo supervisor para ayudar al cirujano oncólogo pediátrico. El posicionamiento quirúrgico depende de la ubicación a abordar y del procedimiento robótico que se realizará. **Conclusión:** Se identificó la necesidad de una simulación realista con la participación de todos los miembros del equipo para mejorar los procesos de atención y la educación permanente en la formación del equipo.

**Palabras clave:** Enfermería perioperatoria. Robótica. Pediatría.

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## INTRODUCTION

The treatment of childhood and juvenile cancer has advanced in recent decades due to the techniques of early diagnosis and the evolution of therapeutic methods. Each therapeutic planning determines the patient's chances of cure and has its particularities, recommendations, limits, and benefits, in addition to possible complications<sup>1</sup>.

Surgical technology advances rapidly, becoming a common practice. The Da Vinci Surgical System® robotic surgical system, for example, is ideal for small spaces, so that robot-assisted surgery is extending into the pediatric specialty. The documented benefits of robotic surgery in pediatrics, since the first case in 2000, are basically the same as minimally invasive surgery through laparoscopy, with a shorter hospital stay, less bleeding, less incidence of pain, faster recovery, and better aesthetic result<sup>2,3</sup>.

Surgical positioning in pediatric robotic surgery is similar to that of adult patients. However, the multidisciplinary team must take into account the size of the patient and understand the context of the robotic platform. Each robotic procedure requires different positions and the use of appropriate devices to assist in the patient positioning. It is important for the perioperative nurses understand the safest instructions for positioning the patients in robotic surgeries<sup>4</sup>.

Patient safety and the efficiency of the procedure can be compromised if the perioperative nurses is not trained in the care for patients undergoing robotic procedures or who do not have technical/scientific knowledge about the technology. Studies have shown some concern about the training and education of the nursing team in robotic surgery. Thus, institutions offered a training program for perioperative nurses involved in robotic surgery, providing skills to the practice of these professionals, reducing complications, promoting positive results for nursing care, and improving their quality indicators<sup>5-7</sup>.

The present study aims to report the experience of the first six cases of pediatric robotic surgery and the performance of nurses specialized in robotic surgery in an oncology institution.

Minimally invasive surgery has been a great challenge for nursing professionals who works with high-tech equipment and innovations in surgical techniques with exponential improvements. Thus, the engagement and empowerment of this professional with the multidisciplinary team are essential for assertive assistance, with quality and guarantee

of credibility in their theoretical and practical knowledge. The minimally invasive surgical technology by robotic modality increasingly makes the nursing professional updated and approach the specialists in this area, strengthening this type of study and encouraging professionals in the search for continuous improvement.

## OBJECTIVE

To report the experience of the first six cases of pediatric robotic surgery and the role of nurses specialized in robotic surgery in an oncology institution.

## METHOD

It is an account of experience in clinical practice that fostered the discussion about the first six cases of pediatric robotic surgery and the role of nurses who are specialists in robotic surgery in an oncology institution, between the years 2017 and 2019.

The scenario used is inserted in a large, philanthropic oncology institution, located in the city of São Paulo (SP). The surgical center (SC) has 14 surgical rooms, and 1,000 surgeries/month are performed there, on average. Out of these 1,000 procedures, about 40 are performed with robotic technology.

The process of implanting pediatric robotic surgery began in 2017, with two initial cases, an adrenalectomy and a nephrectomy. The other four subsequent cases performed were: nephrectomy, cystoprostatectomy, hysterectomy, and cystectomy. All were followed up and executed in the presence of the proctor urologist surgeon to assist the pediatric oncology surgeon.

The process of implanting pediatric robotic surgery is challenging. Initially, specific, well-designed, and multidisciplinary protocols were adopted, which guide professionals to perform their function safely.

## RESULTS

On the eve of the surgery, the nurses in the robotic program gathered the materials and equipment to meet this surgical modality. Also, there was a realistic simulation with the participation of the surgical team, composed of:

## DISCUSSION

nurse, nursing technician (circulating nurse), instrumentalist, surgeon, and anesthesiologist. Each team member performed excellently in the tasks performed. In addition, the importance of the institution of having the appropriate devices to assist in the surgical positioning in pediatric robotic surgery.

In the initial cases, patients submitted to adrenalectomy and nephrectomy were placed in lateral decubitus, under general inhalation and venous anesthesia. The perioperative nurse applied pressure redistribution adhesive coverage to the bony prominences that were supported on the operating table. The head was supported on the halo-shaped cephalic viscoelastic polymer, which is used to rest the head and avoid pressure on the external ear. One upper limb was supported by the viscoelastic polymer on the operating table and the other was parallel-positioned, on a pyramidal foam.

The patient's instability is corrected by flexing the lower limb supported on the operating table and keeping the upper one stretched in a pyramidal foam, reducing the pressure caused by the weight of the upper limb on the lower. Complete stabilization of the patient in lateral decubitus is achieved by applying a redistribution adhesive cover to the iliac crest and a tape strip with a fixation on the operating table.

In cystoprostatectomy, hysterectomy, and cystectomy surgeries, the Trendelenburg position was used, in which the patient is placed in supine position on the operating table and receives an inclination, where the trunk and head are in the lower plane. With this inclination, the natural tendency is for the patient to slide towards the head of the table. Therefore, there was a need to perform the fixation over the chest with a pyramidal foam and tape to avoid any accidental movement during the operation. The upper limbs were supported on the operating table, the hip region was supported on the edge of the table joint, and the lower limbs were flexed, facilitating positioning. The perioperative nurse must perform a positioning review after the robot is docked (approached to the operating table).

Surgical positioning certainly depends on the location to be approached and the robotic procedure to be performed. The nurse specialist in robotic surgery must be attentive to the details of the procedure and to the appropriate devices for surgical positioning. Positioning techniques were used in all patients, respecting their health condition and anatomical status. The wide experience of professional nurses in robotic surgeries had positive initial results in this new surgical modality.

Based on the available literature, the role of nursing in robotic surgery has a positive impact on both the patient and the multidisciplinary team, through their skills, combined with the improvement of care processes and permanent education in team formation<sup>6,8,9</sup>.

Studies reinforce that one of the significant and challenging factors is the positioning of patients in robotic surgery, which is a shared responsibility between the perioperative nurse, the anesthesiologist, and the surgeon<sup>10</sup>. In another study, the authors highlight the importance of each team member in recognizing their role and responsibility in robotic surgery<sup>8</sup>.

An epidemiological study carried out in the city of São Paulo reported a cumulative incidence of pressure injury (PI) of 21.4% (95%CI 1.8–42.8) in hospitalized children treated at the SC, with a sample of 229 patients, with ages ranging between 30 days and 18 years. In this study, in addition to the known factors, such as immobility, humidity, surgical time, temperature variation, and body mass index, the associated risk factors were sedation/analgesia ( $p=0.04$ ) and intensive care treatments, for example, mechanical ventilation ( $p=0.001$ )<sup>11</sup>.

In the case of children and adolescents, empirical observations have indicated that 20 to 40 minutes of ischemia in bone prominences are sufficient for the development of tissue injury, with the consequent formation of PI<sup>11</sup>.

To maintain the safety of these patients, it is important to have adequate devices for this surgical modality, in addition to inspecting the skin, the areas of bony prominences, respecting the anatomical body alignment, and documenting any changes in the integrity of the skin in the systematization form of perioperative nursing care (*sistematização da assistência de enfermagem perioperatória – SAEP*)<sup>4,7</sup>.

Another study, conducted in the United States, assessed the clinical results and costs associated with robotic surgery in a pediatric population of 43 institutions participating in the research, of which 51% had cases in pediatrics. The findings indicated shorter hospital stay, but at a higher cost<sup>12</sup>.

Robotic surgery is a technology that has been shown to be safe and effective for pediatric procedures, especially for tumor resections<sup>13</sup>.

Prospective studies have shown that the evolution of robotic procedures will offer alternative approaches to the treatment of pediatric patients, with improvements in care and quality of life<sup>14</sup>.

## FINAL CONSIDERATIONS

This experience report made it possible to recognize the duties of nurses and members of the surgical team in pediatric robotic surgery. However, the need for a realistic simulation was identified, with the participation of all team members to improve the care processes and permanent education in team formation.

Another peculiarity observed in the study is the need for the institution to have adequate devices to assist in the

positioning of patient in pediatric robotic surgery. Therefore, the use of appropriate devices must be understood as a parameter of good nursing practices and of the multidisciplinary team, which can greatly contribute to the prevention of PI, resulting from surgical positioning.

The literature proved to be scarce. Thus, it is suggested that new studies be developed concerning the subject in question, aiming to act in clinical practice with excellence and to outline the role of nurses in robotic surgery.

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